THREE ESSAYS ON LABOUR AND HEALTH OUTCOMES OF VULNERABLE POPULATIONS IN CANADA

by

Min Hu

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Abstract

This dissertation contains three essays examining the labour market and health outcomes of vulnerable populations in Canada. The first essay examines the relationship between information-processing skills, educational attainment, and labour market outcomes among Indigenous peoples in Canada, and uses the 2012 Programme for the International Assessment of Adult Competencies (PIAAC). Relative to the non-Indigenous sample, this study finds negative earning differentials, lower information-processing skills, higher unemployment, lower employment and labour market participation among Indigenous peoples. The results show a positive relationship between skills and earnings and there is no evidence of economic discrimination based on the returns to skills which are very similar for both groups. The results also imply the need to consider barriers to education faced by Indigenous peoples. The second essay measures and examines the gender gaps in the health status among Indigenous adults living off-reserve in 2001, 2006 and 2012 with three corresponded Aboriginal People Surveys (APS). It shows that the self-rated general health gap between Indigenous males and females widened from 1.6 to 5.2 percentage point between 2001 and 2012. Oaxaca-Blinder decomposition shows that differences in the observable characteristics between males and females explain more than half of the gender difference in good general health. Specifically, the results indicated that improving socioeconomic status and participation in traditional activities of females to the level of males will effectively reduce the gender health gap among Indigenous peoples in Canada. The third essay investigates the causal detrimental effect of Ramadan fasting during pregnancy on infant birth weight and fraction of male births in Canada. With seven million birth record from 1990-2016 Canadian Vital Statistics Birth Record, and large variation in daylight hours within geographic locations over time, as well as across locations, this study also enables estimations of a large amount variation in Ramadan fasting hours. The results show that babies of Muslim mothers have lower average birth weight and are more likely to be below the low birth threshold. Moreover, once the extreme fasting hours are removed, modest reductions are found in birth weight associated with Ramadan falling on the ninth, seventh or fifth month of pregnancy.

List of Abbreviations Used

PIAAC	Programme for the International Assessment of Adult Competencies
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary Least Squares
RIF	Recentered Influence Function
APS	Aboriginal Peoples' Survey
GGH	Good General Health
RFN	Registered First Nation
NRFN	Non-registered First Nation
SES	Socioeconomic Status
LPM	Linear Probability Model
OB	Oaxaca-Blinder
LMP	Last Menstrual Period
CD	Census Division

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Chapter 1

Introduction

This dissertation consists of three essays that investigate the labour and health outcomes for two vulnerable populations, Indigenous and Muslims in Canada. A large body of literature has suggested Indigenous and Muslim populations have comparatively poorer labour market outcomes and general health status. In chapter 2, my co-authors and I examine the relationship between information-processing skills, educational attainment, and labour market outcomes among Indigenous peoples in Canada by using the 2012 Programme for the International Assessment of Adult Competencies (PIAAC 2012). Comparing to non-Indigenous Canadians, we find negative earning differentials, higher unemployment, lower employment and labour market participation among Indigenous peoples, as well as important differences between First Nations, Métis, and Inuit workers. First Nations peoples show larger gaps in terms of earnings and employment outcomes, and Métis people show worse employment outcomes and negative earnings differentials in the upper part of the distribution. There are also sizable gaps in literacy, numeracy, and technology skill relative to the non-Indigenous sample. Not surprisingly, there is a positive relationship between these information-processing skills and wages. However, the returns to skills are very similar for Indigenous and non-Indigenous peoples. That is, we find no evidence of economic discrimination. Once these skills are conditioned on, the earnings differentials decline. We also find that education can reduce skill and wage gaps, although the additional impact is small. The results imply the need to consider barriers to education faced by Indigenous peoples.

In chapter 3, I measure the annual gender gaps in the health status among Indigenous adults (age 18 and above) living off-reserve, by using the three Aboriginal People Surveys (APSs, 2001, 2006 and 2012). Then, I apply the Oaxaca-Blinder (OB) decomposition method to identify factors explaining the difference in the health status between Indigenous men and women in Canada in each survey year. The results suggest that Indigenous men compared to their female counterparts have a higher rate of good general health (excellent/very good/good) over the period studied. The health gap for Indigenous males and females widens from 1.6 percentage points (82.6 percent males vs

81 percent females) in 2001 to 5.2 percentage points (81.1percent males vs 75.9 percent females) in 2012. The gender health gap also increases within four Indigenous subgroups *viz.* registered First Nations, non-registered First Nations, Métis, and Inuit living off-reserve in Canada. The results of the OB decomposition suggest that differences in the observable characteristics between males and females in each survey year explain more than half of the gender difference in good general health. The difference in returns of observed factors and unobserved factors explain the remaining unexplained part of the gender health gap. Specifically, the results indicate that improving socioeconomic status (e.g. employment status and income) and participation in traditional activities (hunting, fishing, trapping and gathering wild plants) of females to the level of males will reduce the gender health gap among Indigenous peoples in Canada.

In chapter 4, my co-author and I use the 1990-2016 Canadian Vital Statistics Birth Record (VSDB) and examine the impact of Ramadan fasting during pregnancy on infant birth weight and fraction of male births in Canada. We find very large differences in birth weight between Muslim and non-Muslim children, with a difference of almost 120 grams, or a little more than 3 percent off the base mean. Muslim babies are also around 0.8 percentage points more likely to be born weighing less than 2,500 grams, or around two-thirds larger than the base mean. These differences are larger for males, and we find no detectable difference in terms of male births ratio. We find only a small statistically insignificant 4-gram reduction in birth weight for Muslim babies whose gestation period overlapped any time with Ramadan. When we restrict the sample to observations with daylight between 10 to 16 hours, a sizeable 12-gram reduction is found for the third trimester, and 29 grams for the ninth gestation month. We do not find a continuous negative impact of the length of Ramadan in terms of daylight hours on birth weight, as the propensity to fast may decline with hours of daylight. The overall negative effect that we find in this paper is between the previous estimates found in the United States and Germany.

My thesis investigates health and labour market outcomes for two important vulnerable populations, Indigenous and Muslim Canadians. Also, my essays broaden the economics literatures regarding cognitive skills and labour outcomes, social determinants and health

for Indigenous Canadians, as well as fetal health and religion observations for Muslim Canadians.

Chapter 2

Literacy, Numeracy, Technology Skill, and Labour Market Outcomes among Indigenous Peoples in Canada

This chapter is co-authored with Angela Daley and Casey Warman. It is the original manuscript of an article published as the version of record in the Canadian Public Policy, Volume 45, Issue 1, March, 2019. Appendix D contains copyright permission to include the paper in this dissertation. The article can be accessed at: https://www.utpjournals.press/doi/full/10.3138/cpp.2017-068.

2.1 Introduction

Indigenous populations are relatively young and growing at a rate that is three times higher than the rest of the Canadian population.[1] Previous research has uncovered important differences in earnings and employment outcomes between Indigenous and non-Indigenous workers.[2] While the degree of the disparity depends on the outcome, on balance, Indigenous peoples face challenges in the Canadian labour market.[3]

Some suggest that educational attainment is a major contributor (Drost 1994; Frenette 2011; George and Kuhn 1994; Halchuk 2006; Lamb 2013; Walters, White and Maxim 2004). While we do not disagree, we argue the issue is more complex than merely differences in credentials or years of schooling. Specifically, information-processing skills (i.e. literacy, numeracy, and technology skill) are vital to human capital and labour market outcomes in a knowledge-based economy, and may not be fully reflected in educational attainment. While correlated, educational attainment and information-processing skills are not necessarily the same. For example, differences in the quality of education received could manifest in differences in information-processing skills, even for a given educational attainment.

More recent literature has demonstrated the importance of information-processing skills in determining labour market outcomes. Using data from the Programme for the International Assessment of Adult Competencies (PIAAC), Hanushek et al. (2015) show that, while there is some variation in the returns to skills across the 23 countries studied, average earnings increase by 18 percent with a one standard deviation improvement in numeracy. Similarly, Chiswick, Lee, and Miller (2003) find that higher levels of literacy and numeracy are associated with greater labour market success in Australia.

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[1] There are three Indigenous groups in Canada: First Nations; Métis; and Inuit. Population growth rates between 2006 and 2011 were 23, 16 and 18 percent, respectively. See Statistics Canada (2015).

[2] See for example: De Silva (1999); Feir (2013); Hossain and Lamb (2012); Kuhn and Sweetman (2002); Lamb (2013); Maxim et al. (2001); Mendelson (2004); Mueller (2004); Patrinos and Sakellariou (1992); Pendakur and Pendakur (1998); Pendakur and Pendakur (2011); White, Maxim, and Gyimah (2003).

[3] A similar situation is observed among Indigenous peoples in Australia and the United States. For example, Jones (1993) finds that Indigenous Australians are more likely to be unemployed and are confined to a narrow range of jobs with comparatively lower wages. In the United States, Gitter and Reagan (2002) find the unemployment rate among American Indians is 11 to 14 percent higher and wages are 17 percent lower compared to the non-Indian population.

In research focusing on Canada, Finnie and Meng (2002) find that some minority groups have lower levels of literacy and numeracy, which account for up to 65 percent of the minority-white income gap among men. Similarly, Ferrer, Green, and Riddell (2006) find that differences in literacy among university graduates explain about two thirds of the earnings gap between immigrants and native-born Canadians.[4]

We build on this literature by considering the importance of literacy, numeracy, and technology skill for labour market outcomes among Indigenous peoples in Canada (compared to and in conjunction with educational attainment). There is a small body of research that examines this issue. Finnie and Meng (2002) show that Indigenous peoples have lower levels of literacy and numeracy, but are not able to consider First Nations, Métis, and Inuit people separately due to small sample sizes. Moreover, using data from the 2012 PIAAC, Arriagada and Hango (2016) show that First Nations adults living off reserve and Métis adults have lower levels of literacy and numeracy than the non-Indigenous population. They also find that, among those with high levels of literacy and numeracy, First Nations adults are less likely to be employed. In fact, First Nations adults with high levels of literacy and numeracy are less likely to be employed than non-Indigenous adults with low skills, all else constant.[5] Finally, we build on Biswal (2008), who uses the 2003 International Adult and Literacy and Skill Survey and finds that earnings are almost 20 percent higher for Indigenous peoples with a literacy score of 'three to five' compared to 'one to two' on a five-point scale.

In this paper, we assess whether there are differences in literacy, numeracy, and technology skill between off-reserve First Nations, Métis, Inuit, and non-Indigenous respondents. We then determine whether differences in information-processing skills explain labour market outcomes in terms of hourly wages, both at the mean and across the distribution. In doing so, we consider the independent effect of educational attainment and information-processing skills, as well as the combined effect. We also

[4] Also see Bonikowska, Riddell, and Green (2008).
[5] Arriagada and Hango (2016) compare differences in literacy and numeracy between First Nations, Métis and non-Indigenous peoples. They also examine the relationship between literacy, numeracy and employment. We build on this study by including Inuit in our sample, and by considering technology skill. Moreover in addition to employment, we consider other key labour market outcomes (i.e. earnings, unemployment, and labour force participation).

estimate Oaxaca-Blinder decompositions of log hourly wages. We then estimate the returns to information-processing skills to determine whether Indigenous peoples face economic discrimination (i.e. different returns to productive characteristics). Finally, we examine how much education and information-processing skills account differences in employment, unemployment and labour force participation.

Using microdata from the 2012 PIAAC, we find considerable deficiencies in English/French literacy, numeracy, and technology skill for Indigenous peoples. The gaps relative to non-Indigenous respondents are largest for Inuit, then First Nations people. There are also small, statistically significant differences for Métis people. Once education is controlled for, the gaps are greatly reduced, although they remain large for Inuit and First Nations people. We also find that the gaps are generally much higher in the lower part of the skill distribution, and there are important differences within education groupings. The latter may reflect differences in the quality of education. In terms of labour market outcomes, once skills or education are controlled for, the wage gap is greatly reduced between First Nations and non-Indigenous workers and eliminated for Métis and Inuit workers. While adding skills to the model has a larger impact on the wage gap for First Nations workers, education has a small additional impact. We find significant differences across the earnings distribution for First Nations people, as well as gaps in the upper part of the distribution for Métis people. Similar to previous research, we find that a one standard deviation increases in either literacy or numeracy raises earnings by 15 to 20 percent. Further, we find that a one standard deviation increase in technology skill raises earnings by 29 to 36 percent. Importantly, we find no differences in the returns to skills (in terms of earnings, employment or unemployment) between Indigenous and non-Indigenous workers.

In the next section, we discuss the data and methodology, while in Section 2.3, we discuss the empirical results. In Section 2.4, we conclude.

2.2 Data and Methodology

We use microdata from the 2012 PIAAC, which was developed by the Organization for Economic Co-operation and Development (OECD) to assess the skills needed for

individuals to prosper, both socially and economically. In addition to rich information on labour market and demographic characteristics, the PIAAC contains information about three information-processing skills: literacy; numeracy; and technology skill. The PIAAC surveyed adults aged 16 to 65 in 24 countries. We use the Canadian subsample, which was collected by Statistics Canada from November 2011 to June 2012. The survey excludes individuals on military bases and in institutions, as well as First Nations people living on reserve. While the PIAAC covers more than 96 percent of the target population (Statistics Canada 2013a), our estimates will likely understate the earnings gap, especially for First Nations people, given that previous research finds worse labour market outcomes for those who live on reserve (Drost and Richards 2003; Feir 2013; Pendakur and Pendakur 2011). For example, Pendakur and Pendakur (2011) find the earnings gap between Indigenous and non-Indigenous males ranges from 20 to 50 percent, with larger disparities for those who live on reserve. Similarly, Feir (2013) finds evidence of an annual earnings penalty for those who live on reserve, almost half of which is accounted for by weeks worked. Both papers control for individual characteristics, such as age and education, but neither considers information-processing skills.

As part of the PIAAC, respondents were given various tasks, usually real-world problems, to assess three domains of information-processing skills: literacy; numeracy; and problem solving in technology-rich environments. Literacy is defined as "understanding, evaluating, using, and engaging with written texts to participate in society, to achieve one's goals, and to develop one's knowledge and potential" (Statistics Canada 2013a, 22). The test is based on continuous, non-continuous, mixed and multiple texts such as descriptions, narrations, expositions, argumentation, instructions, records of texts, etc. Numeracy is defined as "the ability to access, use, interpret, and communicate mathematical information and ideas, in order to engage in and manage the mathematical demands of a range of situations in adult life" (Statistics Canada 2013a, 29). It is tested with questions regarding numbers, shapes, patterns, graphs tables, etc. Finally, problem solving in technology-rich environments, herein referred to as technology skill, is "the ability to use digital technology, communication tools and networks to acquire and evaluate information, communicate with others, and perform practical tasks" (Statistics

Canada, 2013a, 21). The test involves searching for websites solutions, communicate by email, shop online, and etc. (OECD 2012)

While some previous research has treated literacy, numeracy, and technology skill as measures of cognitive abilities, we refrain from this interpretation since these variables may capture other aspects of skills, such as language ability. This is particularly relevant to people for whom English and French are not a mother tongue as the tests are conducted in these languages.

Each respondent is assigned ten plausible scores in literacy, numeracy, and technology skill on a 500-point scale (i.e. imputed proficiency scores). The PIAAC derived plausible scores associated with replicated weights by using a matrix-sampling design and Item Response Theory, combined with each individual's response in the assessment, in order to improve the accuracy of skill measurements. This methodology uses all available data to directly estimate the characteristics of populations and sub-populations but is not meaningful for an individual respondent.[6] Therefore, the PIAAC recommends a jackknifed replicated resampling method to derive standard errors with the associated replicated weights.[7] We use jackknifed standard errors throughout the paper.

A little less than 20 percent of our sample (2,976 respondents) did not complete the technology skill section and thus have a missing value. There are three possible reasons for this: (1) some individuals have never used computers; (2) some people have no ability in the use of information and communication technology; and (3) some people just did not take the computer-based test (Statistics Canada 2013a). Respondents with a missing value for technology skill may have one or more of these reasons.

In addition to the three information-processing skills, the PIAAC has information about earnings, work experience, and education. In terms of earnings, we focus on hourly wages for employees. Work experience is defined as the number of years in paid work. Education is based on the International Standard Classification of Education: primary or

[6] See Mislevy (1988).
[7] Please refer to Statistics Canada (2013a) for more information about jackknife replicated weights in the 2012 PIAAC.

less, lower secondary, high school degree, trade or community college, professional school degree, Bachelor's degree, and Master's degree or higher. We include dummy variables for each category and use high school degree as the base group. Education is likely endogenous in our regressions. While we condition on objective measures with information-processing skills, there is likely unobserved heterogeneity that is correlated with both education and labour market outcomes. Unfortunately, we have no instrumental variables to tackle this issue.

The PIAAC also contains basic demographic information about respondents. We restrict our sample to individuals aged 24 to 59 to reduce the effect of education and retirement decisions, instead focusing on the relationship between skills and labour market outcomes. We provide separate indicators for whether respondents are First Nations people living off reserve, Métis or Inuit. This is necessary because there are considerable differences between and within groups in terms of history, language, culture, and other dimensions.[8] We drop a handful of individuals who have multiple Indigenous identities. We also drop immigrants to focus on the comparison between Indigenous and non-Indigenous respondents. We use sampling weights throughout our analysis.

We begin by examining differences in the three information-processing skills. We estimate the following equation for each:

$$Skill_i = \alpha_0 + \alpha_1^j Indigenous_i + \beta X_i + \mu_i \qquad (2.1).$$

$Skill_i$ denotes literacy, numeracy or technology skill for person *i*. α_i are the coefficients on dummy variables for the three Indigenous groups, where the superscript *j* indicates self-identification as First Nations, Métis or Inuit, respectively. Our comparison group consists of non-Indigenous people. X_i is a vector of demographic, socio-economic and other controls. In the simplest model, we condition on age and age-squared. We then add controls for education, actual work experience and its quadratic, as well as region of

[8] For example, Feir (2013) excludes Inuit and those living in the North (i.e. Yukon, Northwest Territories, and Nunavut), noting very different economic circumstances.

residence.[9] In a third variation of the model, we add controls for family background including: number of books in the household at age 16 (less than ten (base group), 11 to 25, 26 to 100, 101 to 200, 201 to 500, 500 or more, missing number of books), parental education (neither parent has a Bachelor's degree or higher (base group), one parent has a Bachelor's degree or higher, both parents have a Bachelor's degree or higher, missing parental education) and a dummy for whether French of English was spoken at home.[10] α_0 is the intercept and μ_i is the error term. We estimate separate models by gender. We first use Ordinary Least Squares (OLS). Then, using Recentered Influence Function (RIF) regressions outlined by Firpo, Fortin, and Lemieux (2009), we estimate differences across the skill distributions and present coefficients for the 10th, 25th, 50th, 75th, and 90th quantiles. Since the PIAAC captures basic skills, differences may vary considerably across the distributions. We examine differences in skills in terms of the 500-point scale. We standardize each skill by subtracting its mean and dividing by the standard deviation. We also present estimates based on raw scores in the appendix.

We next examine differences in labour market outcomes by estimating variants of the following equation:

$$Y_i = \alpha_0 + \alpha_1^j Indigenous_i + \alpha_2^k Skills_i + \beta X_i + \mu_i \qquad (2.2).$$

Y_i is either log hourly wage, employment, unemployment or labour force participation. Note that wages are not reported for those who are self-employed. Moreover, for employment, we use a dummy variable that equals one if the respondent is employed or self-employed and zero if they are unemployed or not in the labour force. For unemployment, we use a dummy variable that equals one if the respondent is unemployed and zero if they are employed. It does not include those who are not in the

[9] The work experience variable is based on the question: "In total, for approximately how many years have you had paid work? Only include those years where 6 months or more was spent in either full-time or part-time work." In terms of region of residence, we include dummy variables for Atlantic Canada (i.e. New Brunswick, Nova Scotia, Prince Edward Island, Newfoundland and Labrador), Quebec, Manitoba, Saskatchewan, Alberta, British Columbia, and the North (i.e. Yukon, Northwest Territories, and Nunavut). Ontario is the base group.

[10] In terms of the question on books, respondents are asked: "About how many books were there in your home when you were 16 years old? Do not include magazines, newspapers or school books. To give an estimation, one meter of shelving is about 40 books."

labour force. For labour force participation, we use a dummy variable that equals one if the respondent is employed or unemployed, relative to those who are not in the labour force. α_2 are the coefficients on skills, where the superscript k indicates literacy, numeracy and technology skill, respectively. We also include their squares and a dummy variable for missing technology skill. The latter allows for an intercept shift between respondents with and without a technology skill score, then the technology skill variable captures the slope for those with a valid score. Like before, X_i is a vector of demographic, socio-economic and other controls. In our simplest model, we control for age, age-squared, and region of residence to capture differences in labour market conditions and cost of living. We then condition on the highest level of education, replacing it with information-processing skills (i.e. $Skills_i$) and their quadratics, followed by education and skills together. This enables us to examine the separate impact of education and information-processing skills on labour market outcomes. When log hourly wage is the dependent variable, we present another specification in which we include 22 occupation indicators and condition on work experience. We instead add family background indicators in a final specification. Like before, we include dummy variables for the three Indigenous groups (i.e. First Nations people living off reserve, Métis and Inuit). α_0 is the intercept and μ_i is the error term. Again, we estimate the models separately by gender. For the models in which log hourly wage is the dependent variable we use OLS. We also estimate RIF regressions to examine how the wage gap changes across the earnings distribution. When employment, unemployment or labour force participation are the dependent variables, we use linear probability models, although marginal effects from probit models are very similar.

2. 3 Empirical Results

2.3.1 Descriptive Statistics

Table 2.1 contains descriptive statistics for non-Indigenous and Indigenous peoples (i.e. First Nations, Métis, and Inuit), for females in the first four columns and males in the last four columns. We find that Inuit have relatively low educational attainment, followed by First Nations people. For example, 21.6 percent of First Nations males versus 29.1 percent of non-Indigenous males have a university degree (i.e. Bachelor's, Master's or

higher). Further, while 12.2 percent of non-Indigenous males did not obtain at least a high school degree, over 30 percent of First Nations males have less than high school education. Métis people tend to be somewhat closer to the non-Indigenous sample in terms of education. Moreover, while Indigenous peoples tend to be younger, their years of work experience and schooling are much lower than what would be suggested by the age gap, especially among Inuit. This suggests that Indigenous peoples tend to have more employment interruptions than non-Indigenous respondents.

Table 2.1 also indicates that non-Indigenous people have higher scores in literacy, numeracy, and technology skill. For females, Métis people are similar to the non-Indigenous sample, while First Nations people have slightly lower scores. Inuit respondents have much lower scores, on average. For technology skill, while around 12.7 percent of non-Indigenous females did not complete the test, 28.7 percent of First Nations and 46 percent of Inuit females did not complete the test. For males, these rates are similar, with 16, 28.3 and 54.7 percent of non-Indigenous, First Nations and Inuit males not completing the technology skill test. For all of our study groups, males have comparatively higher scores than females in numeracy, while females perform better in literacy and technology skill.

Table 2.1 shows that Indigenous respondents have lower levels of literacy, numeracy and technology skill, as well as lower levels of educational attainment. This suggests that education could be correlated with skill gaps between Indigenous and non-Indigenous peoples. We explore this in Figures 2.1a, 2.1b and 2.1c by examining information-processing skills by highest level of educational attainment. These figures show differences in average skills for First Nations, Métis and Inuit people relative to the non-Indigenous sample. They are presented separately by gender and highest level of education.[11] To the extent that we find skill differences for a given level of education, this may reflect differences in the quality of education received. Indeed, Figures 2.1a and 2.1b indicate that Indigenous peoples have lower levels of literacy and numeracy, even when disaggregating by gender and education. For example, literacy scores for those with a high school degree are 16 (Métis) to 41 (Inuit) points lower compared to the non-

[11] Among Inuit, no one has earned a Master's degree or higher.

Indigenous sample. Similarly, numeracy scores are 19 to 48 points lower for Métis and Inuit males with the high school diploma, respectively. In terms of differences across groups, skill gaps for Métis respondents are relatively small. In fact, they sometimes have higher levels of literacy and numeracy than the non-Indigenous sample (e.g. women with a high school diploma or less). On the other hand, Inuit respondents generally have the lowest levels of literacy and numeracy.

Figure 2.1c shows differences in average technology skill for respondents who completed the computer-based test.[12] Again, we compare First Nations, Métis and Inuit people to the non-Indigenous sample. We find that, among those who took the computer-based test, Inuit respondents perform much worse than the non-Indigenous sample. For example, among males with a high school diploma, the average score among Inuit respondents is 143 points lower. Moreover, for respondents who only have some high school education, a group that constitutes about a third of the Inuit sample, the average score among Inuit males who took the test is 92 points lower.

2.3.2 Information-Processing Skills

In Table 2.2, we present the estimates of Equation (2.1) with each skill as the dependent variable. For technology skill, we present estimates for those who took the computer-based test, as well as estimates in which people who did not take the test are assigned a score of zero. In the main text, we display estimates based on standardized skills but present those associated with raw skills in the appendix (Table A1). In the first column, we condition on age and age-squared. We then add controls for education, work experience and region of residence in the second column, followed by controls for family background in the third column. The top half of Table 2.2 contains estimates for females while the bottom half shows estimates for males.

We find that First Nations and Inuit respondents have very large gaps in all skills relative to the non-Indigenous sample. Controlling for age, the literacy gap for First Nations

[12] In general, Indigenous peoples are more likely to have missing values for technology skill, especially at lower levels of education. Of course, there are differences across groups. Métis respondents are similar to the non-Indigenous sample (and are sometimes more likely to have taken the computer-based test), while Inuit respondents are more likely to have missing values.

females and males is a little larger than half a standard deviation. For Inuit, the gap is around 1.2 standard deviations. For Métis females, the gaps are smaller and only numeracy is statistically significant. For Métis males, the gaps for literacy and numeracy are between 0.26 and 0.3 of a standard deviation, respectively. Once we account for education, work experience and region of residence, the skill gaps for Indigenous peoples are greatly reduced.[13] This is consistent with Falch and Sandgren Massih (2011), who demonstrate that education is strongly correlated with information-processing skills.[14] Finally, the gaps are further reduced with the inclusion of family background (i.e. number of books, parental education, language). While relevant to skill gaps, they have a smaller contribution than do education, experience and region of residence.

In Figures 2.1a, 2.1b and 2.1c, we find that gaps between First Nations and Inuit people, relative to the non-Indigenous sample, are much greater at lower levels of education. In Figures 2.2a, 2.2b and 2.2c, we present the raw skill differences by quantile for literacy, numeracy and technology skill (with zeros). We present estimates for the gaps conditional on age and age-squared in the main paper. We include estimates with additional controls (i.e. education and work experience) in the appendix (Figures A2a, A2b and A2c). The estimates for females are presented on the left-hand side, while the estimates for males are on the right-hand side. Generally, for all three skills, the gaps are much more pronounced in the lower part of the distribution. For example, Inuit respondents have gaps of around 150 points at the tenth percentile. Recall from Table 2.1, the mean literacy score was 283 for the non-Indigenous sample, and was between 220 and 223 for Inuit. Therefore, a gap of 150 is very large. The gap for Inuit shrinks and is only around 25 points at the 90th quantile.

[13] Frenette (2011) shows that, in terms of earnings, the returns to education are similar for Indigenous and non-Indigenous workers.

[14] In Figures A1a and A1b, we present the education coefficients associated with Table 2.2 to show the overall relationship between education and skills. Figure A1a contains the estimates with standardized skills, while Figure A1b contains the results with raw skills. We find an important monotonic relationship between education and skills whereby a higher level of education is associated with better performance on the PIAAC tests for literacy, numeracy, and technology skill. For example, women with less than high school have a one standard deviation lower score in literacy and numeracy, which is equivalent to a 50-point gap in the raw score. For males, these gaps are slightly larger. Moreover, compared to those with a high school diploma, females with a graduate degree scored around one standard deviation better in terms of literacy and numeracy, or 50 points. Again, the gaps are larger for males. These estimates indicate a positive correlation between education and skills. Combined with the earlier finding of differences in skills within education groups, our results suggest that both quantity and quality of education are important.

In general, the gaps converge in the upper part of the skill distributions. One exception is for numeracy among Métis females. While they do not have a deficit in the lower part of the distribution, the gap is 18 and 17 points for the 75th and 90th quantiles, respectively. As suggested by Clarke and Skuterud (2016), tests in the PIAAC and similar surveys capture basic skills. Therefore, the general findings notwithstanding, numeracy estimates for Métis females, are not surprising. The possibility of the PIAAC capturing skill differences in the upper part of the distribution is questionable. However, Clarke and Skuterud (2016) also note that such tests may be informative about "the labour market skills of immigrants at the upper end of the distribution" since they may capture an immigrant's English/French ability. This may also be true for some Indigenous respondents if English/French is not their mother tongue or is not used as intensely.

For these reasons, it is important to consider that PIAAC tests were conducted in English or French. Therefore, rather than picking up information-processing skills, they may merely reflect language ability. For Inuit, over a third of the weighted sample were not able to take the test in their mother tongue. The proportion was much lower for Métis and First Nations people, at around 11 and 6.5 percent, respectively. When we separate respondents based on their mother tongue, the mean skills are higher for Indigenous respondents for whom English or French is their native language. However, large gaps persist for English and French speakers relative to non-Indigenous people, and the ranking between the three Indigenous groups is still very similar to the results presented here. Yet, we must consider that mother tongue may not capture language of instruction or daily interaction equally for all respondents.

2.3.3 Earnings

2.3.3.1 Hourly Wage Regressions

So far, we have uncovered considerable differences in information-processing skills between Indigenous and non-Indigenous peoples. In Table 2.3, we examine differences in hourly wages and the relative importance of information-processing skills in explaining these gaps. We begin with our basic controls, age and region of residence. In column 2, we add dummy variables for education. We instead control for information-processing skills in column 3. This allows us to compare which variables, education or

skills, are more important in reducing the wage gaps. In column 4, we add both to see if information-processing skills provide additional information above just controlling for education. In column 5, we condition on occupation and work experience to see if these controls further reduce the wage gap. Finally, in column 6, we add family background variables (i.e. number of books, parental education, language). When interpreting the results in Table 2.3, it should be recognized that, while education, occupation and work experience may reflect productivity, they may also be considered outcome variables. Further, information-processing skills are not static and may be impacted by work experience, occupation and labour market outcomes.

Column 1 shows a large hourly wage gap for First Nations females and males, at around 20 and 17 percent respectively ($[e^{-0.225} - 1]$ and $[e^{-0.188} - 1]$). For Inuit females, the gap is similar to that of First Nations workers, while it is much lower for males. Moreover, gaps for Métis and Inuit males are fairly similar, although the latter is not statistically significant. Two important points brought up by Feir (2013) should be considered when interpreting these results. First, there are differences in weeks worked between Indigenous and non-Indigenous peoples. So, while hourly wages may indicate the rate of pay, it will understate the gap if total wages and salary are the measures of interest. Secondly, Feir (2013) excluded the North (i.e. Yukon, Northwest Territories, Nunavut) and Inuit from her analysis, mentioning very different economic conditions. For example, Daley, Burton, and Phipps (2015) find that cost of living is 46 percent higher in the North relative to the rest of Canada. So, the hourly wage gap for Inuit males is smaller than that of First Nations workers, but this may reflect different economic conditions in Northern Canada where the purchasing power of a dollar is lower.

In column 2, once education is conditioned on, the wage gap is eliminated for Métis people. It also shrinks for First Nations workers, by around 35 percent ($[e^{-0.140} - e^{-0.225}] / [e^{-0.225} - 1]$) for females and 42 percent for males. Controlling for education, our estimates are similar to those of Pendakur and Pendakur (2011). For example, they find a 12 percent earnings gap for First Nations females living off reserve in 2006.

In column 3, we find that information-processing skills have a larger effect on reducing the wage gap than education. For example, for First Nations females, the gap is reduced by 50 percent, while it is reduced by 58 percent for First Nations males. Although skills are important in explaining the Indigenous/non-Indigenous wage gap, education explains a larger fraction of the overall variation in hourly wages, based on the R-squared values. In column 4, when we control for both education and skills, there is a modest reduction in the wage gap for First Nations workers, above just controlling for skills. There is not much change for Métis or Inuit workers; the coefficients remain statistically insignificant. The R-squared increases relative to columns 2 and 3, for both females and males. This indicates that hourly wages are better explained when we consider both information-processing skills and education.[15] In column 5, when we add controls for occupation and work experience, there is a further reduction in the wage gap for First Nations workers, and it is no longer statistically significant for males. The same is true in column 6 when, instead of adding the arguably endogenous controls for occupation and experience, we consider the importance of family background.

2.3.3.2 Oaxaca-Blinder Decompositions

In Table 2.4, we present Oaxaca-Blinder decompositions of log hourly wages for non-Indigenous respondents versus each of the three Indigenous groups. We first show the unconditional log hourly wage gap and then consider the extent to which it is based on differences in characteristics and returns to those characteristics, respectively. We estimate the decomposition four times for each Indigenous group, first with basic controls (age and region of residence), then we add education, then information-processing skills instead of education, and finally we add both education and skills. The top panel presents estimates for females, while the bottom panel contains estimates for males.

We find the unconditional earnings gaps for Métis and Inuit people are small and statistically insignificant; however, First Nations respondents earn about 20 percent less than non-Indigenous people. This is true for both males and females. As such, we will focus on explaining differences between non-Indigenous and First Nations workers.

[15] Like Frenette (2011), we generally find similar returns to education for Indigenous and non-Indigenous workers. However, there are a couple of notable exceptions. First Nations males receive higher returns to a graduate degree relative to the non-Indigenous sample, and Métis males receive lower returns.

While differences in age and region of residence do little to explain the gap, adding education (column 2) explains more than 30 percent. We then find that, relative to education, differences in information-processing skills explain a larger portion of the wage gap (column 3), about 49 percent for females and 60 percent for males. When both education and information-processing skills are included, differences in characteristics explain more than half of the gap for First Nations females and around two-thirds of the gap for First Nations males.[16] The remaining part of the earnings gap is attributable to differences in returns to observable characteristics, which could be evidence of economic discrimination. Of course, this may also be due to group differences in unobserved characteristics.

2.3.3.3 Returns to Literacy, Numeracy, and Technology Skill

In this section, we continue to examine whether there are differences in returns to the three information-processing skills. Combined with the Oaxaca-Blinder decompositions, differences in returns would suggest labour market discrimination (Ferrer, Green, and Riddell 2006). In earlier tables, we conditioned on all three skills at the same time since we were not concerned with measuring the magnitude of the relationship between skills and wages, but rather their impact on wage gaps. While they are jointly and highly statistically significant, multicollinearity makes the individual effects difficult to distinguish.[17] For this reason, Biswal (2008) and Shomos and Forbes (2014) recommend that literacy and numeracy be analyzed separately. Thus, we estimate the returns to each skill separately in Table 2.5.[18]

Using a variation of Equation (2.2), we estimate the returns to each standardized skill in terms of hourly wages, separately for First Nations, Métis and Inuit respondents. The estimates for females are presented in the top half of the table, while the estimates for males are presented in the bottom half. First, we show the returns to literacy, numeracy,

[16] These estimates are slightly larger than those of Feir (2013), who shows that observable characteristics account for about 50 percent of the log weekly earnings gap between First Nations and non-Indigenous workers. This is not surprising since she did not include information-processing skills, which we show to have explanatory power.

[17] The correlation between literacy and numeracy is 0.91, between literacy and technology skill is 0.89 and between numeracy and technology skill is 0.83.

[18] Given the large literature on returns to education, and room constraints, we do not present the returns to education. However, they are similar to those found in previous literature. See for example Ferrer and Riddell (2002) and Frenette (2011).

and technology skill with basic controls (age and region of residence), then we add education. The first coefficient shows the overall return to the given skill, then the subsequent coefficients show the interaction between skill and Indigenous group to determine whether there are differences in returns relative to non-Indigenous workers.

We find that each skill has a positive and statistically significant effect on hourly wages for males and females, controlling for age and region of residence. For females, a one standard deviation increase in literacy and numeracy increases earnings by around 20 percent. For males, the estimates are slightly lower at 16 and 17 percent, respectively. There are larger returns to technology skill; a one standard deviation improvement increases earnings by around 36 percent for females and 29 percent for males.

The returns to skills do not appear to be different for Indigenous peoples relative to the non-Indigenous sample.[19] In most cases, the coefficients are very small and statistically insignificant. One exception is technology skill among Inuit females and all three skills among Inuit males. These coefficients are positive and large in magnitude. However, they are imprecisely measured and not statistically significant. Further, an F-test on overall significance of the interaction terms indicates they are not statistically different from zero.[20] Ferrer, Green, and Riddell (2006) find that immigrants do not receive different returns to literacy and numeracy, and suggest this is evidence against labor market discrimination. The estimates from Table 2.5 also point to this conclusion and suggest that improvements in literacy, numeracy, and technology skill should have the same effect on hourly wages among Indigenous and non-Indigenous peoples. Given these estimates, we argue that 'differences in returns' implied by the Oaxaca-Blinder decompositions may be due to unobserved heterogeneity.

In the second model, when we control for education, we find that returns to information-

[19] We also examine differences in returns to skills across the earnings distribution, however we do not present the estimates due to room constrains. Generally, we find that returns are similar for Indigenous workers across the distribution, with some exceptions in the tails. For example, relative to the non-Indigenous sample, Métis females experience lower returns in the 90th quantile, while Inuit females experience higher returns in the 90th quantile. For First Nations and Inuit males, there is some evidence of higher returns in the tenth quantile.

[20] This is equivalent to comparing a regression with the interaction terms to one without.

processing skills are attenuated, however they are still large. Again, we do not see evidence of lower returns to skills for Indigenous peoples. Furthermore, we investigate the returns to skills in terms of employment and unemployment in Tables A2a and A2b, and do not find differences between Indigenous and non-Indigenous respondents.

2.3.3.4 Quantile Regressions

In Table 2.6, we examine differences between Indigenous and non-Indigenous workers across the earnings distribution, for females on the left-hand side and males on the right-hand side. We present estimates at the 10th, 25th, 50th, 75th, and 90th quantiles. We first include basic controls for age and region of residence, then add controls for education, then we add skills. Finally, we present estimates where we also add controls for years of work experience and occupation.

First, we examine estimates for females in the top panel on the left-hand side of Table 2.6 (basic controls). We find important differences across the distribution for First Nations workers. The biggest difference is at the 25th quantile, with the gap remaining large but declining in the upper part of the distribution. This is consistent with Pendakur and Pendakur (2011), who also find that wage gaps are smaller in higher quantiles. The gap for Inuit workers is fairly large throughout the distribution but shrinks at the 90th percentile. However, given the small sample of Inuit workers, these estimates are not statistically significant. Métis workers do not experience a statistically significant gap in the lower half of the distribution, but they have an earnings disadvantage at the 75th and 90th percentiles.

Next, we examine estimates for males in the top panel on the right-hand side of Table 2.6 (basic controls). We find that First Nations workers have a larger earnings disadvantage in the lower quantiles. It remains around ten percent in the 75th and 90th quantiles, but differences are not statistically significant. For Inuit workers, we find a larger gap in the lower quantiles, but only the 25th quantile is statistically significant at the ten percent level. Again, this is consistent with Pendakur and Pendakur (2011) who find that wage gaps are smaller in the higher quantiles. Oddly, the coefficient at the 90th quantile is large and suggests a 25 percent earnings advantage, perhaps reflecting cost of living and

industry differences that are not captured by our broad region of residence variables. As with females, Métis males do not experience an earnings disadvantage until the 75th quantile, at which point they earn around 16 percent less than non-Indigenous workers.

In the second panel, we add controls for education. In results not shown to conserve space, we find that controlling for skills has a larger effect than conditioning on education. One exception is for Métis females in the upper part of the distribution. In the third panel, when we control for both education and skills, the earnings gap for Inuit and Métis workers is not statistically significant. For First Nations workers, the earnings gap is only statistically significant for females in the 25th percentile and males in the 50th percentile. Again, we see a large earnings advantage for Inuit men in the upper part of the distribution, but it is not statistically significant. Finally, in the fourth panel, we add controls for occupation, however, this does not change the results.

2.3.4 Employment, Unemployment, and Labour Force Participation

Table 2.7 displays the employment, unemployment and labour force participation estimates for females in the first 4 columns and the analogous results for males in the last four columns. Again, the base group is non-Indigenous people. Looking at the first column in the top panel, we find that Indigenous peoples experience large employment gaps, especially First Nations and Inuit. For example, First Nations females and males have a 24 and 23 percentage point lower employment rate, respectively. Column 1 of the middle panel also shows large differences in unemployment. For males, both First Nations and Inuit respondents have a 12 percentage points higher unemployment rate. For females, First Nations respondents have a nine-percentage point higher unemployment rate, while Inuit and Métis respondents have a six- and five-percentage point higher unemployment rate, respectively. Finally, column 1 of the bottom panel shows that First Nations and Inuit people are much less likely to participate in the labour market; for both groups, the rate is about 18 percentage points lower for females and 15 percentage points lower for males. The gap is smaller for Métis people at about 6 percentage points for females (not statistically significant) and 8 percentage points for males. While conditioning on education and skills does, in many cases, reduce the employment, unemployment and labour force participation gaps, very large differences remain for First Nations respondents.

The employment, unemployment and labour force participation results highlight that focusing solely on earnings for those who are employed may not capture the full story. For example, although Inuit males do not face an unconditional wage gap after controlling for human capital, we may conclude that, overall, Inuit do not have an advantage in the labour market; their employment options are more limited, and the higher wage may reflect differences in cost of living.

2.4 Conclusion

The objective of this paper is to better understand differences in labour market outcomes between Indigenous and non-Indigenous peoples, focusing on the impact of information-processing skills. In particular, we assess: (1) whether there are differences in literacy, numeracy, and technology skill between Indigenous and non-Indigenous peoples; (2) whether skill gaps affect the relative performance of Indigenous peoples in the Canadian labour market; and (3) whether Indigenous peoples receive different returns on information-processing skills. Past literature has largely examined the role of other characteristics in explaining Indigenous/non-Indigenous disparities in earnings. For example, Feir (2013) focuses on differences in weeks worked.

We find that Indigenous peoples have lower levels of literacy, numeracy, and technology skill; Métis people have the smallest deficit, while Inuit have the largest. In addition to the tests being conducted in English or French, which are not the mother tongue of a large fraction of Inuit respondents, the gap is consistent with the reported mismatch between skills demanded in the Nunavut labour market and those of the local population (Nunavut Roundtable for Poverty Reduction 2012). This is important given that Inuit account for 85 percent of the population in Nunavut and almost half of the Canadian Inuit population reside in the Territory (Statistics Canada 2013b).

We find comparatively lower wages among Indigenous peoples. However, there are important differences between First Nations, Métis, and Inuit workers. While Inuit have higher unconditional wages (Table 2.1), this switches to an earnings disadvantage once region of residence is accounted for (column 1 of Table 2.3). Further, while the earnings

gap disappears for Métis after controlling for education or skills, a non-negligible gap remains for First Nations workers.

Not surprisingly, there is a positive correlation between information-processing skills and hourly wages. This implies that Indigenous/non-Indigenous disparities in labour market outcomes may be reduced, to some extent, by addressing differences in information-processing skills. At the same time, we find that information-processing skills, on average, improve with education (Figures A1a and A1b).[21] However, from a policy perspective, there are systemic barriers to improving educational outcomes among Indigenous peoples. These include: distrust toward non-Indigenous governments in terms of schooling; lack of Indigenous content in the curricula; and limited access in rural and remote regions where more than half of Indigenous peoples reside (Feir and Hancock 2016; Hanson 2009; Lamb 2014; Ministerial Advisory Council on Rural Health 2002; O'Gorman and Pandey 2015; Standing Senate Committee on Social Affairs, Science and Technology 2011; United Nations General Assembly 2014).[22] Of course, quality of education also matters; we find skill gaps between Indigenous and non-Indigenous peoples, even for a given level of educational attainment.

In addition to quantity and quality of education, policymakers should consider the incentives faced by individuals in making decisions about whether to invest in education. Employment prospects are relatively scarce in rural and remote communities, where more than half of Indigenous peoples reside. For example, in the North, labour demand is limited to communities that are close to mines or government offices (Nunavut Roundtable for Poverty Reduction 2012). Moreover, individuals face challenges in re-locating for work (e.g. housing shortages, costly transportation, leaving family and community support networks). This may be reflected in the probability of employment among Inuit, which is over 20 percentage points lower for both males and females (Table 2.7).[23]

[21] This may be especially true with extra support for language development. For example, Battisti, Friesen, and Krauth (2014) find that support for 'English as a Second Dialect' in public schools is associated with improved literacy among Indigenous students in British Columbia.
[22] See Feir (2016) for a careful examination of the impact of residential schools on economic outcomes.
[23] However, O'Gorman and Pandey (2015) find that differences in high school graduation rates between Northern and Southern Canada are not driven by economic incentives.

Relatedly, we recognize that many of our estimates are conditional on being in the labour market, and thus may be affected by selection. For example, earnings are only observed for individuals who are employed. Indeed, Kuhn and Sweetman (2002) find that selection based on unobserved differences in ability or productivity explain (some but not all) differences in labour market outcomes between Indigenous and non-Indigenous peoples. This suggests that current education policies/programs may not provide the necessary skills for Indigenous peoples to succeed in the Canadian labour market. This could be in terms of quantity, quality or both. It could also be that current policies/programs do not provide the 'right' skills. We also note that the 'right' skills may not be captured in the PIAAC. Further, given that tests were conducted in English and French, differences in skills may merely reflect language ability. For example, more than a third of the weighted sample of Inuit were not able to take the test in their mother tongue.

Despite these challenges, we find little evidence of economic discrimination against Indigenous peoples. That is, improvements in literacy, numeracy, and technology skill have the same effect on labour market outcomes (i.e. hourly wages, employment, unemployment) among Indigenous and non-Indigenous peoples. This is similar to the experience of immigrants (Ferrer, Green and Riddell 2006).

We contribute to the literature on information-processing skills, educational attainment, and labour market outcomes among First Nations, Métis, and Inuit peoples in Canada. We find they have lower levels of literacy, numeracy, and technology skill compared to the non-Indigenous population. These deficits contribute to their relatively poor performance in the Canadian labour market, however there are viable policy options. Given the lower educational attainment of Indigenous peoples, as well as the positive relationship between education, skills and labour market outcomes, our research points to better investment in quantity and quality of culturally-appropriate education, considering the relevant systemic barriers and demand-side labour market constraints. Of course, such initiatives should be developed with, not for, Indigenous peoples (Department of Justice Canada 2018). A positive finding of our work is that improvements in

information-processing skills are rewarded equally for Indigenous and non-Indigenous peoples; there is little evidence of economic discrimination.

Table 2.1: Summary Statistics

	Females				Males			
	Non-Indigen.	First Nations	Métis	Inuit	Non-Indigen.	First Nations	Métis	Inuit
Age	42.78	41.97	40.89	40.31	42.43	41.32	42.92	39.78
	(10.1)	(9.6)	(9.6)	(10.0)	(10.3)	(10.4)	(9.8)	(9.6)
Work Experience	20.28	16.40	18.16	14.80	22.71	19.18	23.54	16.21
	(10.4)	(11.0)	(10.4)	(11.0)	(10.7)	(11.7)	(10.7)	(11.2)
Years of Schooling	14.69	13.20	13.93	11.13	14.41	12.74	13.27	11.09
	(3.3)	(3.5)	(3.3)	(3.2)	(3.4)	(3.4)	(3.3)	(3.2)
Literacy	283.2	255.5	279.4	223.6	283.2	252.7	269.5	220.0
	(45.1)	(51.9)	(41.2)	(52.5)	(48.4)	(52.4)	(52.3)	(51.2)
Numeracy	268.4	232.3	260.2	198.9	280.7	240.6	263.5	205.4
	(48.6)	(56.7)	(42.8)	(56.3)	(53.1)	(57.2)	(58.8)	(56.6)
Mean Tech Skill with 0	249.7	191.4	256.5	135.2	240.8	191.1	220.7	111.1
	(103.1)	(127.8)	(92.2)	(128.9)	(113.0)	(126.7)	(118.7)	(126.5)
Median Tech Skill with 0	280.1	243.4	282.1	181.8	277.6	244.9	260.8	N.A.
Missing Technology Skill (%)	12.7	28.7	9.7	46.0	16.0	28.3	20.0	54.7
Mean Tech Skill without 0	285.9	268.4	284.1	250.2	286.6	266.4	275.7	245.4
	(42.6)	(47.4)	(39.8)	(44.4)	(45.3)	(47.9)	(49.4)	(49.1)
Education (%)								
Primary or Less	2.1	7.6	3.7	19.1	2.6	5.9	3.8	16.5
Lower Secondary	6.7	17.4	9.4	31.3	9.6	24.5	19.6	32.9
High School Degree	21.1	19.2	22.3	12.6	21.9	23.2	23.8	19.4
Trade or Community College	17.1	21.4	23.3	18.7	17.7	18.0	20.6	15.2
Professional School Degree	22.7	11.6	15.3	8.5	19.1	6.8	13.7	3.2
Bachelor's Degree	24.7	20.7	24.2	9.8	24.5	19.3	17.6	12.8
Master's Degree or Higher	5.6	2.2	1.8	0.0	4.6	2.3	1.0	0.0
Region of Residence (%)								
Atlantic	8.7	13.5	6.6	16.7	8.4	12.9	5.8	7.7
Quebec	27.3	6.0	8.3	1.0	26.4	8.4	12.2	5.4
Ontario	35.2	22.5	25.9	2.7	34.6	26.7	23.4	8.5
West	28.5	54.6	58.2	4.7	30.4	48.7	57.4	3.0
North	0.2	3.4	0.9	74.9	0.2	3.5	1.3	75.4
Employed (%)	81.5	59.7	73.8	62.9	88.3	65.7	82.4	64.3
Total Observations	6,327	978	851	233	5,425	691	726	216
Unemployed (%)	3.2	11.6	7.8	11.0	3.2	14.6	2.8	16.1
Total Observations	5,241	693	718	161	4,871	569	627	173
Hourly Wage	25.17	21.59	24.03	27.08	29.89	24.50	27.58	30.57
Total Observations	4,332	588	597	122	3,759	431	517	119

Notes: Standard deviations are reported in parentheses. Source: Authors' calculations.

Table 2.2: Regressions for Standardized Literacy, Numeracy, and Technology Skill

	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
	Literacy			Numeracy			Technology without Zero			Technology with Zero		
Females												
First Nations	-0.556**	-0.310**	-0.213**	-0.682**	-0.393**	-0.307**	-0.422**	-0.257*	-0.197+	-0.546**	-0.329**	-0.262**
	(0.094)	(0.0763)	(0.0754)	(0.109)	(0.0980)	(0.0948)	(0.129)	(0.111)	(0.107)	(0.080)	(0.0775)	(0.0787)
Métis	-0.115	-0.00754	0.0451	-0.189*	-0.0535	-0.00600	-0.101	-0.0334	0.0166	0.007	0.0834+	0.121*
	(0.081)	(0.0742)	(0.0739)	(0.075)	(0.0736)	(0.0749)	(0.094)	(0.0877)	(0.0893)	(0.052)	(0.0501)	(0.0535)
Inuit	-1.234**	-0.521**	-0.432**	-1.335**	-0.577**	-0.495**	-0.879**	-0.401+	-0.349+	-1.074**	-0.626**	-0.537**
	(0.153)	(0.169)	(0.167)	(0.130)	(0.132)	(0.160)	(0.185)	(0.205)	(0.203)	(0.136)	(0.133)	(0.153)
Adjusted R^2	0.059	0.304	0.338	0.054	0.294	0.321	0.086	0.245	0.273	0.087	0.206	0.220
Observations	8,393	8,393	8,393	8,393	8,393	8,393	6,994	6,994	6,994	8,393	8,393	8,393
Males												
First Nations	-0.595**	-0.288**	-0.209**	-0.713**	-0.378**	-0.307**	-0.465**	-0.282*	-0.204+	-0.451**	-0.204**	-0.164*
	(0.090)	(0.0796)	(0.0751)	(0.094)	(0.0878)	(0.0870)	(0.126)	(0.117)	(0.111)	(0.077)	(0.0767)	(0.0767)
Métis	-0.260**	-0.0975	-0.0685	-0.300**	-0.134	-0.104	-0.238+	-0.0889	-0.0741	-0.167*	-0.0332	-0.00989
	(0.096)	(0.0825)	(0.0819)	(0.097)	(0.0864)	(0.0841)	(0.125)	(0.107)	(0.114)	(0.082)	(0.0730)	(0.0705)
Inuit	-1.261**	-0.603**	-0.456*	-1.366**	-0.627**	-0.500**	-0.938**	-0.539*	-0.416*	-1.184**	-0.607**	-0.557*
	(0.167)	(0.191)	(0.191)	(0.166)	(0.176)	(0.172)	(0.264)	(0.218)	(0.200)	(0.173)	(0.233)	(0.233)
Adjusted R^2	0.037	0.316	0.353	0.037	0.309	0.343	0.047	0.241	0.277	0.079	0.219	0.232
Observations	7,061	7,061	7,061	7,061	7,061	7,061	5,484	5,484	5,484	7,061	7,061	7,061
Edu/Exp/ /Region	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Family Background	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes

Notes: All regressions include controls for age and age-squared. Education includes indicators for: primary or less, lower secondary, high school degree (base group), trade or community college, professional school degree, Bachelor's degree, Master's degree or higher. Experience includes years of work experience and its quadratic. Family background includes indicators for number of books, parental education and language as outlined in Section 2. Jackknifed standard errors are reported in parentheses. Statistical significance is given by: + ten percent; * five percent; and ** one percent. Source: Authors' calculations.

Table 2.3: Regressions for Differences in Log Hourly Wages

	(1)	(2)	(3)	(4)	(5)	(6)
Females						
First Nations	-0.225**	-0.140**	-0.106**	-0.0979**	-0.0885**	-0.0770*
	(0.0437)	(0.0364)	(0.0368)	(0.0346)	(0.0341)	(0.0352)
Métis	-0.0670+	-0.00144	-0.0392	-0.0005	-0.0147	0.00344
	(0.0362)	(0.0299)	(0.0331)	(0.0290)	(0.0304)	(0.0258)
Inuit	-0.182	0.00501	0.0438	0.0815	0.0205	0.0896
	(0.115)	(0.101)	(0.0873)	(0.0923)	(0.0743)	(0.0985)
Adjusted R^2	0.0473	0.283	0.188	0.310	0.404	0.332
Observations	5,609	5,609	5,609	5,609	5,609	5,609
Males						
First Nations	-0.188**	-0.104**	-0.0742*	-0.0621+	-0.0479	-0.0497
	(0.0382)	(0.0332)	(0.0362)	(0.0336)	(0.0307)	(0.0328)
Métis	-0.0981**	-0.0404	-0.0487	-0.0260	-0.0393	-0.0211
	(0.0357)	(0.0398)	(0.0416)	(0.0422)	(0.0380)	(0.0439)
Inuit	-0.107	0.0462	0.0986	0.122	0.148	0.157
	(0.161)	(0.139)	(0.118)	(0.121)	(0.125)	(0.125)
Adjusted R^2	0.0473	0.283	0.188	0.310	0.404	0.253
Observations	4,823	4,823	4,823	4,823	4,823	4,823
Basic Controls	Yes	Yes	Yes	Yes	Yes	Yes
Education	No	Yes	No	Yes	Yes	Yes
Skills	No	No	Yes	Yes	Yes	Yes
Occ/Exp	No	No	No	No	Yes	No
Family Background	No	No	No	No	No	Yes

Notes: Basic controls include age, age-squared, and region of residence. Education includes indicators for: primary or less, lower secondary, high school degree (base group), trade or community college, professional school degree, Bachelor's degree, Master's degree or higher. Skills include literacy, numeracy, technology skill and their quadratics, as well as a dummy variable for missing technology skill. Occupation is based on 22 indicators, while experience includes years of work experience and its quadratic. Family background includes indicators for number of books, parental education and language as outlined in Section 2. Jackknifed standard errors are reported in parentheses. Statistical significance is given by: + ten percent; * five percent; and ** one percent. Source: Authors' calculations.

Table 2.4: Oaxaca-Blinder Decompositions of Log Hourly Wages, Non-Indigenous versus each Indigenous Group

	Non-Indigenous versus First Nations				Non-Indigenous versus Métis				Non-Indigenous versus Inuit			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Females												
Unconditional Log Hourly Wage Gap												
	0.205**	0.205**	0.205**	0.205**	0.0458	0.0458	0.0458	0.0458	0.0212	0.0212	0.0212	0.0212
	(0.0445)	(0.0445)	(0.0445	(0.0445)	(0.0375)	(0.0375)	(0.0375)	(0.0375)	(0.0999)	(0.0999)	(0.0999)	(0.0999)
Differences in Characteristics												
	-0.020+	0.0660*	0.100**	0.108**	-0.0219*	0.0443*	0.0070	0.0456*	-0.152*	0.0485	0.0864	0.128*
	(0.0115)	(0.0265)	(0.0277	(0.0299)	(0.0117)	(0.0250)	(0.0242)	(0.0268)	(0.0702)	(0.0597)	(0.0531)	(0.0568)
Differences in Returns												
	0.224**	0.139**	0.104**	0.0962*	0.0677*	0.0015	0.0388	0.0002	0.174	-0.0272	-0.0652	-0.106
	(0.0439)	(0.0365)	(0.0371	(0.0347)	(0.0361)	(0.0299)	(0.0331)	(0.0290)	(0.124)	(0.111)	(0.0979)	(0.104)
Observations	4,885	4,885	4,885	4,885	4,929	4,929	4,929	4,929	4,454	4,454	4,454	4,454
Males												
Unconditional Log Hourly Wage Gap												
	0.187**	0.187**	0.187**	0.187**	0.0526	0.0526	0.0526	0.0526	-0.0062	-0.0062	-0.0062	-0.0062
	(0.0400)	(0.0400)	(0.0400	(0.0400)	(0.0361)	(0.0361)	(0.0361)	(0.0361)	(0.112)	(0.112)	(0.112)	(0.112)
Differences in Characteristics												
	-0.0036	0.0805**	0.111**	0.123**	-0.047**	0.0112	0.0028	0.0257	-0.107	0.0556	0.109*	0.134
	(0.0150)	(0.0254)	(0.0256	(0.0291)	(0.0166)	(0.0245)	(0.0249)	(0.0273)	(0.0667)	(0.0476)	(0.0522)	(0.0482)
Differences in Returns												
	0.190**	0.106**	0.0751*	0.0635+	0.0994*	0.0414	0.0497	0.0268	0.101	-0.0618	-0.115	-0.140
	(0.0384)	(0.0332)	(0.0364	(0.0338)	(0.0358)	(0.0399)	(0.0416)	(0.0423)	(0.167)	(0.141)	(0.120)	(0.122)
Observations	4,185	4,185	4,185	4,185	4,273	4,273	4,273	4,273	3,876	3,876	3,876	3,876
Basic Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Education	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Skills	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes

Notes: Basic controls include age, age-squared, and region of residence. Education includes indicators for: primary or less, lower secondary, high school degree (base group), trade or community college, professional school degree, Bachelor's degree, Master's degree or higher. Skills include literacy, numeracy, technology skill and their quadratics, as well as a dummy variable for missing technology skill. Jackknifed standard errors are reported in parentheses. Statistical significance is given by: + ten percent; * five percent; and ** one percent. Source: Authors' calculations.

Table 2.5: Regressions for Returns to Skills in Log Hourly Wages, by Indigenous Group, Standardized Literacy, Numeracy, and Technology Skill

	(1)	(2)	(1)	(2)	(1)	(2)
	Skill=Literacy		Skill=Numeracy		Skill=Technology	
Females						
Skill	0.197**	0.090**	0.198**	0.094**	0.358**	0.157**
	(0.012)	(0.015)	(0.013)	(0.016)	(0.030)	(0.034)
First Nations x Skill	0.030	0.047	0.034	0.058	0.047	0.068
	(0.044)	(0.040)	(0.046)	(0.040)	(0.127)	(0.08)
Métis x Skill	-0.044	-0.028	-0.027	-0.008	-0.066	-0.047
	(0.037)	(0.037)	(0.036)	(0.036)	(0.111)	(0.099)
Inuit x Skill	0.063	0.068	0.063	0.076	0.217	0.213
	(0.076)	(0.075)	(0.082)	(0.078)	(0.174)	(0.176)
Adjusted R^2	0.166	0.302	0.171	0.305	0.125	0.297
P-Value for F-Test	0.779	0.855	0.936	0.817	0.973	0.972
Observations	5,609	5,609	5,609	5,609	5,609	5,609
Males						
Skill	0.157**	0.071**	0.174**	0.097**	0.290**	0.117**
	(0.015)	(0.018)	(0.015)	(0.018)	(0.035)	(0.038)
First Nations x Skill	0.022	0.028	0.009	0.018	0.030	0.077
	(0.044)	(0.041)	(0.041)	(0.041)	(0.098)	(0.088)
Métis x Skill	-0.059	-0.057	-0.059	-0.055	-0.105	-0.125
	(0.062)	(0.070)	(0.060)	(0.066)	(0.156)	(0.169)
Inuit x Skill	0.164	0.161	0.160	0.160	0.505	0.494
	(0.121)	(0.122)	(0.118)	(0.120)	(0.370)	(0.354)
P-Value for F-Test	0.577	0.654	0.545	0.633	0.522	0.363
Adjusted R^2	0.160	0.228	0.179	0.239	0.147	0.229
Observations	4,823	4,823	4,823	4,823	4,823	4,823
Basic Controls	Yes	Yes	Yes	Yes	Yes	Yes
Education	No	Yes	No	Yes	No	Yes

Notes: Basic controls include age, age-squared, and region of residence. Education includes indicators for: primary or less, lower secondary, high school degree (base group), trade or community college, professional school degree, Bachelor's degree, Master's degree or higher. Jackknifed standard errors are reported in parentheses. We report P-values for F-tests of overall significance with respect to indicators for First Nations, Métis and Inuit interacted with the skill variable. Statistical significance is given by: + ten percent; * five percent; and ** one percent**.** Source: Authors' calculations

Table 2.6: Regressions for Differences in Log Hourly Wages by Quantile

	Females					Males				
Quantile	10th	25th	50th	75th	90th	10th	25th	50th	75th	90th
1. Basic Controls										
First Nations	-0.324*	-0.335**	-0.180**	-0.144**	-0.122*	-0.233	-0.187**	-0.224**	-0.121	-0.115
	(0.148)	(0.0727)	(0.0549)	(0.0429)	(0.0488)	(0.180)	(0.0647)	(0.0455)	(0.0780)	(0.362)
Métis	-0.0259	-0.0641	-0.0330	-0.132**	-0.116**	0.0020	-0.0442	-0.0649	-0.162*	-0.216+
	(0.0548)	(0.0632)	(0.0645)	(0.0463)	(0.0412)	(0.109)	(0.0820)	(0.0524)	(0.0664)	(0.125)
Inuit	-0.184	-0.247	-0.200	-0.164	-0.0474	-0.254	-0.217+	-0.163	-0.0595	0.245
	(0.276)	(0.164)	(0.159)	(0.110)	(0.134)	(0.162)	(0.131)	(0.165)	(0.195)	(0.421)
2. With Education										
First Nations	-0.216	-0.242**	-0.0813	-0.0572	-0.0618	-0.181	-0.0918	-0.136**	-0.0362	-0.0351
	(0.153)	(0.0649)	(0.0528)	(0.0396)	(0.0402)	(0.168)	(0.0560)	(0.0425)	(0.0777)	(0.355)
Métis	0.0307	0.0006	0.0449	-0.0503	-0.0586	0.0412	0.0171	0.000481	-0.100	-0.159
	(0.0490)	(0.0511)	(0.0496)	(0.0522)	(0.0459)	(0.112)	(0.0885)	(0.0575)	(0.0660)	(0.119)
Inuit	0.0774	-0.0333	0.0166	0.0171	0.0635	-0.168	-0.0496	0.0008	0.0999	0.400
	(0.218)	(0.158)	(0.146)	(0.107)	(0.121)	(0.157)	(0.113)	(0.139)	(0.177)	(0.424)
3. With Education and Skills										
First Nations	-0.165	-0.179**	-0.0351	-0.0237	-0.0453	-0.125	-0.0376	-0.0956*	-0.0091	-0.0073
	(0.154)	(0.0636)	(0.0498)	(0.0395)	(0.0477)	(0.162)	(0.0602)	(0.0433)	(0.0785)	(0.355)
Métis	0.0276	-0.0021	0.0465	-0.0458	-0.0534	0.0605	0.0354	0.0140	-0.0904	-0.146
	(0.0484)	(0.0535)	(0.0500)	(0.0516)	(0.0453)	(0.117)	(0.0892)	(0.0586)	(0.0658)	(0.119)
Inuit	0.173	0.0823	0.0975	0.0751	0.0920	-0.0558	0.0610	0.0686	0.139	0.432
	(0.205)	(0.151)	(0.157)	(0.101)	(0.126)	(0.149)	(0.103)	(0.134)	(0.163)	(0.409)
4. With Education, Skills, Occupation and Work Experience										
First Nations	-0.126	-0.157**	-0.0371	-0.0302	-0.0492	-0.101	-0.0266	-0.0958**	0.0030	0.0289
	(0.157)	(0.0622)	(0.0481)	(0.0376)	(0.0468)	(0.151)	(0.0605)	(0.0415)	(0.0748)	(0.348)
Métis	0.0195	-0.0161	0.0199	-0.0598	-0.0573	0.0566	0.0181	-0.0064	-0.105	-0.162
	(0.0514)	(0.0523)	(0.0514)	(0.0542)	(0.0446)	(0.132)	(0.0827)	(0.0518)	(0.0656)	(0.120)
Inuit	0.0453	-0.0313	0.0252	0.0497	0.0963	0.0202	0.0889	0.0579	0.137	0.473
	(0.149)	(0.123)	(0.151)	(0.105)	(0.123)	(0.172)	(0.116)	(0.142)	(0.175)	(0.408)

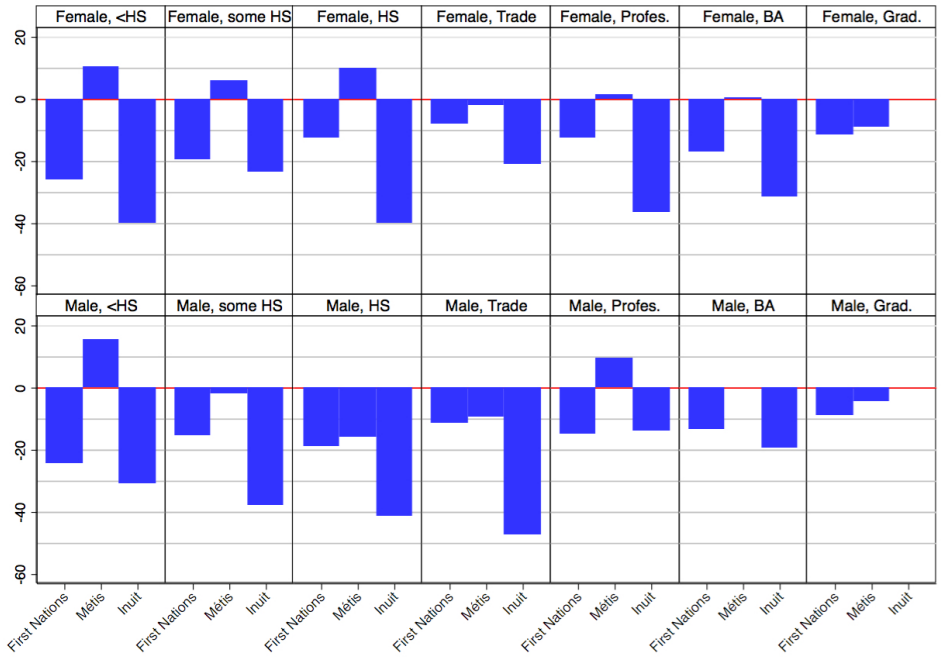
Notes: Basic controls include age, age-squared, and region of residence. Education includes indicators for: primary or less, lower secondary, high school degree (base group), trade or community college, professional school degree, Bachelor's degree, Master's degree or higher. Skills include literacy, numeracy, technology skill and their quadratics, as well as a dummy variable for missing technology skill. Occupation is based on 22 indicators, while experience includes years of work experience and its quadratic. Jackknifed standard errors are reported in parentheses. Statistical significance is given by: + ten percent; * five percent; and ** one percent. Source: Authors' calculations.

Table 2.7: Regressions for Employment, Unemployment, and Labour Force Participation

	Females				Males			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
1. Employed[a]								
First Nations	-0.235**	-0.177**	-0.150**	-0.140**	-0.233**	-0.197**	-0.177**	-0.171**
	(0.0326)	(0.0335)	(0.0350)	(0.0354)	(0.0454)	(0.0469)	(0.0477)	(0.0483)
Métis	-0.0997*	-0.0726	-0.0869+	-0.0736	-0.0776**	-0.0526+	-0.0547+	-0.0454
	(0.0490)	(0.0490)	(0.0487)	(0.0490)	(0.0289)	(0.0289)	(0.0284)	(0.0281)
Inuit	-0.216**	-0.0806	-0.0578	-0.0203	-0.239**	-0.165**	-0.130*	-0.115*
	(0.0654)	(0.0562)	(0.0672)	(0.0623)	(0.0619)	(0.0499)	(0.0634)	(0.0562)
Adjusted R^2	0.0229	0.0868	0.0819	0.108	0.0382	0.0790	0.0847	0.0990
Observations	8,389	8,389	8,389	8,389	7,058	7,058	7,058	7,058
2. Unemployed[b]								
First Nations	0.0854**	0.0791**	0.0731*	0.0720*	0.116**	0.110**	0.102**	0.102**
	(0.0295)	(0.0300)	(0.0304)	(0.0308)	(0.0389)	(0.0392)	(0.0381)	(0.0387)
Métis	0.0489+	0.0450	0.0446	0.0428	0.0003	-0.0050	-0.0034	-0.0057
	(0.0286)	(0.0287)	(0.0283)	(0.0285)	(0.0089)	(0.0094)	(0.0095)	(0.0096)
Inuit	0.0634+	0.0469	0.0415	0.0369	0.116**	0.101*	0.0867*	0.0846+
	(0.0336)	(0.0353)	(0.0360)	(0.0369)	(0.0441)	(0.0424)	(0.0442)	(0.0436)
Adjusted R^2	0.0112	0.0156	0.0236	0.0246	0.0070	0.0138	0.0184	0.0207
Observations	6,813	6,813	6,813	6,813	6,240	6,240	6,240	6,240
3. Labour Force Participation[c]								
First Nations	-0.183**	-0.128**	-0.104**	-0.0950**	-0.148**	-0.117**	-0.102*	-0.0963*
	(0.0292)	(0.0300)	(0.0325)	(0.0325)	(0.0424)	(0.0435)	(0.0447)	(0.0450)
Métis	-0.0611	-0.0365	-0.0512	-0.0389	-0.0794**	-0.0583*	-0.0600*	-0.0521*
	(0.0478)	(0.0479)	(0.0477)	(0.0478)	(0.0267)	(0.0268)	(0.0263)	(0.0261)
Inuit	-0.179**	-0.0503	-0.0299	0.0066	-0.155**	-0.0930+	-0.0638	-0.0509
	(0.0614)	(0.0518)	(0.0607)	(0.0555)	(0.0582)	(0.0491)	(0.0610)	(0.0556)
Adjusted R^2	0.0266	0.0912	0.0830	0.110	0.0398	0.0771	0.0805	0.0938
Observations	8,389	8,389	8,389	8,389	7,058	7,058	7,058	7,058
Basic Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Education	No	Yes	No	Yes	No	Yes	No	Yes
Skills	No	No	Yes	Yes	No	No	Yes	Yes

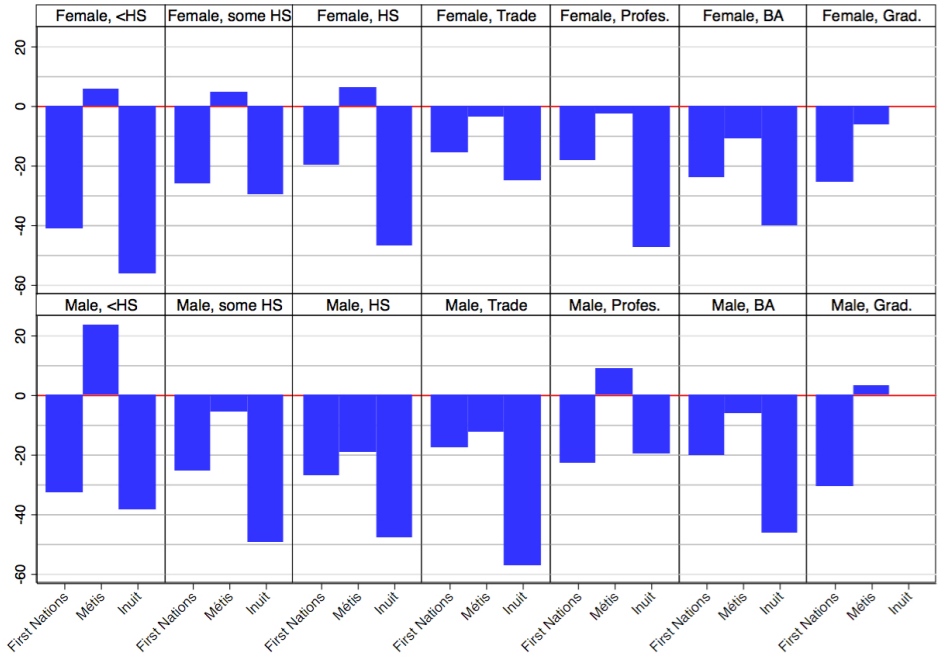
Notes: **a**. Employed equals one if the respondent is employed or self-employed and zero if they are unemployed or not in the labour force. **b**. Unemployed equals one if the respondent is unemployed and zero if they are employed. **c**. Labour force participation equals one if the respondent is employed or unemployed and zero if they are not in the labour force. Basic controls include age, age-squared, and region of residence. Education includes indicators for: primary or less, lower secondary, high school degree (base group), trade or community college, professional school degree, Bachelor's degree, Master's degree or higher. Skills include literacy, numeracy, technology skill and their quadratics, as well as a dummy variable for missing technology skill. Jackknifed standard errors are reported in parentheses. Statistical significance is given by: + ten percent; * five percent; and ** one percent. Source: Authors' calculations.

Figure 2.1a: Literacy relative to the Non-Indigenous Sample, by Education Group



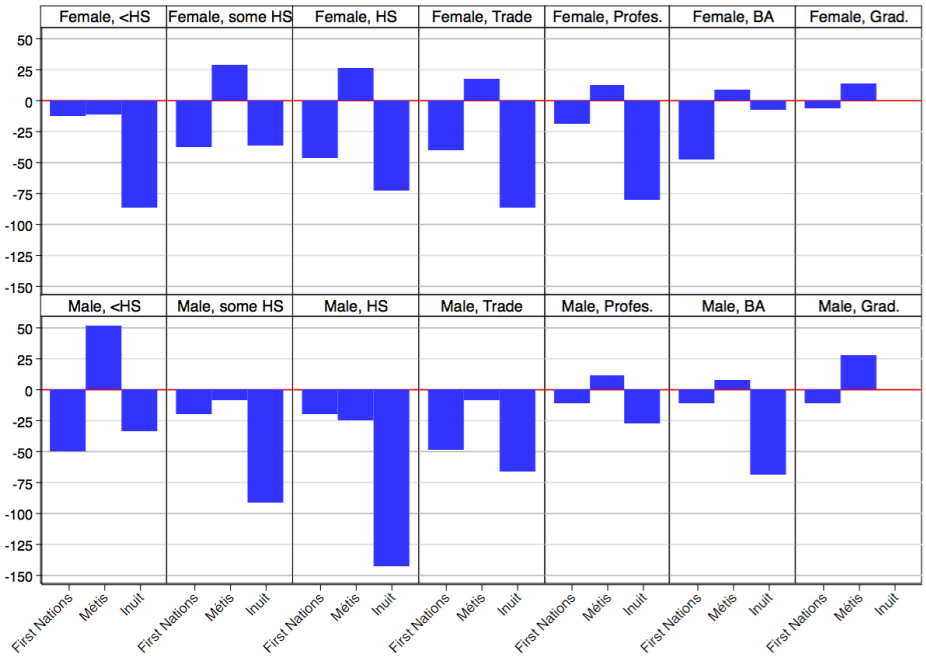
Notes: HS = High School; Profes. = Professional School Degree; BA = Bachelor's Degree; Grad. = Master's Degree or Higher. Source: Authors' calculations.

Figure 2.1b: Numeracy relative to the Non-Indigenous Sample, by Education Group



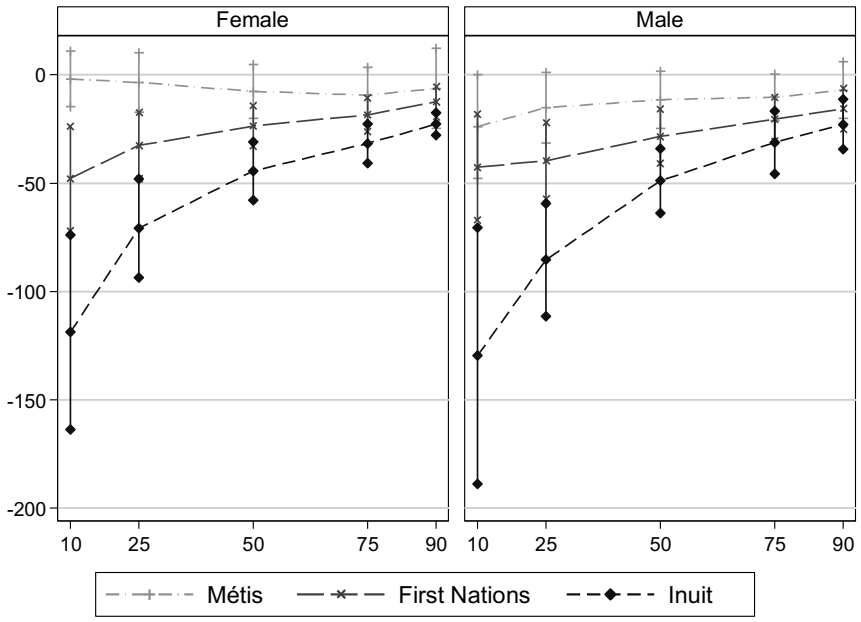
Notes: HS = High School; Profes. = Professional School Degree; BA = Bachelor's Degree; Grad. = Master's Degree or Higher. Source: Authors' calculations.

Figure 2.1c: Technology Skill relative to the Non-Indigenous Sample, by Education Group



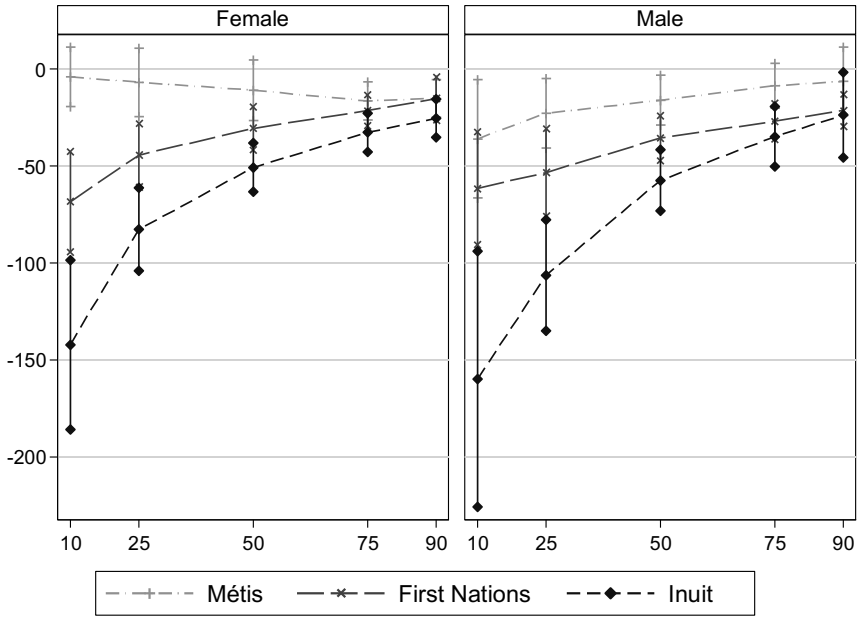
Notes: HS = High School; Profes. = Professional School Degree; BA = Bachelor's Degree; Grad. = Master's Degree or Higher. Source: Authors' calculations.

Figure 2.2a: Literacy Score Difference by Quantile with Base Controls, Raw Scores by Gender



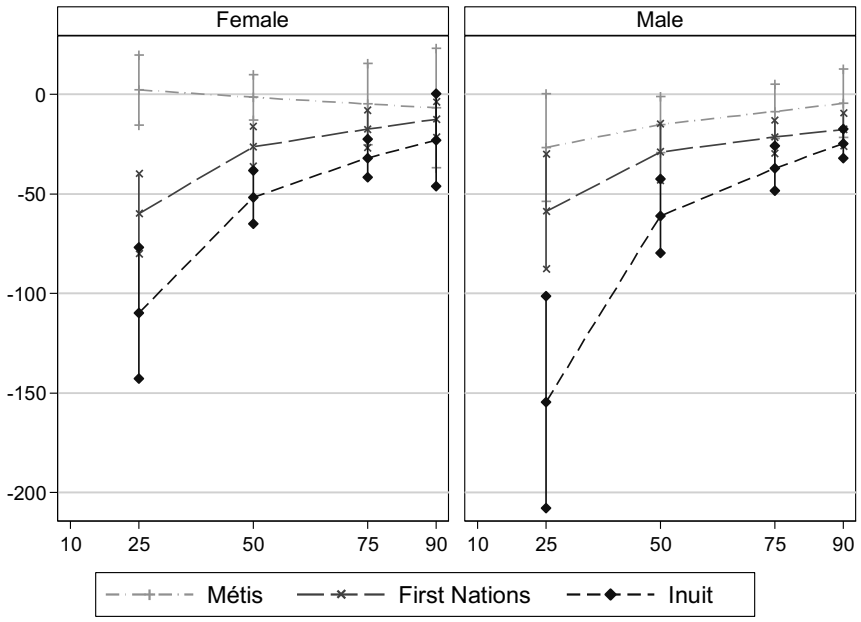
Notes: Bars represent 95 percent confidence intervals. We control for age and age-squared.
Source: Authors' calculations.

Figure 2.2b: Numeracy Score Difference by Quantile with Base Controls, Raw Scores by Gender



Notes: Bars represent 95 percent confidence intervals. We control for age and age-squared.
Source: Authors' calculations.

Figure 2.2c: Technology Skill Difference by Quantile with Base Controls, Raw Scores by Gender



Notes: Bars represent 95 percent confidence intervals. We control for age and age-squared.
Source: Authors' calculations.

Chapter 3

Mind the Gap – What Factors Determine the Worsening Health Status of Indigenous Women Relative to Men Living Off-reserve in Canada?

3.1 Introduction

Inequalities in health status among different populations are a major global health challenge (Marmot, 2005). Systematic differences exist for various measures of health (e.g. mortality, self-reported health status and psychological well-being) and across many social groups (e.g. income, education, gender and marital status) (Goldman, 2001). Despite an overall improvement in population health status in recent decades, significant inequalities exist in health and its risk factors in Canada (Frohlich et al. 2006) and reducing such inequalities is considered as one of the main priorities of public policies and government goals across Canada (Cristine Rotenberg, 2016; Hajizadeh et al, 2018).[24] A recent report by the Canadian Institute for Health Information, for example, shows that there are persistent health gaps between the poor and rich Canadians in several health indicators and risk factors including chronic disease, well-being, access to housing, food security, smoking, and obesity.[25] There is also evidence suggesting that socioeconomic inequality in health has widened over the past 15 years in Canada, especially among women (Hajizadeh, Mitnitski, and Rockwood, 2016).

Indigenous peoples living in Canada experience worse health than non-Indigenous Canadians (Wilson and Macdonald, 2010). The persistent differences in health between Indigenous and non-Indigenous people are reported for a wide range of health outcomes such as life expectancy, diabetes and obesity (Ford et al., 2010), and suicide and addiction rates (Adelson, 2005; Frohlich et al., 2006; MacMillan et al., 1996). The existing literature showed how both contemporary and historical aspects of colonization that discriminate against Indigenous populations in Canada are linked to the observed inequalities in health (Bombay, Matheson, and Anisman, 2014; Walls and Whitbeck, 2012). The final report of the Truth and Reconciliation Commission of Canada (Truth

[24] See https://www150.statcan.gc.ca/n1/pub/82-624-x/2013001/article/11763-eng.htm.
[25] See https://www.cihi.ca/en/trends-in-income-related-health-inequalities-in-canada.

and Reconcilliation Commission of Canada, 2015) in 2015 calls explicitly to reduce the health gaps between Indigenous and non-Indigenous populations.

In addition to their poor health status, Indigenous peoples are among the most socioeconomically vulnerable and disadvantaged group in Canada (Stephens et al., 2006). Compared to non-Indigenous peoples in Canada, the three main Indigenous groups, *viz*. First Nations[26], Métis and Inuit, have lower levels of income, employment and educational attainment (Wilson and Macdonald, 2010). Inequalities in social determinants of health such as income and education are widely considered to be main contributors to differences in health outcomes (Marmot, 2005; Frohlich et al., 2006; Rotenberg, 2016; Hajizadeh et al., 2018). Indigenous women experience poorer social determinants of health than Indigenous men in Canada (Brownridge, 2003). Although the number of Indigenous women with higher educational attainments (a post-secondary degree) increased in the last 15 years, Indigenous women have lower median incomes than Indigenous men (Tait, 2008). Besides biological (World Health Orgnization, 2009) and historical factors (Emberley, 2001), the lower socio-economic status (SES) of Indigenous women in Canada may have contributed to the observed gender gaps in health status (Hajizadeh et al., 2016) among Indigenous populations.

To date, several studies investigated inequalities between Indigenous and non-Indigenous populations in Canada (Adelson, 2005; Clark and Cameron, 2009; Ford et al., 2010; Frohlich et al., 2006; MacMillan et al., 1996). However, inequalities in health *within* Indigenous groups have not been examined extensively. Specifically, the gender gap in health among Indigenous people have not been assessed in the existing literature. To fill this gap, I measure the differences in health status between off-reserve Indigenous females and males. Then, I use the Oaxaca-Blinder (OB) decomposition method to parse out the observed gender health gap into the difference in characteristics, and the difference in returns of those factors. As there are significant differences in SES, cultures, and present-day situation of the four distinct Indigenous subgroups (i.e., Registered First

[26] There are two types of First Nations population, Registered First Nations (RFN) and Non-registered First Nations (NRFN). RFN is the only official record of Status Indians or registered Indians in Canada. RFNs in Canada are entitled to access to wide range of government programs and benefits such as extended hunting season, exemptions from federal and provincial taxes, government funding, and more freedom in the management of gaming and tobacco franchises. See the following link for more information: https://www.aadnc-aandc.gc.ca/eng/1461939932579/1461939954663.

Nations [RFN], Non-registered First Nations [NRFN], Metis, and Inuit) (Adelson, 2005; Kirmayer, Brass, and Tait, 2000), I examine the gender health gap separately for each group of Indigenous populations.

Using the three cycles of Aboriginal Peoples Survey (APS, 2001, 2006 and 2012), I find that Indigenous men compared to their female counterparts had a higher rate of excellent/very good/good perceived health status (Good General Health [GGH]). The gender health gap increased from 2001 to 2012, and comparatively larger among RFN and NRFN. The results reveal that Indigenous peoples who are married, employed, had higher educational degrees and income, and participate in cultural activities are more likely to report good general health. The results of the OB decomposition suggest that differences in the observable characteristics between males and females in each survey year explain more than 60 percent of the observed gender gap in good general health. The difference in SES factors between Indigenous males and females explain more than 50 percent of the gap in good general health. As Indigenous females have higher educational attainments than males, this factor does not contribute to the difference in the health gap. The results also indicate that increasing participation in traditional activities (hunting, fishing, trapping and gathering wild plants) among females to the level of males could reduce the gender health gap among Indigenous peoples in Canada.

The remainder of this paper is organized as follows: In Section 3.2, I introduce the datasets and the methodology. I will then present the empirical results in Section 3.3, and Section 3.4 concludes the paper.

3.2 Data and Methodology

3.2.1 Data

Three cycles of confidential master files of the Aboriginal Peoples Survey (APS), collected by Statistics Canada in 2001, 2006 and 2012 are used for the analysis. Each APS is a large nationally representative cross-sectional survey of more than 20,000 Indigenous peoples living off-reserves[27] in all provinces and territories in Canada. The survey collects information on demographic (e.g. age, gender, marital status) and SES

[27] Since the 2001 APS is the only cycle that contains information on Indigenous peoples living on-reserves, I only focused on off-reserve Indigenous peoples in the analysis.

status (e.g. educational attainment, household incomes, and employment status) from Indigenous peoples in Canada. The APS also contains information on the self-reported general health status of all individuals (aged 18 years and older) rated as "excellent", "very good", "good", "fair" or "poor". The survey is a unique source of information for Indigenous organizations, communities service providers, as well as researchers (Calcutt, 2009; Statistics Canada, 2016). The three cycles of APS are combined for the analysis. After dropping respondents who are less than 18 years old, with multiple Indigenous identity or any missing information in variables used in the study (approximately 1 percent of the overall sample) the final sample size for the analysis is 64,460.[28] For the analysis, I divide the overall Indigenous populations into four Indigenous subgroups because there are significant differences in the SES circumstances and lived world experiences among these subgroups.

3.2.2 Variable

Self-reported health status, a well-validated and widely-used indicator of health status (Layes, Asada, and Kepart, 2012), is used as a measure of health in the study. As per current literature (Brzezinski, 2015; Giordano and Lindstrom, 2010; Jones, Rice, and Roberts, 2010; Maheswaran, Kupek, and Petrou, 2015; Nedjat at al., 2012), the five-point Likert scale variable of self-reported health is dichotomized into "fair or poor health status" and "good, very good, or excellent health status". Several demographic, SES and cultural determinants of health status are used as determinant of health in the analysis. As household income is a better measurement of SES than individual income, the equivalized household income is used as a proxy for individual income in the analysis. As per the Economic Co-operation and Development (OECD) publications, equivalized household income is calculated as household income divided by square root of household size (Sarfati, 2009). Traditional harvesting activities of "fishing, hunting, trapping" and "wild plant gathering" are also used as the two cultural determinants of health status among Indigenous peoples. Also, I use place of residence (urban/rural) and regional fixed effects to control for unobserved heterogeneity across different regions in Canada.

[28] As per the Statistics Canada's Research Data Centres (RDC) policy, the sample size is rounded to base 10.

Table 3.1 presents the description of the variables used in the analysis. The outcome variable in the study is defined as a dummy variable equals one if the self-reported general health status is good, very good, or excellent, and zero otherwise. Four main categories of educational attainment are used in the estimations: less than high school, high school diploma, some postsecondary education or degrees below bachelor's degree, bachelor's degree or higher. Due to the small Indigenous populations in some provinces, I combine Nova Scotia, New Brunswick, Prince Edward Island and Newfoundland and Labrador into one dummy variable called Atlantic. The provinces of Alberta, Saskatchewan and Manitoba are combined into one dummy variable named Prairies. As a large proportion of the Inuit population lives Territories (North West Territories, Yukon and Nunavut), I only use the Territories dummy variable in the regression analysis for Inuit peoples. Similarly, as there are only a small number of Inuit people holding bachelor's degrees or higher living in some specific regions, the top two educational attainment degree variables are combined in the analysis related to the Inuit population. The sampling weight is applied throughout the analysis. The analyses are conducted for the overall sample as well as for each of the four Indigenous subgroups separately.

Tables 3.2, 3.3, and 3.4 contain weighted descriptive statistics of all variables used in the study for the three survey years. Each table presents the mean of the variables for the overall sample, as well as for RFN, NRFN, Métis and Inuit separately, with females in the first five columns and males in the last five columns. As reported in Table 3.2, a higher proportion of RFN males (82.2 percent) rate their general health status as good general health in 2001 compared to the RFN females (78.3 percent). NRFN, Métis, and Inuit males have a similar average level of good general health as their female counterparts in 2001. As reported in Table 3.3, the gap in good general health between males and females widens in 2006 within all Indigenous subgroups, except within Inuit population. The difference in the proportion of men and women with good general health increases to 6.6 percentage point (83.3-76.7) for NRFN and 1.8 percentage point (85.5-82.9) for Métis. The observed gaps in health status between men and women in 2006 persists for NRFN and Métis in 2012, whereas the gap increases to 7.2 percentage points (80.5-73.7) within RFN and 2.6 percentage points (81.6-79.0) within Inuit. Increasing the health gap between males and females among the four Indigenous groups is primarily due to the reduction in the good general health of Indigenous females.

With regards to the demographic variables, the average age increases from 39 years old to 42 years old for all Indigenous subgroups from 2001 to 2012, similar to the overall Canadian trend. Inuit people are relatively younger than the other Indigenous subgroups. While the majority of Inuit people (60 percent) live in Territories, RFN and NRFN peoples mainly resides in Ontario or Prairies. A higher proportion of women are separated or widowed than men, as females tend to live longer than males.

Indigenous males have relatively lower educational attainment than Indigenous females in all the three survey years in 2001, 2006 and 2012. For example, while 52.4 percent of RFN females have postsecondary educations or higher in the year 2001, this figure is 48.6 percent for RFN males. There is a reduction in the proportion of NRFN males with at least a high school degree among NRFN males. While 36.5 percent of NRFN males do not obtain at least a high school degree in 2001, the proportion decreases to 33.4 and 29.2 percent in 2006 and 2012, respectively. Approximately 55 percent of Inuit males have less than high school education, which is 3 percentage points higher than Inuit females. Métis people tend to have the highest educational attainments among the four Indigenous subgroups. The educational attainment among Indigenous peoples improves for women and men from 2001 to 2012, with higher education level for females compared to males in all cycles.

Males have higher employment rate than females among all Indigenous subgroups. The highest gender employment gap is 12.8 percentage points (62.5-49.7) among RFN in 2001. In 2001, 35.5 percent of Indigenous females are not in the labour force, the corresponding figure is 21.7 percent among males. There is an increase in the rate of not in labour force among both men and women. There are also noticeable differences in terms of employment status among each Indigenous subgroup.

With regard to the traditional and cultural activities, the descriptive statistics results suggest that 53 percent of males and 29.1 percent of females participate in hunting, fishing, or trapping in the last 12 months of in 2001. Males tend to participate more in traditional and cultural activities than their female counterparts. Both Inuit males and females participate more in traditional and cultural activities than individuals of the other three Indigenous subgroups. The proportions of Indigenous peoples who participate in

traditional and cultural activities (i.e., hunting, fishing, trapping, and wild plant gathering) in the past 12 months decrease over the study period.

I first examine the gender health gap for all Indigenous peoples living off-reserve and then I conduct separate analyses of the gender health gap for each subgroup of Indigenous peoples. As there may exist a potential self-identification issue of Indigenous peoples (especially Métis) over time, I do not pool the three APSs together and examine the gender health gap for each survey separately.

3.2.3 Method

To examine the gender health gap within the Indigenous population, I start with the linear probability model (LPM) in order to assess the health differences between females and males using the following equation:

$$Y_i = \alpha_0 + \alpha_1^j \, Male + \alpha_2^j Indigenous_i + \beta X_i + \mu_i. \qquad (3.1).$$

In Equation (3.1), Y_i denotes the outcome variable of good general health for person i, α_0 is the intercept, α_1 is the coefficient on the dummy variable for male, and α_2 is the coefficient related to the four Indigenous groups, where the superscript j indicates self-identification for NRFN, Métis or Inuit. The comparison group consists of RFN people. X_i is a vector of other control variables (demographic, SES, traditional activities and geographic factors) and μ_i is the error term.

I first perform the LPM model with only ethnicity, age, age-squared, marital status, and geographic factors as control variables. Then, covariates for education, employment status, as well as equivalized household income were added to the model. I further control for participating in traditional activities in the last 12 months to control for cultural determinants of health status. I estimate separate models by survey years. In addition to LPM, I perform the analyses using logistic regressions as a robustness check of the results obtained from LPM and present the marginal effects obtained from logistic models in the Appendix B.

To understand the contributing factors to the difference in the good general health difference between Indigenous males and females, I employ the OB decomposition

method (Blinder, 1973; Oaxaca, 1973). The OB method disaggregates the health gap between males and females into the difference in the average level of the characteristics (endowment effect) and the difference in these factors' returns (return effect). For example, Indigenous females may have a lower average level of good general health because they have a lower employment rate, or the returns to general health from the employment rate for Indigenous females is smaller than Indigenous males. I apply the two-fold OB decomposition[29], with males as the default group to compare with.

Consider that the good general health status among males, Y_{mi}, and females Y_{fi} are related to vectors of demographic, SES, traditional activities and geographic factors for males and females (X_{mi} and X_{fi}, respectively) as follows:

$$Y_{mi} = X_{mi}\beta_m + \mu_{mi} \quad \text{and} \quad Y_{fi} = X_{fi}\beta_f + \mu_{fi}, \qquad (3.2)$$

where β_m and β_f are the rates of return for these characteristics, and μ_{mi} and μ_{fi} are error terms with an expected value of zero. Taking expectations of males' and females' health respectively, and subtract the expected value of females' health from males' health, the difference in the average of good general health between two genders can be written as:

$$Diff = \bar{Y}_m - \bar{Y}_f = \bar{X}_m\beta_m - \bar{X}_f\beta_f \qquad (3.3).$$

Adding and subtracting the term $\bar{X}_f\beta_m$ in Equation (3.3) leads to:

$$Diff = (\bar{X}_m - \bar{X}_f)\beta_m + \bar{X}_f(\beta_m - \beta_f) \qquad (3.4).$$

The first component $(\bar{X}_m - \bar{X}_f)\,\beta_m$ in equation (3.4) represents the difference in good general health between males and females explained by the differences in mean level of characteristics, which is often called the "explained" part. The second component $\bar{X}_f(\beta_m - \beta_f)$ in equation (3.4) represents the difference in the general good health that is due to returns to characteristics between males and females, which is also called the "unexplained" part. I conduct OB decomposition analysis using LPM model. Some

[29] Two-fold OB decomposition assume there is potential disadvantage (negative discrimination) on females' health and there is no advantage (positive discrimination) for males.

studies highlight potential problems associated with the choice of the base group when a set of dummy variables is used in the OB analysis (Horrace and Oaxaca, 2001; Yun, 2005a, 2005b). In other words, since the associated coefficients are sensitive with respect to the choice of reference category, the decomposition results vary by altering the reference group. To overcome this issue, I employ the idea of deviation contrast transform to each set of categorical variables and restrict the coefficients for the same set of categorical variables sum up to zero. The results are equal to the simple averages of the results one would get from a series of decompositions in which the categories are used one after another as the base category. This approach overcomes the issue related to the choice of the base group as the contribution of a categorical predictor to the unexplained part of the decomposition does not depend on the choice of the base category. Since the outcome variable is binary, I also decompose the gap in good general health between males and females using an extension of the OB decomposition (Powers, Yoshioka, and Yun, 2011) to non-linear outcomes. As the results are robust and consistent with the OB of LPM analysis I present these findings in the Appendix B.

3.3 Empirical Results

3.3.1 Linear Probability Model Results

Table 3.5 presents the results of the LPM model specified in Equation (3.1) for total Indigenous peoples by survey year. The LPM results are presented in three columns. The first column contains the regression results that control for demographic and geographical factors (Model 1). The second column reports the results of the regression that adjust for demographic, geographical and socio-economic factors (Model 2). The results of the regression that includes demographic, geographical and SES factors, as well as traditional activities are presented in the third column (Model 3).

As reported in Table 3.5, the Indigenous males and females have a similar average level of good general health in 2001, but the gap between genders increases in 2006 and 2012. After controlling for basic demographic and geographical factors, Indigenous males, on average, are 1.3 percentage point more likely to report good general health status than their female counterparts in 2001. This figure increases to 2.9 percentage point in 2006 and 4.0 percentage point in 2012. Once SES variables are also included in the regression

analysis, the gender health gaps decrease by half. Controlling traditional activities in the regression analysis (Model 3) also reduces the absolute gender health gaps. As reported in the table, better SES and participation in traditional activities are positively correlated with good general health (see the coefficients on these variables in Model 3). Compared to RFN, Inuit peoples are more likely to report good general health, *ceteris paribus*. Being married and having higher educational attainment are associated with better health status within Indigenous populations living off-reserve in Canada. As expected, Indigenous people who are employed are 20 percentage point more likely to report good general health compared to those who are not in labour force. Household income and participation in traditional activities are positively associated with good general health among the Indigenous peoples.

The results of stratified analysis by four Indigenous subgroups are reported in Tables 3.6 to 3.9. Tables 3.6 and 3.7 report the regression results for RFN and NRFN peoples. Similar to the results of the total sample, more males rate their health status as good health compared to females in 2001, 2006, and 2012. When controlling for only demographic and geographical factors (Model 1), the results indicate that the probabilities of reporting good general health status are 3.1 and 5.3 percentage points higher in men compared to women in 2001 and 2012, respectively. Higher educational attainment is positively associated with reporting good general health among First Nations peoples. RFN with a bachelor's degree and higher in 2001 is 11.7 percentage point more likely to report good general health than those with less than high school education. The returns to education, however, is only 4 percentage points for NRFN. The corresponding percentage point increases to 16.4 and 18.9 in 2012 for RFN and NRFN, respectively. Compared to individuals who are not in labour force, the probability of reporting good general health in 2001 is 19 percentage point higher for employed RFN (23 percentage point higher for employed NRFN). Based on the results, a one percent increase in equivalized household income is associated with 2 and 4 percentage point increases in the probability of reporting good general health among RFN and NRFN. Traditional activities generally have a significant positive impact on the health status of RFN and NRFN. After controlling for demographic, geographical, SES variables traditional activities variables, the gender health differences within RFN and

NRFN reduced and become statistically insignificant in all years (see the coefficients on the male covariate in Model 3 in Tables 3.6 and 3.7).

Table 3.8 reports the regression results for the Métis population. Based on the results of the Model 3 which adjust for demographic, geographical, socioeconomic variables traditional activities variables, Métis females in 2001 are 4 percentage points more likely than males to have good general health status. However, the results do not show any health gap between the two genders in 2006 and 2012. Similar to the results for RFN and NRFN higher SES status and participation in traditional activities such as hunting, trapping, and fishing are associated with a higher possibility to have good general health among Métis.

Table 3.9 contains the results for Inuit people. The results of the three regression models suggest no significant difference in general health status between Inuit men and women in 2001, 2006 or 2012. The higher educational attainment effect on general health status among Inuit people is not as large as the effect found for other Indigenous groups. Compared to Inuit people with less than a high school degree, those with a high school diploma report 3.2 percentage point more good health status in 2001, and those with some postsecondary education report 5.3 percentage point more good health status in 2006. Employed Inuit are about 8.7 percentage points more likely to report good general health status in 2006 and 2010. Table B1 presents the marginal effect of each independent variable obtained from the logistic regression and the results are consistent with the LPM results.

3.3.2 Oaxaca-Blinder Decomposition Results

Tables 3.10 to 3.12 present the OB decomposition results of the gap in good general health between Indigenous men and women living off-reserve in Canada for the years 2001, 2006, and 2012. The gender health gaps are decomposed for all Indigenous populations combined and for all four Indigenous subgroups, separately. Similar to the LPM regressions, I use three different sets of control variables in the decomposition analysis. In the first model, I use demographic and geographical factors in the decomposition analysis. In the second model, I add SES variables to the analysis. In the final model, I also include traditional activities variables to the analysis. The results

indicate that good general health gaps between the two genders increase for the overall sample as well as for all four Indigenous populations from 2001 to 2012. The decomposition results reveal that differences in SES status between males and females account for the majority of the gender health gap among Indigenous population.

Table 3.10 shows the decomposition results for the total Indigenous peoples in 2001, 2006 and 2012. The first two rows in the table reports mean proportions of good general health for Indigenous men and women. The unconditional good general health gap between men and women is reported in the subsequent row. Table 3.10 also reports the overall share of "explained" and "unexplained" components in the overall good general health gap between men and women. The results suggest that unconditional health gap for Indigenous males and females increases from 1.57 percentage point in 2001 to 5.18 percentage point in 2012. Based on the results reported for Models 1, it is apparent that differences in demographic (ethnicity, age, marital status) and geographic factors (region and province of residence) between females and males explain a small share of the health gap. By adding SES status factors (i.e., education attainment, employment status and income) to the decomposition analysis, the share of explained components increases to about two-thirds (e.g. 0.0309/0.0518=59.6 percent in 2012) of the gap in each year. The share of explained part further increases after adding traditional activities to the model. These findings, for example, suggest that if Indigenous females in Canada had the same average level of all the independent factors as their male counterparts, there would be an increase 3.09 percentage point in good general health among Indigenous females.

Based on the detailed results of the decomposition analysis reported in Table 3.10, if females had the same average educational levels as males, their health status would have been lower. This is because the education level of Indigenous women was higher than Indigenous men. Employment status and income explained the majority of the observed health gap between the two genders. For example, if females in 2012 had the same level of employment rate and income, the probability of reporting good general health would have been increased 2.3 percentage points higher (see the sum share of these two factors for the year 2012 for the Model 3 in Table 3.10). Differences in the traditional activities between men and women also explain a small part of the health gap in 2001 and 2006. The remaining part of the health gap is attributable to differences in returns to observable

characteristics and group differences in unobserved characteristics omitted from the model. Figure 3.1 shows the proportion of the gender gap in good general health explained by the differences in the SES factors (education, household income, and employment status), traditional activities (hunting, fishing, trapping and gathering wild plants) and other factors between men and women.

Table 3.11 contains the decomposition results for First Nation peoples (RFN and NRFN). As demographic and geographic factors only explain a small share of the gender gap, I only present the detailed OB decomposition results for SES and traditional activities factors in the table. The results show a growing health gap between males and females in both RFN and NRFN from 2001 to 2012 and the majorly of the gap is explained by the differences in characteristics. For example, if RFN females had the same level of SES factors as males, their good general health status would have been improved by 4.3 and 2.73 percentage point in 2001, 2006, respectively. In 2012, the good general health gap increases to 7.12 percentage point and the proportion that explained by the differences in characteristics is 41 percent (0.0408/0.0712). Turning to NRFN, the results do not suggest a significant difference in health between two genders in 2001 but the gap increased in 2006 and 2011. Similar to RFN, when both SES and traditional activities are included in the model, differences in characteristics explain the majority (more than half) of the health gaps in both 2006 and 2012. Although differences in employment status and income factors do not explain all the gap, they account for more than three-quarters of observed gender health gap.

The decomposition results for Métis and Inuit populations are reported in Table 3.12. Comparing to RFN and NRFN populations, the good general health gap between Métis females and males is smaller in all survey years. There is no statistical difference in general health between the two genders among Métis. However, the gender gap in health increased to about 3 percentage point in 2012. Similar to previous results, the differences in demographic and geographic factors explained a small proportion of the gap and adding SES factors to the decomposition model the share of explained component increases to more than 80 percent (0.0129/0.0169) in 2006, and about 60 percent (0.0177/0.0297) in 2012. After controlling for traditional activities, the difference in characteristics explains almost the whole health gap. Similar to the results obtained for

all Indigenous populations, if Métis females had the same level of employment rate, income level and traditional activities as of Métis males, their general health status would have been even better than males in 2001 and 2006. Although there is no significant health gap found between Inuit females and males, the gap still increases from zero in 2001 to 2.3 percentage point in 2012. Unlike the results for the other three Indigenous groups, employment status and income do not explain much of the health gap in 2001, 2006 or 2012. For example, if Inuit females had the same level of employment rate and income level as Inuit males in 2006, there would have been a 0.4 percentage point reduction in the good general health gap within the Inuit population. Figure 3.2 illustrates the proportion of the gender gap in good general health among four Indigenous groups that explained by the differences in the SES factors, traditional activities and other factors between men and women.

Since the outcome variable in the study is binary, I also decompose the gap in the good general health between males and females using an extension of the OB decomposition to non-linear outcomes. The results are robust to using an extension of the OB to decompose the gender health gap. See the detailed results presented in Table B2 in the Appendix B.

3.4 Conclusion

Improving the health status of Indigenous populations is a continuous challenge in Canada. Although several studies documented inequalities in health between Indigenous and non-Indigenous populations in Canada (Adelson, 2005; Clark and Cameron, 2009; Ford et al., 2010; Frohlich et al., 2006; MacMillan et al., 1996), few studies (Hajizadeh et al., 2018) examined inequalities in health within Indigenous groups in Canada. Using the three cycles of the APS, I assess gender gaps in good general health between Indigenous males and females. I investigate the determinants of health among Indigenous men and women in Canada. I then decompose the observed gender gap in good general health in total and four distinct subgroups of Indigenous peoples into the differences in characteristics (demographic, SES status and cultural determinants) and the differences in the returns of those characteristics.

The results suggest that Indigenous females had poorer good general health than Indigenous males, and the gender gap in health increased from 2001 to 2012, especially among RFN and NRFN. Inuit women are found to be generally as healthy as their male counterparts. Similar to the previous studies (Currie, 2012; Marmot, Friel, Bell, Houweling, and Taylor, 2008; Cutler and Lleras-Muney, 2006; Prus, 2011; Veugelers, 2010, Hajizadeh et al., 2018), the results reveal Indigenous peoples with higher SES are more likely to report good general health. For example, higher educational attainment is positively associated with better health among Indigenous males and females. The positive effect of education on health status is found to be higher in RFN and Métis. Consistent with previous studies (Benach and Muntaner, 2007; Safaei, 2007; Wilson and Macdonald, 2010), being employed and having higher household income are found to be key determinants of good general health among Indigenous peoples. Participation in the cultural and traditional activities such as hunting, fishing, trapping and wild plants gathering are also positively associated with good general health among Indigenous peoples.

The decomposition results suggest that the difference in the SES factors between Indigenous males and females explain more than 50 percent of the gender gap in good general health. For example, the gender gap in good general health between Indigenous males and females in 2012 is 7.12 and 6.72 percentage point for RFN and NRFN, respectively, and the overall difference in the social economic factors explains about 2.5 and 2 percentage point, while the traditional activities explained about 1 percentage point of these overall gaps. The overall difference in characters explain 4.08 and 4.56 percentage point of the health gap. In other words, if RFN women had similar average levels of SES factors, traditional activities and other factors as their male counterparts, the good general health gap would have decreased to less than 3 percentage point. Similar to a recent study by Hajizadeh et. al (2018) that suggests employment status and household incomes as the main determinants of socioeconomic inequalities in health among Indigenous peoples in Canada, I find these two factors are the key factors explaining the observed gender gap in health among Indigenous peoples. For example, the explained part of employment and income account for 78 percent (0.028/0.036), 85 percent (0.023/0.027), and 74 percent (0.023/0.031) of the overall explained part of the gender gap in good general health in 2001, 2006 and 2012, respectively. A recent study

by Hackett and et al. (2018) also highlights the difference in SES as the main determinant of the health gap between Indigenous and non-Indigenous populations in Canada. The results also suggest the difference in the participation of traditional activities between males and females as one of the determinants of the gender gap in good general health among Indigenous peoples. For example, if Inuit and NRFN females participated in traditional activities as their male counterparts in 2006, the gender gap in good general health would have been reduced by 1.37 and 0.96 percentage point, respectively. The difference in educational attainment between males and females, however, do not contribute to the observed gender health gap because Indigenous females have higher average educational degrees than males.

There are some limitations to this paper. First, although self-perceived health status is a well-established and widely-used measure of health (European Commission, 2013; Lundberg and Manderbacka, 1996; Van Doorslaer and Koolman, 2004), there is still possible differences in the interpretation of the question about self-perceived health status by gender and over time. The interpretation of the different state of health (excellent, very good, good, fair and poor) may also vary across different populations (Burgard and Chen, 2014). Second, this paper investigates the gender health gap among Indigenous peoples living off-reserves in Canada. As Indigenous peoples living on-reserves have different SES characteristics and living conditions, further study is required to analyse the gender health gap within on-reserve Indigenous populations. Third, most independent variables, i.e. SES and traditional activities are endogenous in the model. Specifically, there are potential reverse causality (simultaneity bias) between the good general health and SES factors included in the study (Mulatu and Schooler, 2002; Pickett and Wilkinson, 2015). In other words, while studies (Booth, Rioseco, and Crawford, n.d.; Mulatu and Schooler, 2002) have shown social and economic factors as the main determinants of health status, social and economic status of individuals (e.g. income and employment) can also be affected by an individual's health status. Unfortunately, I am not able to find a solution, such as an instrument variable, for this issue.

Caveats considered, the results suggest that Indigenous men living off-reserve had a higher rate of good general health compared to their female counterparts. The gender health gap increases within all four Indigenous subgroups. The decomposition of the

gender gap in the good general health show that household income and employment status explain more than half of the health gap between Indigenous males and females within total Indigenous peoples, as well as each Indigenous subgroup. These results warrant further policy attention to improve the health status of female Indigenous populations in Canada. Public policies aim at addressing the gender gap in health within the Indigenous population should focus on improving income and employment opportunities among women.

Table 3.1: Description of Variables Used in this Study

Variables	Description
Outcome Variable	
Good General Health	1 = if individual rates health status as good, very good, or excellent, 0
Demographic Variables	
Ethnicity Group	
Registered First Nations	1 = if individual is a registered First Nations, 0 otherwise
Non-registered First Nations	1 = if individual is not a registered First Nations, 0 otherwise
Métis	1 = if individual is Métis, 0 otherwise
Inuit	1 = if individual is Inuit, 0 otherwise
Sex	
Male	1 = if individual is male, 0 otherwise
Female	1 = if individual is male, 0 otherwise
Age	Age of individual in years
Marital Status	
Married or de facto married	1 = if individual is married or de facto married, 0 otherwise
Divorced or Widowed	1 = if individual is divorced or widowed, 0 otherwise
Single	1 = if individual is single, 0 otherwise
Socioeconomic Variables	
Education	
Less than High School	1 = if individual has less than secondary education, 0 otherwise
High School	1 = if individual has secondary education, 0 otherwise
Some Post-Secondary	1 = if individual has some post-secondary education, 0 otherwise
Bachelor's Degree or Higher	1 = if individual has post-secondary degree/diploma, 0 otherwise
Employment Status	
Employed	1 = if individual is employed, 0 otherwise
Unemployed or Student	1 = if individual is unemployed or full-time student, 0 otherwise
Not in Labour Force	1 = if individual is not in labour force, 0 otherwise
Equivalized Household Income	Household income divided by the square root of household size
Geographical Factors	
Geographic Region	
Atlantic (AT)	1 = if individual resides in NL, NS, NB, and PEI, 0 otherwise
Quebec (QC)	1 = if individual resides in QC, 0 otherwise
Ontario (ON)	1 = if individual resides in ON, 0 otherwise
Prairie (PR)	1 = if individual resides in MB, SK, and AB, 0 otherwise
British Columbia (BC)	1 = if individual resides in BC, 0 otherwise
Territories (TR)	1 = if individual resides in the three territories (Yukon, Northwest Territories, and Nunavut), 0 otherwise
Geographic Residence Area	
Urban	1 = if individual resides in urban area, 0 otherwise
Rural	1 = if individual resides in rural area, 0 otherwise
Traditional Activities	
Fishing, Hunting, Trapping	1 = if individual hunted, or fished, or trapped in last 12 months, 0
Gathering Wild Plant	1 = if individual gathered wild plant in last 12 months, 0 otherwise

Notes: Newfoundland and Labrador (NL), Prince Edward Island (PEI), Nova Scotia (NS), New Brunswick (NB), Quebec (QC), Ontario (ON), Manitoba (MB), Saskatchewan (SK), Alberta (AB) and British Columbia (BC).

Table 3.2: Summary Statistics of APS 2001

	Females					Males				
	RFN	NRFN	Métis	Inuit	Total	RFN	NRFN	Métis	Inuit	Total
Good General Health (GGH)	0.783	0.812	0.829	0.881	0.810	0.822	0.809	0.829	0.887	0.825
Log Equivalized Household Income	9.538	9.845	9.846	9.652	9.713	9.692	9.883	10.01	9.652	9.859
	(1.475)	(1.236)	(1.092)	(1.148)	(1.295)	(1.384)	(1.237)	(1.025)	(1.025)	(1.211)
Age	39.30	38.23	39.19	36.71	38.93	39.07	39.67	39.02	37.47	39.10
	(14.48)	(12.91)	(14.41)	(14.32)	(14.17)	(14.52)	(13.89)	(14.12)	(14.57)	(14.23)
Marital Status										
Married	0.302	0.406	0.414	0.380	0.366	0.338	0.386	0.434	0.372	0.389
Separated or Widowed	0.239	0.253	0.220	0.117	0.229	0.167	0.174	0.148	0.073	0.156
Single	0.459	0.341	0.366	0.504	0.405	0.496	0.436	0.418	0.555	0.456
Education										
Less than High School	0.349	0.230	0.253	0.519	0.300	0.365	0.311	0.320	0.548	0.346
High School	0.127	0.161	0.175	0.074	0.148	0.149	0.199	0.171	0.088	0.165
Some Post-Secondary	0.456	0.544	0.504	0.377	0.486	0.448	0.423	0.451	0.352	0.438
Bachelor's Degree or Higher	0.068	0.065	0.068	0.027	0.065	0.038	0.066	0.058	0.010	0.051
Employment Status										
Employed	0.497	0.648	0.613	0.558	0.570	0.625	0.726	0.716	0.578	0.680
Unemployed or Student	0.089	0.054	0.072	0.107	0.077	0.112	0.083	0.099	0.148	0.103
Not in Labour Force	0.414	0.299	0.316	0.333	0.353	0.262	0.191	0.185	0.271	0.217
Geographic Region										
Atlantic (AT)	0.046	0.103	0.037	0.132	0.058	0.058	0.091	0.048	0.116	0.064
Quebec (QC)	0.066	0.115	0.059	0.196	0.079	0.078	0.108	0.071	0.229	0.090
Ontario (ON)	0.258	0.391	0.188	0.052	0.248	0.262	0.427	0.182	0.028	0.255
Territories (TR)	0.046	0.008	0.011	0.576	0.051	0.061	0.008	0.010	0.583	0.058
British Columbia (BC)	0.198	0.222	0.143	0.007	0.174	0.213	0.195	0.147	0.028	0.173
Prairie (PR)	0.386	0.161	0.563	0.040	0.390	0.328	0.166	0.542	0.018	0.360
Urban	0.715	0.136	0.754	0.774	0.715	0.680	0.082	0.723	0.785	0.686
Traditional Activities										
Fishing, Hunting, Trapping	0.282	0.249	0.285	0.586	0.291	0.506	0.481	0.538	0.804	0.530
Gathering Wild Plant	0.299	0.303	0.305	0.600	0.316	0.259	0.328	0.266	0.430	0.287
Number of Observations	7020	1300	6000	2010	16330	5230	1210	5540	1990	13970

Notes: Data source from Statistic Canada 2001 APS master file, samples sizes are rounded to 10, standard deviations in brackets; RFN=registered First Nations, NRFN=non-registered First Nations.

Table 3.3: Summary Statistics of APS 2006

	Females					Males				
	RFN	NRFN	Métis	Inuit	Total	RFN	NRFN	Métis	Inuit	Total
Good General Health (GGH)	0.787	0.767	0.837	0.829	0.805	0.818	0.833	0.855	0.827	0.837
Log Equivalized Household	9.743	9.988	10.13	9.865	9.952	9.766	10.16	10.30	9.817	10.08
	(1.441)	(1.100)	(1.099)	(1.294)	(1.253)	(1.810)	(1.099)	(1.134)	(1.579)	(1.416)
Age	40.89	41.69	40.56	38.09	40.80	39.82	41.59	41.76	37.80	40.93
	(14.91)	(14.83)	(14.31)	(14.62)	(14.66)	(14.70)	(14.63)	(14.59)	(15.19)	(14.70)
Marital Status										
Married	0.293	0.347	0.390	0.327	0.344	0.319	0.438	0.445	0.301	0.397
Separated or Widowed	0.224	0.250	0.218	0.143	0.223	0.135	0.151	0.147	0.072	0.140
Single	0.485	0.403	0.390	0.530	0.433	0.546	0.415	0.408	0.627	0.463
Education										
Less than High School	0.287	0.215	0.190	0.475	0.242	0.334	0.295	0.238	0.515	0.293
High School	0.141	0.177	0.172	0.118	0.160	0.167	0.155	0.184	0.104	0.169
Some Post-Secondary	0.450	0.483	0.502	0.334	0.472	0.421	0.446	0.483	0.355	0.449
Bachelor's Degree or Higher	0.123	0.122	0.136	0.070	0.126	0.078	0.105	0.095	0.027	0.088
Employment Status										
Employed	0.561	0.628	0.676	0.553	0.621	0.668	0.702	0.758	0.592	0.710
Unemployed or Student	0.060	0.042	0.040	0.083	0.049	0.085	0.058	0.052	0.109	0.066
Not in Labour Force	0.379	0.326	0.282	0.362	0.330	0.247	0.240	0.190	0.299	0.224
Geographic Region										
Atlantic (AT)	0.049	0.122	0.051	0.148	0.069	0.057	0.128	0.055	0.139	0.074
Quebec (QC)	0.080	0.163	0.087	0.191	0.104	0.082	0.140	0.081	0.208	0.100
Ontario (ON)	0.266	0.385	0.180	0.040	0.246	0.250	0.391	0.209	0.035	0.253
Territories (TR)	0.053	0.007	0.009	0.545	0.047	0.057	0.008	0.011	0.576	0.051
British Columbia (BC)	0.201	0.170	0.166	0.018	0.172	0.178	0.147	0.147	0.019	0.151
Prairie (PR)	0.355	0.149	0.508	0.058	0.362	0.376	0.186	0.499	0.021	0.371
Urban	0.732	0.217	0.777	0.779	0.735	0.706	0.159	0.729	0.740	0.695
Traditional Activities										
Fishing, Hunting, Trapping	0.291	0.219	0.311	0.623	0.299	0.501	0.481	0.549	0.808	0.531
Gathering Wild Plant	0.318	0.285	0.311	0.606	0.322	0.285	0.264	0.281	0.525	0.290
Number of Observations	3690	1440	3230	1990	10350	2640	1290	2800	1870	8600

Notes: Data source from Statistic Canada 2006 APS master file, samples sizes are rounded to 10, standard deviations in brackets; RFN=registered First Nations, NRFN=non-registered First Nations.

Table 3.4: Summary Statistics of APS 2012

	Females					Males				
	RFN	NRFN	Métis	Inuit	Total	RFN	NRFN	Métis	Inuit	Total
Good General Health (GGH)	0.737	0.735	0.789	0.790	0.759	0.805	0.801	0.818	0.816	0.812
Log Equivalized Household	10.22	10.39	10.45	10.44	10.35	10.35	10.53	10.60	10.41	10.50
	(0.920)	(1.111)	(0.997)	(0.826)	(0.994)	(1.023)	(1.122)	(0.981)	(0.827)	(1.024)
Age	42.10	43.05	43.11	40.51	42.63	40.70	43.45	43.77	38.84	42.49
	(15.41)	(15.46)	(15.38)	(15.75)	(15.44)	(14.90)	(15.97)	(15.67)	(14.25)	(15.50)
Marital Status										
Married	0.452	0.484	0.526	0.577	0.494	0.544	0.575	0.608	0.596	0.580
Separated or Widowed	0.197	0.205	0.199	0.135	0.196	0.071	0.102	0.104	0.053	0.091
Single	0.351	0.312	0.276	0.285	0.310	0.382	0.323	0.288	0.351	0.328
Education										
Less than High School	0.232	0.205	0.191	0.477	0.222	0.292	0.231	0.220	0.453	0.257
High School	0.157	0.140	0.168	0.132	0.157	0.143	0.172	0.189	0.122	0.167
Some Post-Secondary	0.486	0.544	0.508	0.349	0.500	0.504	0.505	0.503	0.404	0.499
Bachelor's Degree or Higher	0.122	0.116	0.132	0.043	0.122	0.062	0.091	0.087	0.020	0.077
Employment Status										
Employed	0.450	0.553	0.585	0.448	0.525	0.572	0.640	0.656	0.473	0.618
Unemployed or Student	0.115	0.121	0.104	0.185	0.114	0.154	0.097	0.118	0.204	0.130
Not in Labour Force	0.435	0.330	0.313	0.367	0.361	0.271	0.263	0.226	0.322	0.252
Geographic Region										
Atlantic (AT)	0.073	0.116	0.049	0.128	0.074	0.071	0.113	0.049	0.167	0.074
Quebec (QC)	0.073	0.144	0.087	0.174	0.098	0.069	0.183	0.093	0.176	0.107
Ontario (ON)	0.265	0.400	0.183	0.075	0.250	0.290	0.349	0.191	0.065	0.249
Territories (TR)	0.022	0.009	0.007	0.559	0.038	0.021	0.005	0.005	0.543	0.036
British Columbia (BC)	0.196	0.172	0.152	0.018	0.166	0.200	0.220	0.151	0.020	0.174
Prairie (PR)	0.369	0.158	0.523	0.046	0.374	0.347	0.134	0.510	0.029	0.361
Urban	0.747	0.199	0.809	0.846	0.764	0.742	0.161	0.804	0.762	0.739
Traditional Activities										
Fishing, Hunting, Trapping	0.260	0.233	0.245	0.527	0.260	0.485	0.462	0.495	0.771	0.498
Gathering Wild Plant	0.336	0.298	0.323	0.516	0.332	0.273	0.226	0.275	0.433	0.272
Number of Observations	2740	1080	2990	1410	8220	2100	930	2740	1220	6990

Notes: Data source from Statistic Canada 2012 APS master file, samples sizes are rounded to 10, standard deviations in brackets; RFN=registered First Nations, NRFN=non-registered First Nations.

Table 3.5: LPM Regressions for Overall Indigenous Populations in 2001, 2006 and 2012

	2001			2006			2012		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Non-registered First Nations	0.0076	-0.0143	-0.0120	-0.0001	-0.0178	-0.0148	0.0013	-0.0263	-0.0273
	(0.0173)	(0.0168)	(0.0168)	(0.0144)	(0.0135)	(0.0135)	(0.0201)	(0.0187)	(0.0186)
Métis	0.0187+	-0.0105	-0.0107	0.039**	0.0057	0.0052	0.0400**	0.0058	0.0058
	(0.0101)	(0.0097)	(0.0097)	(0.0094)	(0.0091)	(0.0091)	(0.0139)	(0.0135)	(0.0135)
Inuit	0.0352**	0.0347**	0.0319**	-0.0092	-0.0003	-0.0062	-0.0191	-0.0017	5.61e-06
	(0.0120)	(0.0113)	(0.0114)	(0.0138)	(0.0138)	(0.0137)	(0.0205)	(0.0193)	(0.0196)
Male	0.0137	-0.0104	-0.0198+	0.0296**	0.0139+	0.00503	0.0401**	0.0253*	0.0210+
	(0.0100)	(0.0099)	(0.0106)	(0.00834)	(0.0080)	(0.0082)	(0.0121)	(0.0115)	(0.0118)
Separated or Widowed	-0.0919**	-0.0653**	-0.0644**	-0.0697**	-0.0414**	-0.0393**	-0.104**	-0.0810**	-0.0807**
	(0.0162)	(0.0157)	(0.0155)	(0.0139)	(0.0128)	(0.0127)	(0.0226)	(0.0204)	(0.0203)
Single	-0.0865*	-0.0468*	-0.0447*	-0.0801**	-0.0476**	-0.0442**	-0.0953**	-0.0567**	-0.0562**
	(0.0129)	(0.0120)	(0.0121)	(0.0109)	(0.0103)	(0.0102)	(0.0162)	(0.0154)	(0.0153)
High School Diploma		0.0505**	0.0489**		0.0666**	0.0657**		0.0842**	0.0849**
		(0.0161)	(0.0161)		(0.0140)	(0.0140)		(0.0190)	(0.0190)
Some Postsecondary		0.0475**	0.0465**		0.0863**	0.0843**		0.0676**	0.0691**
		(0.0118)	(0.0118)		(0.0113)	(0.0113)		(0.0163)	(0.0163)
Bachelor' Degree or Higher		0.116**	0.116**		0.127**	0.126**		0.155**	0.159**
		(0.0158)	(0.0160)		(0.0136)	(0.0136)		(0.0185)	(0.0187)
Employed		0.195**	0.194**		0.196**	0.194**		0.194**	0.193**
		(0.0138)	(0.0139)		(0.0119)	(0.0119)		(0.0162)	(0.0161)
Unemployed or Student		0.129**	0.128**		0.151**	0.149**		0.0519*	0.0522*
		(0.0190)	(0.0191)		(0.0179)	(0.0178)		(0.0231)	(0.0232)
Log Equivalized Household Income		0.0243**	0.0236**		0.0232**	0.0225**		0.0320**	0.0315**
		(0.0044)	(0.0045)		(0.0034)	(0.0033)		(0.0063)	(0.0063)
Hunting, Fishing, Trapping			0.0399*			0.0418**			0.0123
			(0.0100)			(0.00785)			(0.0123)
Gathering Wild Plant			-0.0088			0.0068			-0.0284**
			(0.0107)			(0.0082)			(0.0132)
R-squared	0.093	0.161	0.163	0.077	0.153	0.155	0.064	0.138	0.139
Observations	30,330	30,330	30,330	18,950	18,950	18,950	15,210	15,210	15,210
Demographic and Geographical Factors	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Socioeconomic Factors	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Traditional Activities	No	No	Yes	No	No	Yes	No	No	Yes

Notes: Demographic and geographical factors included age and age-squared, marital status and rural/urban and geographical regions. Socioeconomic factors include highest educational degree (less than high school [base group], high school, some postsecondary lower than bachelor's degrees, bachelor's degree or higher), employment status (employed, unemployed or full-time student, not in labour force [base group]) and log equivalized household income. Traditional activities include hunting, fishing or trapping, and wild plant gathering. Statistical significance is given by: + ten percent; * five percent; and ** one percent. Source: Author's calculations.

Table 3.6: LPM Regressions for Registered First Nation Peoples in 2001, 2006 and 2012

	2001			2006			2012		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Male	0.0311+	0.0043	-0.0031	0.0201	0.0069	0.0034	0.0531*	0.0374+	0.0305
	(0.0152)	(0.0142)	(0.0147)	(0.0151)	(0.0147)	(0.0149)	(0.0216)	(0.0210)	(0.0213)
Separated or Widowed	-0.105**	-0.0852**	-0.0852**	-0.0761**	-0.0468*	-0.0438+	-0.0935*	-0.0849*	-0.0843*
	(0.0247)	(0.0221)	(0.0221)	(0.0249)	(0.0227)	(0.0224)	(0.0393)	(0.0360)	(0.0354)
Single	-0.0980*	-0.0580**	-0.0562*	-0.0831*	-0.0509**	-0.0481**	-0.109**	-0.0705**	-0.0693**
	(0.0182)	(0.0172)	(0.0173)	(0.0180)	(0.0171)	(0.0170)	(0.0259)	(0.0245)	(0.0244)
High School Diploma		0.0550*	0.0534*		0.0588*	0.0571*		0.0676*	0.0687*
		(0.0271)	(0.0269)		(0.0229)	(0.0228)		(0.0330)	(0.0329)
Some Postsecondary		0.0729**	0.0724**		0.0950**	0.0925**		0.0584*	0.0618*
		(0.0157)	(0.0156)		(0.0181)	(0.0183)		(0.0260)	(0.0260)
Bachelor' Degree or Higher		0.118**	0.117**		0.142**	0.137**		0.154**	0.164**
		(0.0214)	(0.0213)		(0.0216)	(0.0217)		(0.0328)	(0.0327)
Employed		0.190**	0.189**		0.169**	0.167**		0.179**	0.177**
		(0.0184)	(0.0185)		(0.0197)	(0.0195)		(0.0265)	(0.0261)
Unemployed or Student		0.125**	0.124**		0.124**	0.122**		0.0298	0.0309
		(0.0225)	(0.0228)		(0.0286)	(0.0284)		(0.0357)	(0.0357)
Log Equivalized Household Income		0.0221**	0.0218**		0.0177**	0.0174**		0.0288**	0.0281**
		(0.0053)	(0.0052)		(0.0045)	(0.0044)		(0.0106)	(0.0106)
Hunting, Fishing, Trapping			0.0324**			0.0232			0.0212
			(0.0138)			(0.0141)			(0.0235)
Gathering Wild Plant			-0.0133			0.0217			-0.0512*
			(0.0147)			(0.0138)			(0.0239)
R-squared	0.110	0.180	0.182	0.082	0.148	0.149	0.066	0.133	0.136
Observations	12,250	12,250	12,250	6,330	6,330	6,330	4,840	4,840	4,840
Demographic and Geographical Factors	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Socioeconomic Factors	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Traditional Activities	No	No	Yes	No	No	Yes	No	No	Yes

Notes: Demographic and geographical factors included age and age-squared, marital status and rural/urban and geographical regions. Socioeconomic factors include highest educational degree (less than high school [base group], high school, some postsecondary lower than bachelor's degrees, bachelor's degree or higher), employment status (employed, unemployed or full-time student, not in labour force [base group]) and log equivalized household income. Traditional activities include hunting, fishing or trapping, and wild plant gathering. Statistical significance is given by: + ten percent; * five percent; and ** one percent. Source: Author's calculations.

Table 3.7: LPM Regressions for Non-Registered First Nation Peoples in 2001, 2006 and 2012

	2001			2006			2012		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Male	0.0111	-0.0171	-0.0216	0.0606**	0.0420*	0.0289	0.0552+	0.0331	0.0304
	(0.0325)	(0.0332)	(0.0350)	(0.0226)	(0.0213)	(0.0219)	(0.0316)	(0.0295)	(0.0295)
Separated or Widowed	-0.123**	-0.0951*	-0.0937*	-0.0753*	-0.0283	-0.0256	-0.154*	-0.134*	-0.134***
	(0.0462)	(0.0460)	(0.0456)	(0.0353)	(0.0327)	(0.0325)	(0.0596)	(0.0485)	(0.0487)
Single	-0.0940*	-0.0512	-0.0507	-0.101**	-0.0447	-0.0426	-0.123**	-0.0856+	-0.0868+
	(0.0451)	(0.0409)	(0.0419)	(0.0332)	(0.0304)	(0.0300)	(0.0468)	(0.0454)	(0.0452)
High School Diploma		-0.00870	-0.00964		0.0816**	0.0811*		0.100+	0.0999+
		(0.0510)	(0.0512)		(0.0399)	(0.0401)		(0.0524)	(0.0523)
Some Postsecondary		-0.00564	-0.00649		0.0907**	0.0901**		0.107*	0.108*
		(0.0386)	(0.0390)		(0.0318)	(0.0319)		(0.0444)	(0.0444)
Bachelor' Degree or Higher		0.0451	0.0449		0.130**	0.133**		0.185**	0.189**
		(0.0449)	(0.0449)		(0.0377)	(0.0377)		(0.0454)	(0.0455)
Employed		0.233**	0.233**		0.258**	0.257**		0.232**	0.232**
		(0.0464)	(0.0462)		(0.0330)	(0.0331)		(0.0422)	(0.0422)
Unemployed or Student		0.0986	0.0975		0.230**	0.230**		0.0656	0.0663
		(0.0825)	(0.0830)		(0.0454)	(0.0457)		(0.0622)	(0.0622)
Log Equivalized Household Income		0.0174	0.0168		0.0486**	0.0477**		0.0410*	0.0404*
		(0.0153)	(0.0152)		(0.0143)	(0.0141)		(0.0161)	(0.0162)
Hunting, Fishing, Trapping			0.0184			0.0502*			0.00417
			(0.0305)			(0.0213)			(0.0303)
Gathering Wild Plant			0.000634			-0.0221			-0.0264
			(0.0348)			(0.0232)			(0.0342)
R-squared	0.096	0.166	0.166	0.083	0.207	0.210	0.108	0.211	0.211
Observations	2,510	2,510	2,510	2,730	2,730	2,730	2,010	2,010	2,010
Demographic and Geographical Factors	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Socioeconomic Factors	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Traditional Activities	No	No	Yes	No	No	Yes	No	No	Yes

Notes: Demographic and geographical factors included age and age-squared, marital status and rural/urban and geographical regions. Socioeconomic factors include highest educational degree (less than high school [base group], high school, some postsecondary lower than bachelor's degrees, bachelor's degree or higher), employment status (employed, unemployed or full-time student, not in labour force [base group]) and log equivalized household income. Traditional activities include hunting, fishing or trapping, and wild plant gathering. Statistical significance is given by: + ten percent; * five percent; and ** one percent. Source: Author's calculations.

Table 3.8: LPM Regressions for Métis Peoples in 2001, 2006 and 2012

	2001			2006			2012		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Male	-0.0016	-0.0273*	-0.0409**	0.0228*	0.0041	-0.0069	0.0263	0.0120	0.0080
	(0.0134)	(0.0135)	(0.0148)	(0.0114)	(0.0112)	(0.0113)	(0.0171)	(0.0163)	(0.0174)
Separated or Widowed	-0.0572*	-0.0257	-0.0252	-0.0645*	-0.0391*	-0.0373*	-0.0848*	-0.050+	-0.0499+
	(0.0221)	(0.0224)	(0.0220)	(0.0188)	(0.0177)	(0.0176)	(0.0311)	(0.0290)	(0.0290)
Single	-0.0742**	-0.0354*	-0.0316*	-0.0697**	-0.0417**	-0.0375**	-0.0684**	-0.0300	-0.0289
	(0.0167)	(0.0158)	(0.0155)	(0.0150)	(0.0144)	(0.0143)	(0.0253)	(0.0239)	(0.0240)
High School Diploma		0.0800**	0.0777**		0.0761**	0.0774**		0.102**	0.103**
		(0.0178)	(0.0179)		(0.0202)	(0.0200)		(0.0279)	(0.0279)
Some Postsecondary		0.0506**	0.0481**		0.0848***	0.0833*		0.0692**	0.0704**
		(0.0175)	(0.0179)		(0.0168)	(0.0168)		(0.0249)	(0.0251)
Bachelor' Degree or Higher		0.152**	0.155**		0.116**	0.117**		0.156**	0.159**
		(0.0240)	(0.0245)		(0.0196)	(0.0196)		(0.0277)	(0.0281)
Employed		0.204**	0.201**		0.200**	0.197**		0.200**	0.199**
		(0.0204)	(0.0203)		(0.0176)	(0.0174)		(0.0250)	(0.0249)
Unemployed or Student		0.157**	0.155**		0.147**	0.146**		0.0624	0.0623
		(0.0265)	(0.0265)		(0.0306)	(0.0304)		(0.0383)	(0.0385)
Log Equivalized Household Income		0.0309**	0.0293**		0.0246**	0.0239**		0.0320**	0.0316**
		(0.0063)	(0.0063)		(0.0055)	(0.0054)		(0.00915)	(0.0091)
Hunting, Fishing, Trapping			0.0554**			0.0498**			0.0127
			(0.0146)			(0.0107)			(0.0176)
Gathering Wild Plant			-0.00968			0.00674			-0.0210
			(0.0152)			(0.0117)			(0.0194)
R-squared	0.085	0.160	0.165	0.072	0.146	0.150	0.045	0.122	0.123
Observations	11,540	11,540	11,540	6,030	6,030	6,030	5,730	5,730	5,730
Demographic and Geographical Factors	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Socioeconomic Factors	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Traditional Activities	No	No	Yes	No	No	Yes	No	No	Yes

Notes: Demographic and geographical factors included age and age-squared, marital status and rural/urban and geographical regions. Socioeconomic factors include highest educational degree (less than high school [base group], high school, some postsecondary lower than bachelor's degrees, bachelor's degree or higher), employment status (employed, unemployed or full-time student, not in labour force [base group]) and log equivalized household income. Traditional activities include hunting, fishing or trapping, and wild plant gathering. Statistical significance is given by: + ten percent; * five percent; and ** one percent. Source: Author's calculations.

Table 3.9: LPM Regressions for Inuit Peoples in 2001, 2006 and 2012

	2001			2006			2012		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Male	0.0124	0.0084	0.0027	0.0062	-0.0006	-0.0091	0.0084	0.0067	0.0070
	(0.0135)	(0.0130)	(0.0138)	(0.0182)	(0.0181)	(0.0193)	(0.0243)	(0.0238)	(0.0260)
Separated or Widowed	-0.0632+	-0.0508+	-0.0438	-0.0171	-0.00735	-0.0109	-0.149*	-0.138*	-0.129+
	(0.0326)	(0.0293)	(0.0287)	(0.0359)	(0.0368)	(0.0350)	(0.0753)	(0.0686)	(0.0671)
Single	-0.0335*	-0.0182	-0.0139	-0.0670**	-0.0517*	-0.0440*	-0.0834**	-0.0581*	-0.0541*
	(0.0162)	(0.0166)	(0.0165)	(0.0233)	(0.0223)	(0.0223)	(0.0281)	(0.0262)	(0.0260)
High School Diploma		0.0326+	0.0349+		-0.0287	-0.0298		0.0307	0.0299
		(0.0187)	(0.0186)		(0.0356)	(0.0353)		(0.0354)	(0.0358)
Some Postsecondary or Higher		0.0155	0.0175		0.0524*	0.0476*		0.0417	0.0382
		(0.0189)	(0.0184)		(0.0206)	(0.0203)		(0.0286)	(0.0282)
Employed		0.0542**	0.0534**		0.0943**	0.0872**		0.0898**	0.0871**
		(0.0183)	(0.0180)		(0.0224)	(0.0219)		(0.0332)	(0.0327)
Unemployed or Student		0.0383	0.0382		0.0530*	0.0491		0.0303	0.0270
		(0.0249)	(0.0246)		(0.0314)	(0.0309)		(0.0419)	(0.0413)
Log Equivalized Household Income		0.0252**	0.0236**		0.00537	0.00439		0.0185	0.0168
		(0.0079)	(0.0076)		(0.0067)	(0.0067)		(0.0157)	(0.0162)
Hunting, Fishing, Trapping			0.0494**			0.0658**			0.0184
			(0.0172)			(0.0219)			(0.0310)
Gathering Wild Plant			0.0182			0.0345*			0.0461+
			(0.0151)			(0.0173)			(0.0273)
R-squared	0.075	0.091	0.097	0.041	0.061	0.069	0.067	0.085	0.089
Observations	4,000	4,000	4,000	3,860	3,860	3,860	2,630	2,630	2,630
Demographic and Geographical	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Socioeconomic Factors	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Traditional Activities	No	No	Yes	No	No	Yes	No	No	Yes

Notes: Demographic and geographical factors included age and age-squared, marital status and rural/urban and geographical regions. Socioeconomic factors include highest educational degree (less than high school [base group], high school, some postsecondary or higher degree), employment status (employed, unemployed or full-time student, not in labour force [base group]) and log equivalized household income. Traditional activities include hunting, fishing or trapping, and wild plant gathering. Statistical significance is given by: + ten percent; * five percent; and ** one percent. Source: Author's calculations.

Table 3.10: The Oaxaca-Blinder Decomposition for Overall Indigenous Peoples in 2001, 2006 and 2012

	2001			2006			2012		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Mean Health for Males	0.825**	0.825**	0.825**	0.837**	0.837**	0.837**	0.811**	0.811**	0.811**
Mean Health for Females	0.810**	0.810**	0.810**	0.805**	0.805**	0.805**	0.759**	0.759**	0.759**
Unconditional Health Gap	0.016+	0.016+	0.016+	0.032**	0.032**	0.032**	0.052**	0.052**	0.052**
	(0.0098)	(0.0094)	(0.0093)	(0.0084)	(0.0079)	(0.0079)	(0.0122)	(0.0114)	(0.0114)
Differences in Characteristics	0.00194	0.0261**	0.0355**	0.00272*	0.0184**	0.0272**	0.0118**	0.0266**	0.0309**
	(0.0015)	(0.0024)	(0.0034)	(0.0013)	(0.0020)	(0.0028)	(0.0024)	(0.0030)	(0.0044)
Differences in Returns	0.0137	-0.0104	-0.0198+	0.0296*	0.0139+	0.00503	0.0401**	0.0253*	0.0210+
	(0.0100)	(0.0099)	(0.010)	(0.0083)	(0.0080)	(0.0081)	(0.0120)	(0.0115)	(0.0118)
Explained									
Age	-0.0013**	-0.0009**	-0.0009**	-0.0010**	-0.0007**	-0.0007**	0.0009**	0.00102**	0.0009**
	(0.0004)	(0.0003)	(0.0003)	(0.0003)	(0.0002)	(0.0002)	(0.0003)	(0.0002)	(0.0002)
Ethnicities	0.0010	-0.0005	-0.0005	0.0016*	-9.44e-05	-9.01e-05	0.00121**	0.00020	0.00020
	(0.0007)	(0.0007)	(0.0007)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)
Marital Status	0.0024+	0.0024*	0.0025*	0.0034**	0.0020+	0.0019+	0.0091**	0.0075**	0.0074**
	(0.0012)	(0.0012)	(0.0011)	(0.0011)	(0.00104)	(0.0010)	(0.0024)	(0.0021)	(0.0021)
Geographic Factors	-0.0001	7.38e-06	-0.0003	-0.0007+	0.0002	-0.0002	0.0005*	0.0006*	0.0006*
	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0003)	(0.0003)	(0.0003)
Educational Degrees		-0.0032**	-0.0031**		-0.0061**	-0.0060**		-0.0061**	-0.0063**
		(0.0006)	(0.0006)		(0.0006)	(0.0006)		(0.0008)	(0.0008)
Employment and Income		0.0283**	0.0280**		0.0231**	0.0228**		0.0234**	0.0232**
		(0.0019)	(0.0019)		(0.0013)	(0.0013)		(0.0018)	(0.0018)
Traditional Activities			0.0098**			0.0095**			0.0047
			(0.0024)			(0.0019)			(0.0032)
Observations	30,330	30,330	30,330	18,950	18,950	18,950	15,210	15,210	15,210
Demographic and Geographical	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Socioeconomic Factors	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Traditional Activities	No	No	Yes	No	No	Yes	No	No	Yes

Notes: Demographic and geographical factors included age and age-squared, marital status and rural/urban and geographical regions. Socioeconomic factors include highest educational degree (less than high school [base group], high school, some postsecondary lower than bachelor's degrees, bachelor's degree or higher), employment status (employed, unemployed or full-time student, not in labour force [base group]) and log equivalized household income. Traditional activities include hunting, fishing or trapping, and wild plant gathering. Statistical significance is given by: + ten percent; * five percent; and ** one percent. Source: Author's calculations.

Table 3.11: The Oaxaca-Blinder Decomposition for Registered and Non-Registered First Nations in 2001, 2006 and 2012

	2001			2006			2012		
Registered First Nations	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Unconditional Health Gap	0.0395*	0.0395*	0.0395*	0.0307*	0.0307*	0.0307*	0.0712**	0.0712**	0.0712**
	(0.0148)	(0.0134)	(0.0134)	(0.0150)	(0.0141)	(0.0140)	(0.0212)	(0.0196)	(0.0195)
Differences in Characteristics	0.0084**	0.0352**	0.0426**	0.0106**	0.0237**	0.0273**	0.0181**	0.0338**	0.0408**
	(0.0019)	(0.0032)	(0.0044)	(0.0023)	(0.0038)	(0.0048)	(0.0047)	(0.0068)	(0.0091)
Differences in Returns	0.0311*	0.00426	-0.00313	0.0201	0.00699	0.00343	0.0531*	0.0374+	0.0305
	(0.0151)	(0.0140)	(0.0145)	(0.0151)	(0.0146)	(0.0148)	(0.0214)	(0.0204)	(0.0207)
Explained									
Educational Degrees		-0.0029**	-0.0029**		-0.0075**	-0.0073**		-0.0094**	-0.0010**
		(0.0007)	(0.0008)		(0.0012)	(0.0012)		(0.0020)	(0.0020)
Employment and Income		0.0308**	0.0306**		0.0216**	0.0214**		0.0272**	0.0269**
		(0.0027)	(0.0027)		(0.0026)	(0.0026)		(0.0043)	(0.0042)
Traditional Activities			0.0078*			0.00410			0.00810
			(0.0032)			(0.0031)			(0.0060)
Observations	12,250	12,250	12,250	6,330	6,330	6,330	4,840	4,840	4,840
Non-Registered First Nations	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Unconditional Health Gap	-0.0028	-0.0028	-0.0028	0.0661**	0.0661**	0.0661***	0.0672**	0.0672**	0.0672**
	(0.0307)	(0.0288)	(0.0287)	(0.0228)	(0.0208)	(0.0207)	(0.0315)	(0.0286)	(0.0285)
Differences in Characteristics	-0.0138*	0.0143	0.0189	0.00548	0.0240***	0.0371***	0.0120*	0.0341***	0.0368***
	(0.0067)	(0.0092)	(0.0126)	(0.0037)	(0.0057)	(0.0081)	(0.0073)	(0.0072)	(0.0110)
Differences in Returns	0.0111	-0.0171	-0.0216	0.0606***	0.0420**	0.0289	0.0552*	0.0331	0.0304
	(0.0317)	(0.0318)	(0.0334)	(0.0223)	(0.0208)	(0.0214)	(0.0304)	(0.0282)	(0.0280)
Explained									
Educational Degrees		0.0006	0.0006		-0.0076**	-0.0076**		-0.0052**	-0.0053**
		(0.0038)	(0.0039)		(0.0024)	(0.0025)		(0.0019)	(0.0019)
Employment and Income		0.0216**	0.0216**		0.0307**	0.0305**		0.0246**	0.0245**
		(0.0053)	(0.0053)		(0.0035)	(0.0035)		(0.0034)	(0.0034)
Traditional Activities			0.0044			0.0137*			0.0028
			(0.0077)			(0.0057)			(0.0079)
Observations	2,510	2,510	2,510	2,730	2,730	2,730	2,010	2,010	2,010
Demographic and Geographical Factors	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Socioeconomic Factors	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Traditional Activities	No	No	Yes	No	No	Yes	No	No	Yes

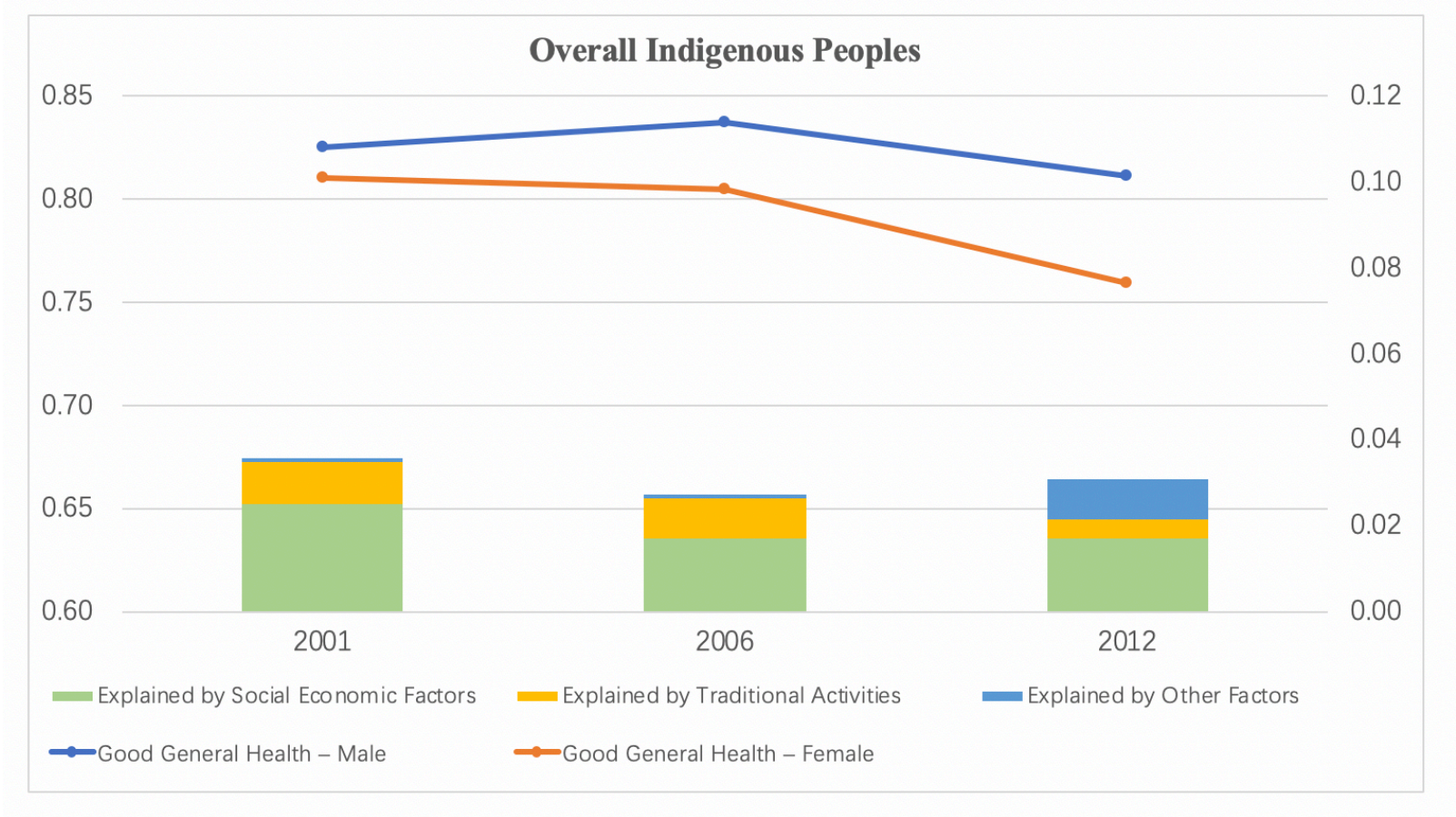
Notes: Demographic and geographical factors included age and age-squared, marital status and rural/urban and geographical regions. Socioeconomic factors include highest educational degree (less than high school [base group], high school, some postsecondary lower than bachelor's degrees, bachelor's degree or higher), employment status (employed, unemployed or full-time student, not in labour force [base group]) and log equivalized household income. Traditional activities include hunting, fishing or trapping, and wild plant gathering. Statistical significance is given by: + ten percent; * five percent; and ** one percent. Source: Author's calculations.

Table 3.12: The Oaxaca-Blinder Decomposition for Métis and Inuit in 2001, 2006 and 2012

	2001			2006			2012		
Métis	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Unconditional Health Gap	-0.0004	-0.0004	-0.0004	0.0169	0.0169	0.0169	0.0297+	0.0297+	0.0297+
	(0.0133)	(0.0128)	(0.0126)	(0.0114)	(0.0108)	(0.0107)	(0.0173)	(0.0163)	(0.0162)
Differences in Characteristics	0.00127	0.0270**	0.0405**	-0.0058**	0.0129**	0.0238**	0.00339	0.0177**	0.0216**
	(0.0019)	(0.0037)	(0.0054)	(0.0018)	(0.0029)	(0.0038)	(0.0032)	(0.0041)	(0.0064)
Differences in Returns	-0.0016	-0.0273*	-0.0409**	0.0228*	0.00408	-0.0069	0.0263	0.0120	0.0080
	(0.0133)	(0.0134)	(0.0146)	(0.0114)	(0.0111)	(0.0112)	(0.0169)	(0.0161)	(0.0172)
Explained									
Educational Degrees		-0.0046**	-0.0045**		-0.0054**	-0.0054**		-0.0053**	-0.0054**
		(0.0011)	(0.0012)		(0.0009)	(0.0009)		(0.0011)	(0.0011)
Employment and Income		0.0307**	0.0300**		0.0221**	0.0216**		0.0200**	0.0199**
		(0.0026)	(0.0026)		(0.0018)	(0.0018)		(0.0025)	(0.0024)
Traditional Activities			0.0144**			0.0116**			0.0042
			(0.0038)			(0.0026)			(0.0045)
Observations	11,540	11,540	11,540	6,030	6,030	6,030	5,730	5,730	5,730
Inuit	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Unconditional Health Gap	0.0058	0.0058	0.0058	0.0006	0.0006	0.0006	0.0233	0.0233	0.0233
	(0.0133)	(0.0129)	(0.0128)	(0.0180)	(0.0174)	(0.0172)	(0.0252)	(0.0244)	(0.0241)
Differences in Characteristics	-0.0066**	-0.0026	0.0030	-0.0056+	0.0012	0.0097	0.0150*	0.0167**	0.0163+
	(0.00224)	(0.00276)	(0.00571)	(0.0032)	(0.0039)	(0.0059)	(0.0060)	(0.0058)	(0.0092)
Differences in Returns	0.0124	0.0084	0.0027	0.0062	-0.0006	-0.0091	0.0084	0.0067	0.0070
	(0.0135)	(0.0127)	(0.0136)	(0.0181)	(0.0178)	(0.0188)	(0.0241)	(0.0235)	(0.0255)
Explained									
Educational Degrees		-0.0002	-0.0003		-0.0008	-0.0007		0.0012	0.0011
		(0.0007)	(0.0007)		(0.0009)	(0.0009)		(0.0009)	(0.0009)
Employment and Income		0.0027+	0.0027+		0.0047**	0.0043**		0.0024	0.0023
		(0.0014)	(0.0014)		(0.0016)	(0.0015)		(0.0017)	(0.0017)
Traditional Activities			0.0076			0.0096*			0.0005
			(0.0049)			(0.0045)			(0.0086)
Observations	4,000	4,000	4,000	3,860	3,860	3,860	2,630	2,630	2,630
Demographic and Geographical Factors	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Socioeconomic Factors	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Traditional Activities	No	No	Yes	No	No	Yes	No	No	Yes

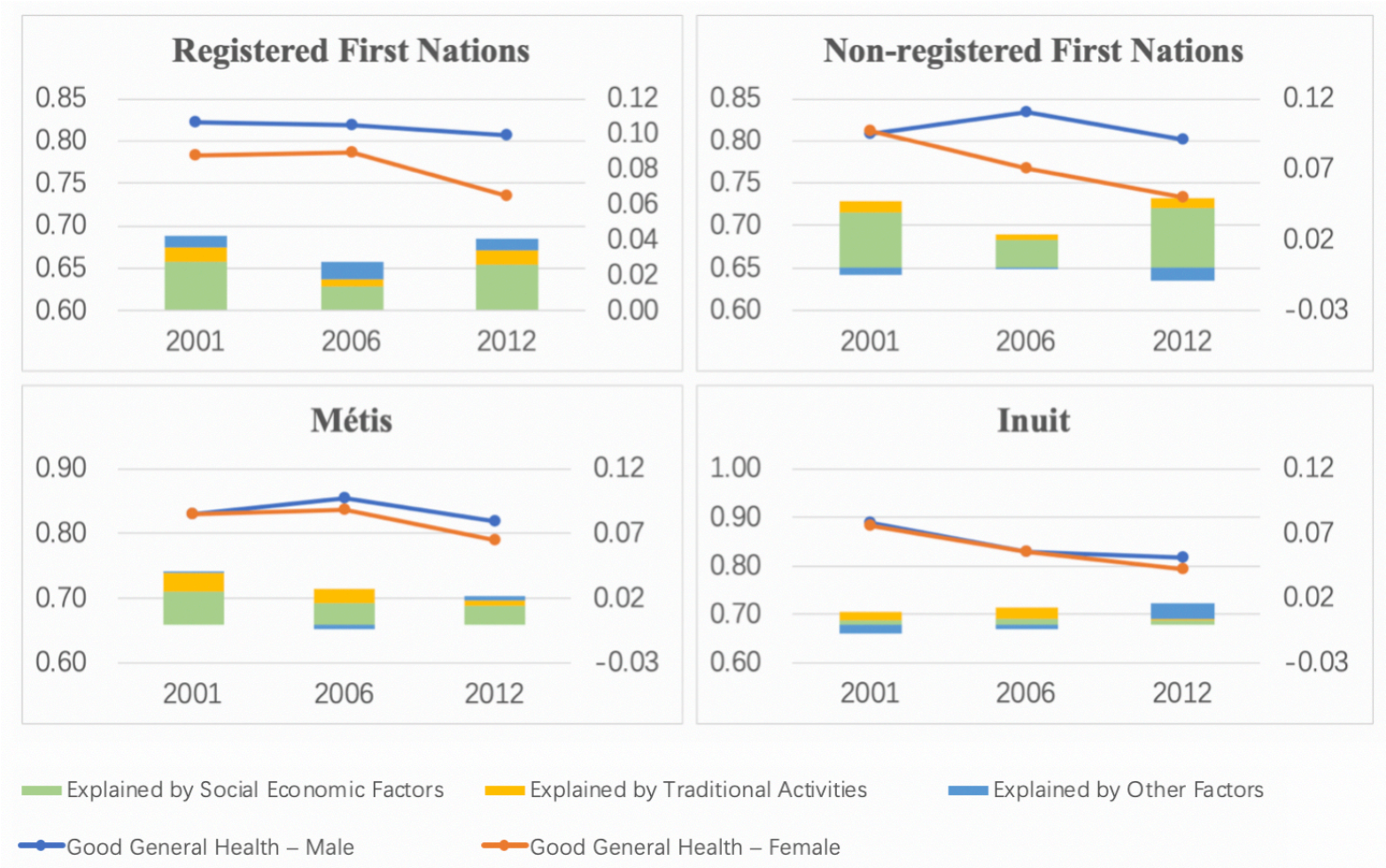
Notes: Demographic and geographical factors included age and age-squared, marital status and rural/urban and geographical regions. Socioeconomic factors include highest educational degree (less than high school [base group], high school, some postsecondary lower than bachelor's degrees, bachelor's degree or higher), Inuit people's highest educational degree is some postsecondary or higher; employment status (employed, unemployed or full-time student, not in labour force [base group]) and log equivalized household income. Traditional activities include hunting, fishing or trapping, and wild plant gathering. Statistical significance is given by: + ten percent; * five percent; and ** one percent. Source: Author's calculations.

Figure 3.1: Proportion of Men and Women Reporting General Good Health Among Indigenous Populations and the Explained Proportion of the Observed Gender Gap in Good General Health



Notes: Source: Author's calculations.

Figure 3.2: Proportion of Men and Women Reporting General Good Health Among Four Subgroups of Indigenous Populations and the Explained Proportion of the Observed Gender Gap in Good General Health



Notes: Source: Author's calculations.

Chapter 4

The Effect of Ramadan Fasting during Pregnancy on Birth Outcomes, Evidence from Canada

Min Hu and Casey Warman

4.1 Introduction

In utero shocks brought on by large nutritional restrictions to the mother have been found to substantially impact both the immediate and long-term health of the child. Research has pointed to utero shocks caused by extreme events such as wars or famines as examples of events causing considerable reductions in nutritional intake and resulting in subsequent detrimental fetal development. However, while these studies are important in showing a link between nutritional restrictions and fetal development, these events are infrequent and often provide little policy guidance for milder, yet often more common dietary restrictions. Therefore, a key question is whether less severe events can also have harmful effects. There are medical studies examining milder reductions in nutrition brought on by the mother restricting her calorie intake. However, generally it is hard to discern causal inference from these studies since the timing of nutritional intake is determined by the mother.

There is a small literature in economics that has turned to Ramadan as a possible exogenous source of dietary restriction. Although the disruption to prenatal nutrition caused by Ramadan may not be as extreme as dietary shocks caused by wars or famines, given that it occurs annually and impacts a considerable fraction of the world's population, understanding the effect of less severe events on fetal development and subsequent outcomes may provide large scope for improving outcomes of a large population. Further, understanding the impacts of Ramadan fasting also provides information about fetal health and child development for less severe nutritional deprivation.

We focus on the impact of in utero exposure of Ramadan on birth weight and fraction of male births in Canada. While there are other potential impacts of fasting that may not show up until later in life, birth weight has been used as an immediate marker of infant health and has been linked to other health outcomes later in life. For example, low birth weight has been associated with poor kidney function. While existing economic literature has generally found negative impacts of in utero Ramadan exposure on several post birth outcomes, the two studies examining birth weight come to differing conclusions. Overall, Almond and Mazumder (2011) find negative effects on birth weight in Michigan and a large decrease in the fraction of male births.[30] Conversely, Jürges (2015) finds no impact on either birth weight or the fraction of male births in Germany.

Using Canadian data, we build on this previous literature. Canada provides the opportunity to study this issue in another developed country with a relatively large Muslim population. We follow this previous literature by using the potential 30 days of fasting during the gestation period brought on by the timing of Ramadan. We use twenty-seven years of Canadian administrative birth records, spanning from 1990 to 2016 that provides over two hundred thousand children born to potential Muslim mothers and over seven million total birth records. Importantly, given the physical size and relatively high latitude of Canada, as well as the fact that Ramadan moves by around 11 days a year, the data provides a large amount of variation in terms of daylight hours both within and across locations permitting us to exploit tremendous variation in the duration of fasting.

Our estimates may be seen as being somewhere in between the Almond and Mazumder (2011) and Jürges (2015) results. Almond and Mazumder (2011) find an 18-gram decrease in birthweight if Ramadan overlapped with the pregnancy of a Muslim mother, and decrease in the fraction of male births by around 6 percentage points, while Jürges (2015) finds no impact on either outcome. While we initially do not find any impact of Ramadan on birthweight, once we restrict the sample based on number of daylight hours of Ramadan, we do uncover a modest reduction in birth weight that increases across trimesters or when Ramadan falls on the 5th, 7th or 9th month. This occurs if we drop very

[30] In addition to finding impacts on long term outcomes, van Ewijk (2011) also finds a lower faction of male births.

long Ramadans, for which given the long duration of fasting may arguably reduce the likelihood of fasting as well as the very short Ramadans, for which the fasting period may be too brief to impact fetal health. Potentially, this may account for some of the different findings between these two papers, with a relatively higher latitude in Germany compared to where the bulk of the population in Michigan is located.[31] While we do find important nonlinearities in terms of the impact of hours of daylight, unlike Almond and Mazumder (2011), we do not find that the impact on birthweight is more severe with longer daylight hours. This is true even if we restrict our analysis to eliminate Ramadans that fall when fasting hours are extreme.

One key issue, as with the previous research, we are not able to observe if the mother is fasting. Under the assumption that the mother is not timing her pregnancy with respect to Ramadan, this amounts to intention-to-treat estimates (ITT). ITT is stacked against finding an impact of Ramadan on birth outcomes if there is a large enough fraction of mothers identified in the target population that do not fast or only partially fast. Therefore, a null finding may be as a result of large enough non-compliance and does not necessarily permit us to rule out an impact of fasting on birth outcomes. Further, any negative impact may be attenuated towards zero so our estimates should be taken as conservative estimates.

The paper proceeds as follows. In Section 4.2 we discuss the relevant literature focusing first on the dietary disruptions and fetal health, then on the relevant economic studies and finally on existing evidence on whether Muslim mothers fast during Ramadan. In Section 4.3 we describe the data and research design, in Section 4.4 we present the estimates on birth weight and sex ratio, and finally in Section 4.5 we offer a discussion and conclude.

[31] For example, in Berlin, the shortest day of Ramadan captured in Jürges (2015) is around 7 hours and 40 minutes while the longest days are around 16 hours and 50 minutes, while in Detroit, the shortest day of Ramadan captured in Almond and Mazumder (2011) and are around 9 hours and 5 minutes and the longest days are around 15 hours and 16 minutes.

4.2 Relevant Literature

Given that previous research such as Almond and Mazumder (2011) provide a very thorough overview of the literature, we limit our discussion and focus on the core issues and some key papers that are essential to understanding and interpreting the analysis we conduct in Section 4.4. We first briefly discuss research which focuses on the impact of fasting and dietary disruptions on fetal health and then review the relevant economic research related to Ramadan and fetal health and human capital development. We then consider the evidence on whether pregnant Muslim women fast.

4.2.1 Dietary Disruptions and Fetal Health

Medical studies have uncovered that certain exposures, chronic health conditions, risky behaviors such as smoking or drinking, and nutritional shortages during pregnancy impact fetal health and development (Barker, 1992; Metzger et al, 1982; Meis, Rose and Swain, 1984; Hobel and Culhane, 2003). Moreover, daytime fasts during pregnancy are more likely to be associated with lower glucose concentrations than nighttime fasts (Metzger et al. 1982; Meis, Rose, and Swain 1984). Pregnant women are more susceptible to the negative impacts of fasting since being pregnant already place greater demands on the body and for a given level and timing of nutrition, they will experience lower levels of glucose. Pregnant women are at an increased risk of reaching states of hypoglycemia and ketoacidosis, which are main causes of intrauterine death from restriction in food intake (Hobel and Culhane, 2003).

4.2.2 Economic Studies

We outline the relevant economic literature. We begin with the literature most pertinent to our study. This covers the immediately detectable signs of an impact of fasting, namely regarding birth weight and fraction of male births. We then organize the remaining literature chronologically over the lifecycle, rather than by specific research paper.

The key paper that our work is related to, Almond and Mazumder (2011) make crucial improvements over past work in the medical literature. Instead of relying on a small number of Ramadans, they use numerous Ramadans to eliminate any seasonality that

may impact birth outcomes.[32] Using the 1989 to 2006 Michigan natality data, they examine the immediate effects of pre-birth Ramadan exposure, and find that average birth weight is around 18 grams lower for Muslim babies whose birth overlaps with Ramadan. As well, they find a sizeable 6 percentage point lower fraction of male births. The other paper to use a similar method to investigate birth weight is Jürges (2015). He investigates the impact of Ramadan fasting on birth weight and the proportion of male births using German birth data spanning from 1996 to 2010 but finds no effect of Ramadan exposure on either outcome. Van Ewijk (2011) finds there is a lower fraction of male births and a higher birth fatality rate among babies whose Muslims mother was exposed to Ramadan fasting.

While we focus on the impact on birth weight and also to a lesser extent examine the impact on the fraction of male births, there is a growing economic literature linking in utero exposure not only to measures at the time of birth, but together outline the impacts throughout the lifecycle. Karimia and Basu (2018), use information from 37 countries that contain information on the mother's religion and find that height is around a quarter of an inch less for boys between ages 3 and 4 who were exposed to Ramadan in utero during early- to mid-gestation. They do not find any impact for girls. Almond, Mazumder and Ewijk (2015) investigate in utero Ramadan exposure and children's academic performance in England and find comparatively lower test scores for students who may have been exposed to Ramadan during early pregnancy. Examining outcomes in Indonesia, Majid (2015) uncovers that in utero exposure lowers cognitive and math test scores when they are children. Greve, Schultz-Nielsen and Tekin (2017) find that in Denmark, in utero exposure to Ramadan lowers test scores, particularly for those of low socioeconomic status, as well as for females.

The impact of Ramadan was not only found at young ages but extends and even worsens into adulthood. In addition to the Michigan data that they used to analyze birth weight and the fraction of male births, Almond and Mazumder (2011) also use data from Uganda and Iraq and find that people with prenatal exposure to Ramadan are more likely to be physically disabled and suffered from mental disabilities as adults. These important

[32] For example, Azizi et al. (2004) use a single Ramadan season and finds no significant differences in the IQ of school age children by maternal fasting behavior.

findings imply that even relatively mild prenatal nutrition shortage could have long-term persistent effects. Schultz-Nielsen, Tekin and Greve (2016) find a reduction in labour market outcomes including lower salary and lower employment outcomes coming from in utero Ramadan exposure during the 7th month of gestation. In addition to examining the impact in childhood on cognitive ability, Majid (2015) find that those with in utero exposure work fewer hours as adults. Van Ewijk (2011) analyzes the Indonesian Family Life Survey (IFLS) data and finds evidence of long-term negative effects of fasting on general health. Moreover, he also finds that people who were prenatally exposed to Ramadan fasting have comparative poorer general health status as well as higher risk of suffering heart problems and type 2 diabetes than others later in life.

4.2.3 Pregnancy and Fasting during Ramadan

Ramadan is the holiest month of Islam Calendar. Muslims generally have to fast from sunrise to sunset during this period. If a Muslim misses a day of fasting, s/he can make up for it on a later day and often pay a penalty. There is debate as to whether pregnant woman fast during Ramadan. Esposito (2003) indicates certain groups are automatically exempted from fasting: "children, people who are ill or too elderly, those who are traveling, and women who are menstruating, have just given birth, or are breast feeding". However, pregnant women are not explicitly exempt. Almond and Mazumder (2011) and other previous literature highlight survey evidence of a high level of fasting during pregnancy in various countries.[33] Previous research suggests that the proportion of women fasting while they are pregnant ranges from 50 to 90 percent (Cross et al., 1990; Joosoph et al., 2004; Robinson and Raisler, 2005). Another consideration is that even if a pregnant Muslim woman is not fully participating in fasting, the nutritional environment is not ideal for her since her family will be likely be fasting. As well, the impact on fetal health from fasting may not be limited purely to the change in calories or a decrease in overall nutrition. There might also be an impact of the timing of when calories are consumed. Further, reduction in fluids may impact fetal health. Finally, there may also be an impact from changes in sleeping patterns.

[33] Almond and Mazumder (2011) in their appendix highlight research from various countries. For example: Iran (Arab and Nasrollahi, 2001), Singapore (Jooseph and Yu 2004), Yemen (Makki, 2002), Birmingham, England (Eaten and Wharton 1982), Gambia (Prentice et al 1983) and a small study in Michigan (Borbin and RASSS, 2005).

As previously discussed, the framework amounts to intention-to-treat estimates. Finding an impact of Ramadan will not only depend on how large an impact that fasting and the nutritional disruption has on the fetal health, but also hinge on what fraction of pregnant Muslim women fast. A null find therefore could instead be due to a lack of fasting, rather than as a result of no impact of fasting on birth outcomes. While there are no Canadian studies examining the fraction of pregnant women fasting during Ramadan, the numerous studies from other countries, including western countries, point to some sizeable degree of fasting. These studies can reasonably inform us of the expected fasting rates in Canada for Muslims from specific source countries unless there are important differences in terms of the types of immigrants Canada attracts.

4.2.4 Contributions and Shortcomings

This study is the first paper focusing on Ramadan fasting on birth weight and sex ratio in Canada. The fraction of the Canadian population that is Muslim is much larger than is the case in the U.S. In the U.S., the Muslim population is smaller and more geographically concentrated. Further, given the lack of information on the religion or ancestry of the mother in the National US Vital Statistics Data, Almond and Mazumder (2011) must rely on data from one location, namely Michigan. While Michigan does contain a sizable fraction of Muslims compared to other areas in the United States, it is limited in terms of daylight hours. With 27 years of birth records that we use, we have a large amount of within Census Division variation in daylight hours, as well, the geographical variation and relatively high altitude provides us with large between location variation. The large variation in daylight hours also enables to estimate how sensitive the estimates are to when Ramadans covering extreme fasting hours are excluded.

Our study has some strength and weaknesses relative to previous studies. Like the key economic studies, we do not observe whether or not the mother fasts so we also obtain intention-to-treat estimates. While Jürges (2015) has information on the religion of the mother, like Almond and Mazumder (2011), we must rely on country of birth to classify

a mother as Muslim.[34] Conversely, Jürges (2015) does not have information on gestation period so must use date of birth to classify the gestation period, while our birth records contain this information. As with Jürges (2015), we also do not have the rich demographic and health behaviors that the Michigan Vital Records provide to enable Almond and Mazumder (2011) to estimate if there is a relationship between the timing of conception with respect to Ramadan and characteristics of the mother. Almond and Mazumder (2011) find no relationship between Ramadan and a variety of mother and family variables such as the mother's highest level of education, tobacco use, alcohol use etc. They note that "it is also possible that patterns of selective timing of fertility may differ across countries". Conversely, Karimova (2018) does find some evidence that women in Indonesia avoid becoming pregnant during Ramadan by altering their contraceptive use.

4.3 Data Description and Research Design

4.3.1 Data Description

We use the 1990 to 2016 Canadian Vital Statistics Birth Records which contains information on all births in Canada over this period. The data provides over seven million birth records including over two hundred thousand potential Muslim births. Information on the exact date of birth and gestation length is contained in the data. The data also provides the baby's exact birth weight in grams. We keep mothers whose age at the time of birth was between 14 and 45. We further restrict the sample by dropping a small number of babies with birth weights less than 300 grams or greater than 5,999 grams for our main analysis when weight is the dependent variable.

4.3.2 Measure of Ramadan and Model

Each Ramadan month is about thirty days and the Islamic Lunar Calendar shifts by around 11 days every year with respect to the Solar Calendar. The information of the infant's exact birth day and the number of weeks of pregnancy duration enables us to count back from the birth date with the number of duration days and calculate the approximated last menstrual period (LMP) date for each birth. The pregnancy duration

[34] Although examining different outcomes variables, Majid (2015) has information on religion and religiosity.

of each birth can be further categorized in three trimesters or nine gestation months. For our main specification, to make our results comparable to past literature, we restrict the sample to pregnancy duration. We restrict the duration to 38 to 42 weeks from the Last Menstrual Period (or 36 to 40 weeks from conception). We also drop a small number of records with invalid information on the mother's age and birth place or the baby's exact birth date, gender, birth weight, and birth of place (based on census division level geography). The conception date can be calculated by using the date of birth and subtracting 270 days for those with full (mature) pregnancies.[35] We divide the trimesters and gestational period based on the fetal age which we define as the Last Menstrual Period (LMP) plus 14 days. We also include a month dummy that covers the two weeks between the LMP and the date of conception as well as an additional two weeks period to the LMP. This will capture any error in the conception date if it occurred earlier than estimated, if the LMP date is earlier than recorded, as well as the potential impact of Ramadan exposure on preconception health.

We estimate several variations of the following model:

$$Weight_{itg} = \beta_0 + \beta_1 Muslim_{itg} + \beta_2 Exposure_{itg} + \beta_3 Muslim_{itg} \times Exposure_{itg} + \beta_4 X_{itg} + \alpha_m^1 + \alpha_t^2 + \omega_g + \epsilon_{itg} \quad (4.1)$$

where $Weight_{itg}$ is the birth weight in grams for baby *i* born at time *t* in Census Division *g*. $Muslim_{itg}$ is a dummy variable indicating whether the person is Muslim (treated) or non-Muslim (comparison group). Given that we have 27 Ramadans, we cannot fully account for other seasonal factors that may impact birth weight. Therefore, we focus on estimates where we also condition on a comparison group composed of births to non-Muslim mothers. The variable $Exposure_{itg}$ captures whether or not the specific period of pregnancy overlaps with Ramadan. We measure this in a few different ways (any overlap, trimester overlapped, month of gestation overlapped, or a measure of the total daylight hours overlapping with Ramadan) which we describe in greater detail below. Of key interest is the Muslim variable interacted with our Ramadan overlap variables. X_{itg} is a vector of controls including mother's age and age squared and the gender of the baby.

[35] There is some variance in full pregnancies and this appears to be changing over time. See Jukic et al. (2013).

We also include birth month (α^1) and birth year (α^2) fixed effects and Census Division fixed effects. ε_{itg} is the error term. We also estimate similar regression (excluding the male dummy) with male as the dependent variable to see if there is any impact on the sex ratio.

Similar to related previous literature, we define our Ramadan fasting exposure using one of three different specifications. In our first specification, we include an indicator for whether Ramadan fasting is overlapped with the pregnancy in any of the nine gestation months.[36] We also include a "gestation month zero" dummy which is an indicator for the thirty days prior to the approximated conception date to capture the potential Ramadan effect on the prenatal intake of calories of the mother. The default group covers the births not overlapped with Ramadan during any time of pregnancy. We also conduct estimates where we divide the gestation period into three trimesters, as well as present estimates where we subdivided the period into the 9 gestation months.

To identify the impact of Ramadan overlapping with trimesters or the pre- or post-periods, we construct six dummy variables. These include "*possible overlap with Ramadan*", a dummy variable that indicates whether the Ramadan starts less than thirty days before the approximate conception date; "*conceived prior to Ramadan and overlapped in the first trimester*" is a dummy variable that indicates whether the conception date is prior Ramadan and Ramadan overlaps with the first trimester; "*Ramadan started during the first trimester*" is a dummy variable that equals one if Ramadan starts after the conception date and before the end of first trimester; "*Ramadan started during the second trimester*" is a dummy variable that equals one if Ramadan starts after the end of first trimester and before the end of second trimester, "*Ramadan started during the third trimester*" is a dummy variable that equals one if Ramadan starts after the end of second trimester and before the birth day; and "*born during Ramadan and overlapped in the third trimester*" is a dummy variable that indicates whether the birth happens during the month of Ramadan. The default group contains those births not overlapped with Ramadan during their whole pregnancy.

[36] Each gestation month is a 30 days period, from the first gestation to the ninth gestation, for example, the first 30 days after the conception day corresponds to the first gestation, and the 31 days to 60 days correspond to the second gestation, until 270 days.

In Figure 4.1, we illustrate examples of both the three-trimester specification (Panel a) as well as the specification where we include the 9 gestation months (Panel b), and give examples for how Ramadan would be coded depending on when it fell. As the examples show in the Panel a of Figure 4.1, Ramadan A starts before but ends after the conception date of a birth, the dummy variable *conceived prior to Ramadan and overlapped* equals one, and all the other trimester dummy variables are equal to zero; Ramadan B starts after the conception date, and ends before the end of first trimester, then the dummy variable *Ramadan started during the first trimester* equals one, and all the other trimester dummy variables are equal to zero; Ramadan C starts after the birth day, also there is no other Ramadan overlapped less than 30 days before the conception date, so all of the dummies are zero, this birth is one of the default group.

In Panel b, we present a few examples when we use 9 gestation month dummies. Ramadan A would equal one for the dummy variable for gestation month 1 and gestation month 2 and the other dummies are zero; if a birth overlapped with Ramadan B, gestation months 4 and 5 are equal to one and the other dummies are equal to zero. Finally, for a birth that overlaps with Ramadan C, all of the dummies are zero, and this birth belongs to the default group.

A fourth measure is constructed as a fraction of daylight hours where the numerator is the number of daylight hours over the next thirty days that overlap with Ramadan, and the denominator is the average length of the sum of daylight hours (330 hours) over next 30 days period.[37,38] Muslims fast from sunrise to sunset and the length of daylight various by latitude of each Census Division, and also changes by when Ramadan falls for the given year.

In Figure 4.2, we present the daylight hours for a given year (2010) to show how the number of hours of daylight varies across the year and across locations. While there is even greater within location variation as we go further north in Canada, the Muslim

[37] We obtained the longitude and latitude information from Natural Resources Canada http://www.nrcan.gc.ca/earth-sciences/geography/place-names/data/9245 and the sunrise and sunset information from https://sunrise-sunset.org/api.
[38] We use daytime length for each day for each Census Division from January 1989 to December 2016.

population is not very sizable.[39] We therefore present variation for three well populated Census Divisions that have sizable Muslim populations, namely Toronto, Edmonton and Vancouver. Given Canada's latitude, there is a great variation over the year in terms of daylight hours and subsequently more variation in hours of fasting. For example, on June 21st in Toronto there is around 15 and a half hours of daylight, while in December 21st, there is around 8 hours and 55 minutes of daylight. Figure 4.2 also shows a large amount of variation between Census Divisions. For example, in Edmonton, the peak hours of sunlight is around 17 hours and the shortest day has around 7 and a half hours of daylight.

In Figure 4.3, we present the Ramadan periods covered by the data. Again, we include Edmonton, Toronto and Vancouver. The between location difference in daylight across latitudes is more extreme when Ramadan falls near the Summer Solstice or Winter Solstice and is not very great when Ramadan is closer to one of the two Equinoxes. Fasting hours are shortest when Ramadan falls around 2000 and longest when Ramadan occurs in 2016.

4.3.3 Definition of Muslim

While the Vital Statistic Birth Record does not provided information on the religion of the mother, it does report the mother's birth country.[40] We first extract information on religion by birth country from the 1991 and 2001 Master file Census data and define a country with at least 50 percent of foreign-born population reporting Muslim religion in either Census as a Muslim country. In order to not miss potential Muslim immigrants before our next restriction, we further net a few additional countries based on them having greater than 80 percent of the source country population identifying as Muslim (in Wikipedia). We then identify Muslim status in the Vital Statistics Birth Record data by the country of birth of the mother. Even from countries that are a majority Muslim, a high fraction who end up immigrating to Canada are not Muslim, and there is great variation by region of residence in Canada. For example, while almost 85 percent of immigrants from Iraq who were residing in Ottawa listed Islam as their religion in the 2001 Census, only around half of those residing in Greater Vancouver or Edmonton did.

[39] However, there are some scattered communities further north. For example, Inuvik (latitude of 68.36 degrees) has had a Mosque since 2010 to service its Muslim population (made up of immigrants largely from Sudan). See Chez Chiara (2010).

[40] We considered also using the father's birth country to further help identify a baby's Muslim status, however, information on the father's birth country was only introduced to the VSDB in 2012.

Therefore, to try and account for this geographical concentration and get a cleaner measure of Muslim mothers, for the countries we have indicated as Muslim, we calculate the fraction of people from that country in the given Census Division that identifies as Muslim in the 2001 Master file Census. We then drop people from that country in the given Census Division if in the Census Division in 2001, the fraction from the country is less than 85 percent Muslim.

We also drop a large number of Census Divisions that have no Muslims or only a handful of Muslims to make the sample more homogenous in terms of geography (dropping 179 out of 293 Census Divisions). To try and eliminate Muslim mothers from our "non-Muslim" sample, we drop babies from our Birth Record data if their mother lives in a Census Division for which the fraction of Muslims from the country of birth in 2001 in the Census Division was greater than 10 percent but the group does not meet our 85 percent threshold. After all of the restrictions, we end up with 98 Census Divisions.

4.4 Results

4.4.1 Basic Differences

Table 4.1 presents differences in the means of our key dependent variable: birth weight in grams. We include a Muslim indicator and control for the mother's age and age squared. We subtract 30 from the age to make the constant interpretable as the outcome for a child born to a thirty-year old non-Muslim mother.[41] We also show estimates for whether the child was of low birth weight (<2,500 grams), and whether the child was a male. We find very large differences in birth weight between Muslim and non-Muslim children, with a difference of almost 120 grams, or a little more than 3 percent off the base mean (column 1). These differences are larger for males. Next when we examine whether the baby was of low birth weight, we find that Muslim babies are around 0.8 percentage points more likely to be born weighing less than 2,500 grams, or around two-thirds higher than the base mean. We find no detectable difference in terms of male births to Muslim and non-Muslim mothers. Overall, approximately 51 percent of the babies are female.

4.4.2 Birth Weight

[41] Thirty is close to the mean age of the mothers in our sample.

So far, we have found some sizable differences in terms of birth weight and low birth weight between children born to Muslim and non-Muslim mothers. How related are these differences to the exposure to Ramadan? We next examine the effects Ramadan overlapping with pregnancy on birth weight. Table 4.2 shows the estimates where we include a single dummy variable to capture whether Ramadan occurred at any time during the pregnancy and interact this with a Muslim indicator. In column 1 we present the estimates for the full sample, and then in columns 2 and 3 we show the estimates restricting the sample to females and males respectively. We present the constant at the bottom to give an indication of the mean birth weight for the default category. Looking at the full sample, the overlap coefficient is near zero. Given that when Ramadan falls should not impact non-Muslims, unless a large enough fraction of (fasting) Muslim mothers are contained in our comparison group, this is what we would expect. Overall, we find only a small statistically insignificant 4-gram reduction in birth weight for Muslim babies whose gestation period overlapped any time with Ramadan. This is much lower than what is found by Almond and Mazumder (2011) who find around an 18-gram reduction, and arguably more in line with Jürges (2015) who finds no impact. Again, differences in source country could impact the estimates if Muslims from certain countries are more likely to fast and the source countries for Canada, Michigan and Germany differ. When re-estimate the model for female and males separately, again, we do not find any statistically significant impact.

Since we cannot directly observe whether the mother is fasting and how long she is fasting our Overlap x Muslim estimates are likely attenuated towards zero. Arguably, the length of daylight hours of a given Ramadan may be one trait that impacts whether or not a mother fasts and the intensity of fasting. Daylight hours and therefore normal fasting will be shorter when Ramadan falls near the Winter Solstice and longer when it falls near the Summer Solstice. For example, in Edmonton, daylight hours are around 7 and half hours a day when Ramadan overlaps with the Winter Solstice and around 17 hours a day when it is near the Summer Solstice. We eliminate the really long hours (Ramadans with days greater than 16 hours of fasting). We also eliminate the very short Ramadans since these are unlikely to have much impact on in utero health. Therefore, in columns 4-6 we present estimates where we restrict the analysis to “non-extreme” Ramadans, where we

drop Ramadan periods for which the longest day is less than 10 hours or more than 16 hours. The coefficient more than doubles and the p-value for full restricted hours sample and female sample is just above the 10 percent level.

We divide up the overall overlap dummy by trimester and include a couple extra dummies to capture if Ramadan falls at around conception or a period when there may be some measurement error in coding whether the pregnancy has begun. As well, we include a dummy variable for if Ramadan falls during the birth period. When we use the full set of hours, we do not find any impact of Ramadan on birth weight. However, when we restrict the sample to between a maximum of 10 daylight hours to a maximum of 16 daylight hours on any day of Ramadan, we see some moderate evidence of an impact of Ramadan on birth weight for babies born to Muslim mothers. While we do not see any impact when Ramadan overlaps with the early part of pregnancy, the impact seems to increase across pregnancy with a 9-gram reduction if Ramadan falls in the first trimester, 10 grams in the second trimester and 12 grams in the third trimester. The largest effect occurs if Ramadan falls at the end of pregnancy, the key time for which the baby is gaining weight.

We next further break up the trimesters into months of gestation. When we do not place any restrictions on the potential hours of fasting, we do not see any impact of Ramadan, regardless of the month of pregnancy it overlaps with (see Appendix Table C1). In Table 4.4, we present the estimates by month of pregnancy, but again restricting the sample to get rid of the Ramadans that are likely too short in terms of hours of daylight and the ones with extreme fasting hours to partially reduce the ITT issue. With these restrictions, we do detect some modest impact of fasting on birth weight. The largest impact on birth weight occurs if Ramadan falls on the ninth month of pregnancy, reducing birth weight by around 20 grams. This effect is larger for males, with a 24-gram reduction. For females, the effect is smaller at around 15 grams, and the level of statistical significance is just below the ten-percent level. We also find a reduction of around 12 grams in the overall sample, and around 15 grams for males if Ramadan overlaps with the seventh month. We see a tiny decrease in birth weight of less than 3 grams for non-Muslims if Ramadan fell on the 6 month of pregnancy and around a 2-gram increase if Ramadan fell

on the 7 month pregnancy, potentially indicating some small seasonal effects not fully captured by the number of Ramadans available in our data.[42] For females, the largest impact occurs if Ramadan corresponds with the fifth month of pregnancy.

Next we directly examine whether birth weight declines with the length of hours of daylight of Ramadan. We previously show that the results are sensitive to including Ramadans that fall when either daylight hours are short or very long. However, while we see this discontinuous impact of daylight hours, the length of Ramadan does not seem to have a continuous impact on birth weight. We present estimates by trimester in Table 4.5. The estimates that we present drop observations that cross trimesters to eliminate cases where hours overlap over two periods. In the sample where we do not drop extreme Ramadans, we see that the impact of hours is actually positive, contrary to what we would expect. One argument is that the length of Ramadan may reduce the fraction of Muslim mothers fasting since it will increase the hardship they experience. When we restrict the sample to Ramadans with a maximum of between 10 to 16 hours of daylight, while the positive effect we found in the overall results shrinks, we again do not find any evidence of a negative impact of Ramadan. Again, even within these hours of daylight subsample, the propensity to fast may decline with hours of daylight.

4.4.3 Fraction of Male Births

In Table 4.6, we present estimates of the impact of Ramadan exposure on the fraction of male births. To conserve space, we present estimates showing the overlap by trimester, but similar conclusions are reached with other specifications. The first column in each specification shows the dummies for the comparison group (non-Muslim), while the second column shows the interaction with the Muslim indicator. If there is an impact of Ramadan on fraction of male births, we would expect to see it occur early in the birth. However, we do not see this. While we do see the third trimester dummy is negative and statistically significant, we do not see any impact in the first trimester, putting into doubt the possibility that Ramadan had an impact on the sex ratio. When we restrict the sample to eliminate the Ramadans with very short or long daylight hours, we do not find any statistically significant impact on the fraction of male births.

[42] This is also true if we do not place our hours restrictions. See Appendix Table C1.

4.5 Discussion and Conclusion

Restricting nutritional intake while pregnant has been found to have a detrimental impact on the health of the fetus and potential long-term consequences. Using administrative Canadian birth records data, we examine this issue focusing on the timing of Ramadan. We examine the impact of prenatal exposure to Ramadan, and potential fasting on birth weight and the proportion of male births. The findings in the two other papers has been mixed with Almond and Mazumder (2011) uncovering a reduction in birth weight for children born to Muslim mothers and in utero during Ramadan in Michigan, as well as a sizable decline in the proportion of males while Jürges (2015) finds no impact on either outcome when examining German data.

The Canadian data provides a large Muslim population relative to the U.S., as well as a large amount of both within region and between region variation in daylight hours. Overall, while we do not see as large effects as found by Almond and Mazumder (2011), we do see some evidence of an impact on birth weight. In particular, our hours of daylight restricted estimates do potentially point to differences in fasting hours brought on by the different latitudes in Michigan and Germany, and point to this as one source that may lead to their differing conclusions. Conversely, as with Jürges (2015), we do not find any impact on the sex ratio. As well, we also do not find the same evidence as Almond and Mazumder (2011) in terms of a linear decline in birth weight with hours of daylight.

The different findings across Almond and Mazumder (2011), Jürges (2015) and our study may be due to the source groups being examined and different rates of fasting compliance. For example, Jürges (2015) notes that a majority of the Muslim mothers in Germany are of Turkish origin which may impact the comparability with Almond and Mazumder (2011). Key for future research will be to conduct a large-scale study that examines fasting rates to better be able to link the mechanism with health outcomes. Further, we examine the immediate impact of Ramadan, looking at measures of birth weight and fraction of male births. However, this does not necessarily mean that effects will not emerge later in life as has been found in other research in terms of outcomes such as academic achievement and disabilities.

Table 4.1: Mean Weight, Low Birth weight and Fraction of Male Children

	Birth weight	< 2,500 grams	Male Child
Everyone			
Muslim	-118.9**	0.0077**	0.0005
	(1.368)	(0.0003)	(0.0015)
Mean	3,520	0.0116	.510
Female			
Muslim	-108.6**	0.0086**	
	(1.893)	(0.0005)	
Mean	3,448	0.0146	
Male			
Muslim	-128.9**	0.0069**	
	(1.932)	(0.0004)	
Mean	3,588	0.0088	

Notes: Conditions on mother's age and age squared. Statistical significance is given by: + ten percent; * five percent; and ** one percent.

Table 4.2: Effect of Ramadan on Birth Weight, Ramadan Occurring at Any Time During Pregnancy

	No hours of daylight restrictions			Restricted to between 10 to 16 hours of daylight		
	Full Sample	Female	Male	Full Sample	Female	Male
Overlap	0.230	-0.084	0.545	-0.369	-0.475	-0.252
	(0.571)	(0.838)	(0.727)	(0.795)	(1.081)	(0.991)
Overlap x Muslim	-4.029	-5.087	-3.164	-9.925	-11.830	-8.159
	(4.888)	(5.867)	(5.203)	(6.076)	(7.184)	(5.741)
Base mean	3,439	3,434	3,580	3,441	3,437	3,582
Observations	6,068,200	2,977,760	3,090,440	3,766,325	1,847,115	1,919,215
R-squared	0.036	0.014	0.015	0.034	0.013	0.014
Clusters	98	98	98	98	98	98

Notes: Birth weight is in grams. All regressions condition on mother's age-30 and its square, a Muslim indicator, a potential overlap with a pre-period indicator interacted with the Muslim indicator, Census Division fixed effects and year and month fixed effects. A gender dummy is also included when the regressions include both genders. Base mean is for non-Muslim babies whose gestation period did not overlap with Ramadan and who born to 30-year old mothers in January 1990. Statistical significance is given by: + ten percent; * five percent; and ** one percent.

Table 4.3: Effect of Ramadan on birth weight (in grams), by Trimester

	Full sample, no hours restrictions		Maximum 10 to 16 hours of daylight	
	Overlap	Overlap X Muslim	Overlap	Overlap X Muslim
Ramadan possible	-1.111	-4.186	-0.415	-3.803
	(0.948)	(4.510)	(1.100)	(6.086)
Conception during Ramadan	-0.755	-0.452	-0.928	-2.624
	(0.912)	(7.567)	(1.209)	(8.290)
Trimester 1	0.300	-2.477	0.276	-9.270*
	(0.632)	(3.698)	(0.841)	(3.791)
Trimester 2	-0.905	-3.845	-1.574+	-9.900+
	(0.659)	(5.389)	(0.873)	(5.692)
Trimester 3	0.0228	-2.958	1.324	-11.70*
	(0.660)	(4.710)	(1.020)	(5.259)
Birth during Ramadan	0.0847	-6.265	1.320	-20.51**
	(0.944)	(4.174)	(1.329)	(6.542)
Constant	3,439**		3,442**	
	(6.938)		(6.842)	
Observations	6,068,200		3,766,325	
R-squared	0.036		0.034	
Clusters	98		98	

Notes: Birth weight is in grams. All regressions condition on mother's age-30 and its square, a Muslim indicator, Census Division fixed effects and year and month fixed effects. A gender dummy is also included when the regressions include both genders. Base mean is for non-Muslim babies whose gestation period did not overlap with Ramadan and who born to 30-year old mothers in January 1990. Statistical significance is given by: + ten percent; * five percent; and ** one percent.

Table 4.4: Effect of Ramadan exposure on birth weight (in grams), Restricted to periods for which Ramadan has between daily maximum of 10 to 16 hours of daylight

	Full sample		Females		Males	
	Overlap	Overlap X	Overlap	Overlap X	Overlap	Overlap X
First month	0.339	-4.631	0.750	-15.65	-0.0270	6.128
	(1.192)	(8.025)	(1.467)	(9.818)	(1.508)	(9.429)
Second month	0.741	-1.916	0.394	7.548	1.100	-11.42
	(1.210)	(9.749)	(1.630)	(9.456)	(1.881)	(14.07)
Third month	-0.195	-11.17	1.161	-14.42	-1.507	-7.704
	(1.343)	(8.099)	(1.875)	(9.388)	(1.619)	(14.48)
Fourth month	-1.433	2.430	-1.699	4.861	-1.154	-0.512
	(1.393)	(14.42)	(1.745)	(11.52)	(1.952)	(19.38)
Fifth month	1.414	-12.10+	0.373	-16.83*	2.396	-6.923
	(1.107)	(7.072)	(1.891)	(8.388)	(1.526)	(9.983)
Sixth month	-2.734*	-0.204	-1.342	4.243	-4.057*	-5.249
	(1.197)	(9.044)	(1.740)	(11.28)	(1.554)	(10.08)
Seventh month	2.213*	-11.59*	-0.138	-8.019	4.472**	-14.99*
	(1.091)	(5.162)	(1.782)	(6.590)	(1.290)	(6.757)
Eighth month	0.171	3.990	1.468	6.604	-1.095	1.287
	(1.148)	(6.780)	(1.464)	(9.544)	(1.643)	(8.216)
Ninth month	1.265	-19.95**	1.961	-15.38	0.600	-24.21**
	(1.246)	(7.063)	(1.596)	(9.540)	(1.522)	(7.139)
Observations	3,766,325		1,847,115		1,919,215	
R-squared	0.034		0.013		0.014	
Clusters	98		98		98	
P-values from F-test of Overlap X Muslim coefficients						
$B_1=B_2=\ldots=B_9$	0.007		0.249		0.000	
	0.007		0.328		0.000	

Notes: Birth weight is in grams. All regressions condition on mother's age-30 and its square, a Muslim indicator, Census Division fixed effects and year and month fixed effects. A gender dummy is also included when the regressions include both genders. Base mean is for non-Muslim babies whose gestation period did not overlap with Ramadan and who born to 30-year old mothers in January 1990. Statistical significance is given by: + ten percent; * five percent; and ** one percent.

Table 4.5: Effect of Ramadan exposure on birth weight (in grams), Hours of daylight

	Full sample, no hours restrictions		Maximum 10 to 16 hours of daylight	
	Overlap	Overlap X Muslim	Overlap	Overlap X Muslim
Trimester 1	0.618	12.16	1.326	3.996
	(0.956)	(7.989)	(1.233)	(8.028)
Trimester 2	-1.564+	17.13*	-1.597+	10.23*
	(0.872)	(6.685)	(0.932)	(4.814)
Trimester 3	1.881*	13.08*	3.177*	3.547
	(0.894)	(5.952)	(1.242)	(4.863)
Constant	3,439**		3,442**	
	(6.863)		(6.700)	
Observations	4,574,375		2,851,420	
R-squared	0.036		0.034	
Clusters	98		98	

Notes: Birth weight is in grams. All regressions condition on mother's age-30 and its square, a Muslim indicator, Census Division fixed effects and year and month fixed effects. A gender dummy is also included when the regressions include both genders. Base mean is for non-Muslim babies whose gestation period did not overlap with Ramadan and who born to 30-year old mothers in January 1990. Statistical significance is given by: + ten percent; * five percent; and ** one percent.

Table 4.6: Effect of Ramadan exposure on Fraction of male births

	Full sample, no hours restrictions		Maximum 10 to 16 hours of daylight	
	Overlap	Overlap X Muslim	Overlap	Overlap X Muslim
Ramadan possible	0.0002	0.0019	-0.0012	-0.0000
	(0.0011)	(0.0067)	(0.0015)	(0.0054)
Conception during Ramadan	-0.00089	0.0021	-0.00121	0.00662
	(0.0007)	(0.00889)	(0.0009)	(0.0078)
Trimester 1	-0.0004	-0.00472	-0.0002	-0.00236
	(0.0007)	(0.00595)	(0.0007)	(0.0044)
Trimester 2	-0.00013	-0.00515	-0.00107	-0.00323
	(0.00068)	(0.00639)	(0.0008)	(0.0053)
Trimester 3	0.00029	-0.00599*	-0.0000	-0.00386
	(0.00059)	(0.00288)	(0.0010)	(0.0028)
Birth during Ramadan	-0.00056	-0.00304	-0.0016	0.00541
	(0.00085)	(0.00546)	(0.0011)	(0.0037)
Constant	0.514**		0.515**	
	(0.00130)		(0.00121)	
Observations	7,069,835		4,376,670	
R-squared	0.000		0.000	
Clusters	98		98	

Notes: Birth weight is in grams. All regressions condition on mother's age-30 and its square, a Muslim indicator, Census Division fixed effects and year and month fixed effects. A gender dummy is also included when the regressions include both genders. Base mean is for non-Muslim babies whose gestation period did not overlap with Ramadan and who born to 30-year old mothers in January 1990. Statistical significance is given by: + ten percent; * five percent; and ** one percent.

Figure 4.1: Definition of Ramadan Fasting Exposure Dummy Variables by Trimester and Gestation Month

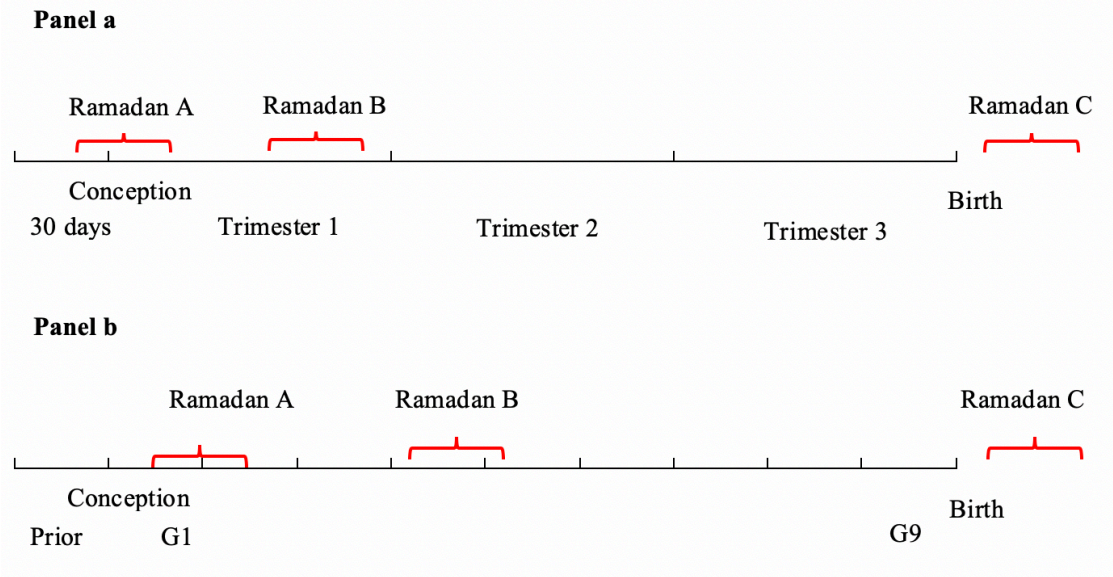


Figure 4.2: Daylight hours for 2010, Toronto, Edmonton and Vancouver

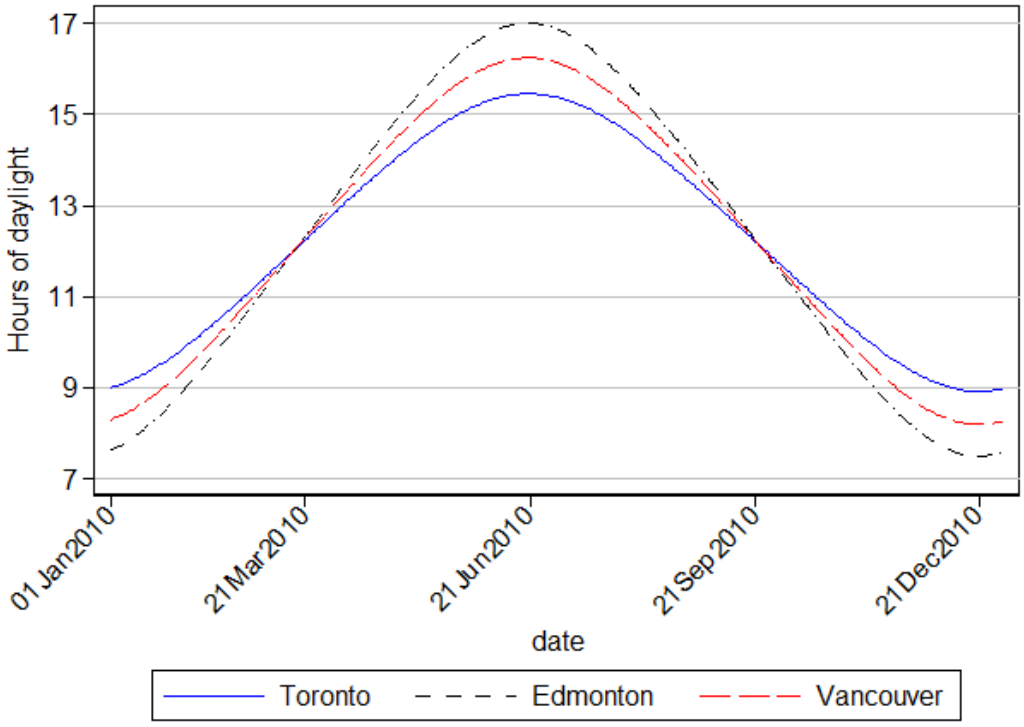
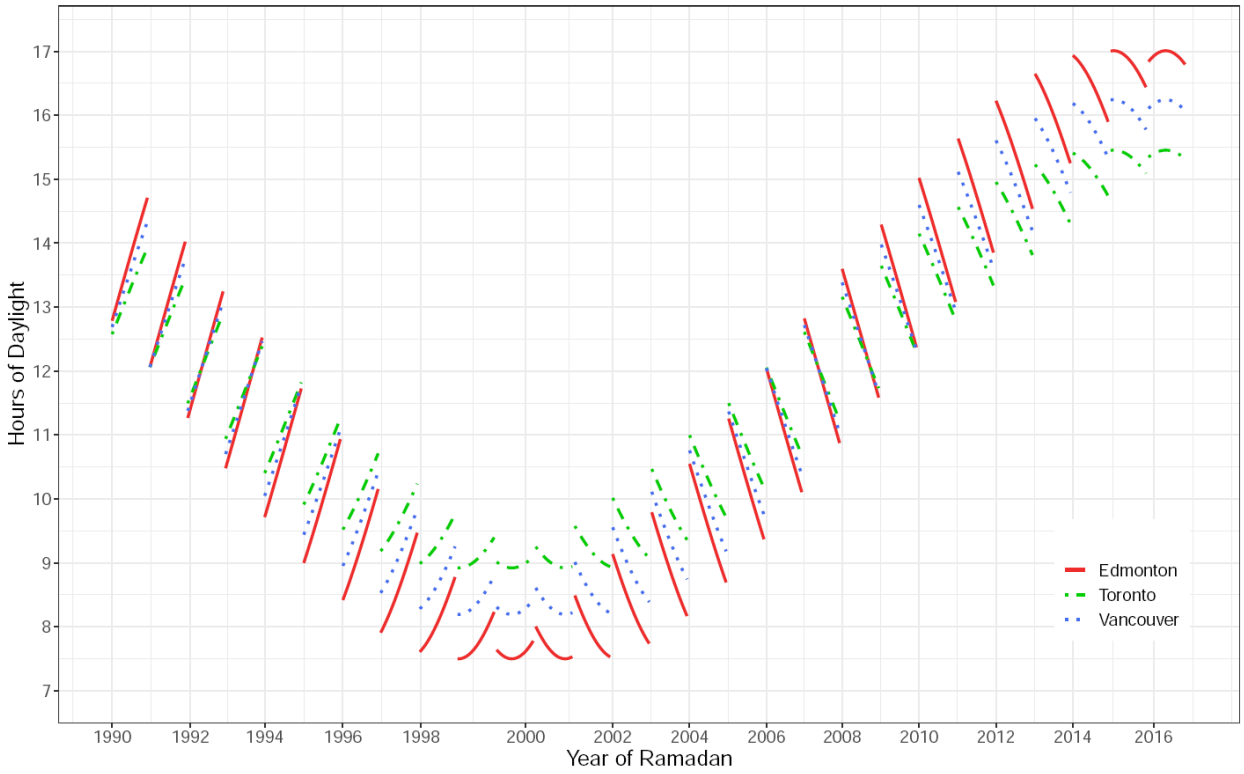


Figure 4.3: Daylight hours for each Ramadan, Toronto, Edmonton and Vancouver, 1990 to 2016



Notes: Figure shows the 30-day period covered by Ramadan in each year

Chapter 5
Conclusion

In this dissertation, I examine the labour outcomes for Indigenous peoples and health outcomes for Indigenous and Muslim peoples in Canada. These two vulnerable populations require special attention because they tend to be different in ways that affect their labour market and health outcomes, and they are underrepresented in economic research. For example, most previous research combines three Indigenous populations together, and compares with non-Indigenous peoples. While, the majority of Inuit peoples are living in the northern territories with different geographic and economic environments, the same factors but challenging climate and higher prices may have an impact on their labour market and health outcomes. Therefore, it makes more sense to investigate three Indigenous groups, *vit.* First Nations, Métis and Inuit separately. Canada is a country with a high fraction of immigrants and there are more than one million Muslim people. Their religious observance and fasting during Ramadan has been associated with detrimental impacts on health outcomes.

In Chapter 2, my co-authors and I address the gaps of earnings and information-processing skills between Indigenous and non-Indigenous populations in Canada. We find Indigenous populations have lower levels of information-processing skills and earn less than non-Indigenous peoples. Information-processing skills are rewarded positively and equally for Indigenous and non-Indigenous peoples, and there is little evidence of economic discrimination. Indigenous peoples also have comparatively lower health, and Indigenous women experience poorer social determinants of health than Indigenous men in Canada. Therefore, in Chapter 3, I examine the health gaps between Indigenous females and males and conduct decomposition analysis of the social determinants on health status for each Indigenous group. The results indicate that the level of SES factors explain more than half of the health gaps between females and males. If Indigenous females have the same level of income, employment rate, and traditional activities participation, the gender health gap could be greatly reduced, and Indigenous females could be healthier than their male counterparts. In Chapter 4, my co-author and I examine the impact of prenatal exposure to Ramadan, and potential fasting on birth weight and the proportion of male births. We find sizable differences in birth weight

between Muslim and non-Muslim babies, with a difference of almost 120 grams, or a little more than 3 percent off the base mean, and Muslim babies are around 0.8 percentage points more likely to be born weighing less than 2,500 grams. When hours of daylight are restricted between 10 to 16 hours, we find some evidence of the effect of pregnancy overlapping with Ramadan fasting on birth weight. We do not find any impact on the sex ratio or any evidence in terms of a linear decline in birth weight with hours of daylight.

To conclude, this dissertation contributes to the literature on the labour market performance of Indigenous peoples, and health issues of Indigenous and Muslim populations. The deficits of information-skills peoples contribute to Indigenous peoples' relatively poor performance in the Canadian labour market and suggest a need to investment in quantity and quality of culturally-appropriate education, for example, education could be provided in Indigenous languages and have more Indigenous content. My findings also suggest improving social economics status could effectively improve health. Moreover, some evidence is found between Ramadan fasting and fetal health. It is important to place emphasis on vulnerable groups in Canada, to try to better understand their challenges and issues, and give appropriate policy suggestions to address the gaps and improve their outcomes.

References

Adelson, N. (2005). The embodiment of inequity: health disparities in aboriginal Canada. *Canadian Journal of Public Health*, 96 Suppl 2, S45-61.

Almond, D., and Currie, J. (2011). Killing me softly: The fetal origins hypothesis. *The Journal of Economic Perspectives*, 25(3), 153-172.

Almond, D., and Mazumder, B. A. (2011). Health capital and the prenatal environment: The effect of Ramadan observance during pregnancy. *American Economic Journal: Applied Economics*, 3(4), 56-85.

Almond, D., Mazumder, B. A., and Van Ewijk, R. (2015). In utero Ramadan exposure and children's academic performance. *The Economic Journal*, 125(589), 1501-1533.

Arab, M., and Nasrollahi, S. (2001). Interrelation of Ramadan fasting and birth weight. *Medical Journal Islamic Academy Science*, 14(3), 91-95.

Arriagada, P., and D. Hango. 2016. Literacy and Numeracy Among Off-Reserve First Nations People and Métis: Do Higher Skill Levels Improve Labour Market Outcomes? In *Insights on Canadian Society*. Cat. No. 75-006-X. Ottawa: Statistics Canada.

Azizi, F., Hossein S., Behnam S., and Nasrollah R. (2004). Intellectual development of children born of mothers who fasted in Ramadan during pregnancy. *International Journal for Vitamin and Nutrition Research*, 74(5), 374-380.

Barker, D. J. (1992). Fetal growth and adult disease. *BJOG: An International Journal of Obstetrics and Gynaecology*, 99(4), 275-276.

Battisti, M., Friesen, J. and Krauth, B. (2014). English as a second dialect policy and achievement of Aboriginal students in British Columbia. *Canadian Public Policy*, 40(2), 182-192.

Benach, J., and Muntaner, C. (2007). Precarious employment and health: developing a research agenda. *Journal of Epidemiology and Community Health*, 61(4), 276–277.

Biswal, B. (2008). *Literacy Performance of Working-Age Aboriginal People in Canada: Findings based on the International Adult Literacy and Skills Survey (IALSS) 2003.* Gatineau, Quebec: Human Resources and Social Development Canada.

Blinder, A. S. (1973). Wage Discrimination: Reduced Form and Structural Estimates. *The Journal of Human Resources*, 8(4), 436.

Bombay, A., Matheson, K., and Anisman, H. (2014). The intergenerational effects of Indian Residential Schools: implications for the concept of historical trauma. *Transcultural Psychiatry*, 51(3), 320–338.

Bonikowska, A., Riddell, W.C. and Green, D.A. (2008). *Literacy and the labour market: Cognitive skills and immigrant earnings.* Ottawa: Statistics Canada, Catalogue no. 89-552-M No. 020.

Booth, H., Rioseco, P., amnd Crawford, H. (2014). What can reverse causation tell us about demographic differences in the social network and social support determinants of self-rated health in later life?. *Vienna Yearbook of Population Research*, 23-51.

Brownridge, D. A. (2003). Male Partner Violence Against Aboriginal Women in Canada. *Journal of Interpersonal Violence*, 18(1), 65–83.

Brzezinski, M. (2015). Accounting for trends in health poverty: a decomposition analysis for Britain, 1991–2008. *The European Journal of Health Economics*, 16(2), 153–159.

Burgard, S. A., and Chen, P. V. (2014). Challenges of health measurement in studies of health disparities. *Social Science & Medicine*, 106, 143–150.

Calcutt, D. (2009). *Aboriginal People's Survey, 2006: Concepts and Methods Guide.* Ottawa, ON.

Chez Chiara (2010). "http://www.chezchiara.com/2010/09/little-yellow-mosque-that-could-arab.html" Last accessed June 17, 2018.

Chiswick, B. R., Lee, Y. L. and Miller, P. W. (2003). Schooling, literacy, numeracy and labour market success. *Economic Record*, 79(245), 165-181.

Clark, M., and Cameron, D. W. (2009). Tuberculosis elimination in the Canadian First Nations population: assessment by a state-transfer, compartmental epidemic model. *International Journal of Infectious Diseases*, 13(2), 220–226.

Clarke, A. and Skuterud, M. (2016). A comparative analysis of immigrant skills and their utilization in Australian, Canada, and the US. *Journal of Population Economics,* 29(3), 894–882.

Cristine R. (2016). *Social determinants of health for the off-reserve First Nations population, 15 years of age and older, 2012*. Statistics Canada, (89-653-X2016009).

Cross, J. H., Eminson, J., and Wharton, B. A. (1990). Ramadan and birth weight at full term in Asian Moslem pregnant women in Birmingham. *Archives of Disease in Childhood*. 65(10 Spec No), 1053-1056.

Currie, C., Zanotti, C., Morgan, A., Currie, D., De Looze, M., Roberts, C., and Barnekow, V. (2009). Social determinants of health and well-being among young people. *Health Behaviour in School-aged Children (HBSC) study: international report from the*, 2010, 271.

Cutler, D. M., and Lleras-Muney, A. (2006). E*ducation and health: evaluating theories and evidence (No. w12352)*. National bureau of economic research.

Daley, A., Burton, P. and Phipps, S. (2015). Measuring poverty and inequality in Northern Canada. *Journal of Children and Poverty*, 21(2), 89-110.

Department of Justice Canada (2018). Respecting the Government of Canada's relationship with Indigenous peoples. http://www.justice.gc.ca/eng/csj-sjc/principles.pdf.

De Silva, A. (1999). Wage discrimination against Natives. *Canadian Public Policy*, 25(1), 65-85.

Dikensoy, E., Balat, O., Cebesoy, B., Ozkur, A., Cicek, H., and Can, G. (2009). The effect of Ramadan fasting on maternal serum lipids, cortisol levels and fetal development. *Archives of Gynecology and Obstetrics*, 279(2), 119.

Drost, H. (1994). Schooling, vocational training and unemployment: The case of Canadian Aboriginals. *Canadian Public Policy*, 20(1), 52-65.

Drost, H. and Richards, J. (2003). Income on- and off-reserve: How Aboriginals are faring. *C.D. Howe Institute Commentary No. 175*. Ottawa: Renouf Publishing Co. Ltd. http://www.turtleisland.org/news/income.pdf.

Emberley, J. V. (2001). The Bourgeois Family, Aboriginal Women, and Colonial Governance in Canada: A Study in Feminist Historical and Cultural Materialism. *Journal of Women in Culture and Society*, 27(1), 59–85.

Marmot, M (Consortium Lead). *Health inequalities in the EU – Final report of a consortium. Brussels: European Commission Directorate-General for Health and Consumers, 2013*. https://www.worldcat.org/title/health-inequalities-in-the-eu-final-report-of-a-consortium-consortium-lead-sir-michael-marmot/oclc/881304451

Falch, T. and Sandgren Massih, S. (2011). The effect of education on cognitive ability. *Economic Inquiry*, 49(3), 838-856.

Feir, D. (2013). Size, structure, and change: Exploring the sources of Aboriginal earnings gaps in 1995 and 2005. *Canadian Public Policy*, 39(2), 309-34.

Feir, D. (2016). The long term effects of forcible assimilation policy: The case of Indian boarding schools. *Canadian Journal of Economics*, 49(2), 433-480.

Feir, D. and R. Hancock. (2016). Answering the call: A guide to reconciliation for quantitative social scientists. *Canadian Public Policy*, 42(3), 350-365.

Ferrer, A., Green, D. A. and Riddell, W. C. (2006). The effect of literacy on immigrant earnings. *Journal of Human Resources*, 41(2), 380-410.

Ferrer, A. and Riddell, W. C. (2002). The role of credentials in the Canadian labour market. *Canadian Journal of Economics*, 35(4), 879-905.

Finnie, R. and Meng, R. (2002). Minorities, cognitive skills and incomes of Canadians. *Canadian Public Policy*, 28(2), 257-273.

Firpo, S., N.M. Fortin, and T. Lemieux. (2009). Unconditional quantile regressions. *Econometrica*, 77(3), 953-973.

Ford, J. D., Berrang-Ford, L., King, M., & Furgal, C. (2010). Vulnerability of Aboriginal health systems in Canada to climate change. *Global Environmental Change,* 20(4), 668-680.

Frenette, M. (2011). *Are the labour market benefits to schooling different for Aboriginal and non-Aboriginal people*? CLSRN Working Papers 79, Vancouver School of Economics.

Frohlich, K. L., Ross, N., and Richmond, C. (2006). Health disparities in Canada today: Some evidence and a theoretical framework. *Health Policy*, 79(2), 132–143.

George, P. and Kuhn, P. (1994). The size and structure of native-white wage differentials in Canada. *Canadian Journal of Economics*, 27(1), 20-42.

Giordano, G. N., and Lindstrom, M. (2010). The impact of changes in different aspects of social capital and material conditions on self-rated health over time: a longitudinal cohort study. *Social Science & Medicine*, 70(5), 700–710.

Gitter, R. J. and Reagan, P. B. (2002). Reservation wages: An analysis of the effects of reservations on employment of American Indian men. *American Economic Review*, 92(4), 1160-1168.

Goldman, N. (2001). Social inequalities in health disentangling the underlying mechanisms. *Annals of the New York Academy of Sciences*, 954, 118–139.

Greve, J., Schultz-Nielsen, M. L., and Tekin, E. (2017). Fetal malnutrition and academic success: Evidence from Muslim immigrants in Denmark. *Economics of Education Review*, 60, 20-35

Hackett, C. (2018). The health of Indigenous peoples living in Canada: Understanding distal, intermediate and proximal determinants of health (*Doctoral dissertation of MacMaster University*). https://macsphere.mcmaster.ca/handle/11375/22862

Hajizadeh, M., Hu, M., Bombay, A., and Asada, Y. (2018). Socioeconomic inequalities in health among Indigenous peoples living off-reserve in Canada: Trends and determinants. *Health Policy*, 122(8), 854–865.

Hajizadeh, M., Mitnitski, A., and Rockwood, K. (2016). Socioeconomic gradient in health in Canada: Is the gap widening or narrowing? *Health Policy*, 120(9), 1040–1050.

Halchuk, P. (2006). Measuring employment outcomes for Indigenous Australians. *Australian Journal of Labour Economics*, 9(2), 201.

Hanson, E. (2009). *The residential school system. Vancouver, British Columbia: First Nations and Indigenous Studies*, The University of British Columbia.

Hanushek, E. A., Schwerdt, G., Wiederhold, S. and Woessmann, L. (2015). Returns to skills around the world: Evidence from PIAAC. *European Economic Review*, 73, 103-130.

Herrmann, T. S., Siega-Riz, A. M., Hobel, C. J., Aurora, C., and Dunkel-Schetter, C. (2001). Prolonged periods without food intake during pregnancy increase risk for elevated maternal corticotropin-releasing hormone concentrations. *American Journal of Obstetrics & Gynecology*, 185(2), 403-412.

Hobel, C., and Culhane, J. (2003). Role of psychosocial and nutritional stress on poor pregnancy outcome. *The Journal of Nutrition*, 133(5), 1709S-1717S.

Horrace, W. C., and Oaxaca, R. L. (2001). Inter-Industry Wage Differentials and the Gender Wage Gap: An Identification Problem. *Industrial and Labor Relations Review*, 54(3), 611.

Hossain, B. and Lamb, L. (2012). The impact of human and social capital on Aboriginal employment income in Canada. *Economic Papers*, 31(4), 440-450.

Jones, F. (1993). Unlucky Australians: Labour market outcomes among Aboriginal Australians. *Ethnic and Racial Studies*, 16(3), 420-458.

Jones, A. M., Rice, N., and Roberts, J. (2010). Sick of work or too sick to work? Evidence on self-reported health shocks and early retirement from the BHPS. *Economic Modelling,* 27(4), 866–880.

Joosoph, J., Abu, J., and Yu, S. L. (2004). A survey of fasting during pregnancy. *Singapore Medical Journal*, 45(12), 583-6.

Jukic, A. M., D. D. Baird, C. R. Weinberg, D. R. McConnaughey, and A. J. Wilcox (2013). "Length of human pregnancy and contributors to its natural variation." *Human Reproduction*, 28(10), 2848-2855.

Jürges, H. (2015). Ramadan fasting, sex-ratio at birth, and birth weight: No effects on Muslim infants born in Germany. *Economics Letters*, 137, 13-16.

Karimia SM, and Basu A, (2018). The Effect of prenatal exposure to Ramadan on children's height. *Economics and Human Biology*, 30,69-83

Karimova A, (2018). *Ramadan and the Timing of Fertility: Evidence from Indonesia.* working paper.

Kirmayer, L. J., Brass, G. M., and Tait, C. L. (2000). The mental health of Aboriginal peoples: transformations of identity and community. *The Canadian Journal of Psychiatry*.

Kuhn, P. and Sweetman, A. (2002). Aboriginals as unwilling immigrants: Contact, assimilation and labour market outcomes. *Journal of Population Economics*, 15(2), 331-355.

Lamb, D. (2013). Earnings inequality among Aboriginal groups in Canada. *Journal of Labor Research*, 34(2), 224-240.

Lamb, D. (2014). Aboriginal early school leavers on- and off-reserve: An empirical analysis. *Canadian Public Policy*, 40(2), 156-165.

Layes, A., Asada, Y., and Kepart, G. (2012). Whiners and deniers - What does self-rated health measure? *Social Science and Medicine*, 75(1), 1–9.

Lundberg, O., and Manderbacka, K. (1996). Assessing reliability of a measure of self-rated health. *Scandinavian Journal of Social Medicine*, 24(3), 218–224.

MacMillan, H. L., MacMillan, A. B., Offord, D. R., and Dingle, J. L. (1996). Aboriginal health. *CMAJ : Canadian Medical Association Journal*, 155(11), 1569–1578.

Maheswaran, H., Kupek, E., and Petrou, S. (2015). Self-reported health and socio-economic inequalities in England, 1996–2009: Repeated national cross-sectional study. *Social Science & Medicine*, 136–137, 135–146.

Majid, M. F., (2015). The persistent effects of in utero nutrition shocks over the life cycle: evidence from Ramadan fasting in Indonesia, *Journal of Development Economics*, 117(C), 48-57.

Marmot, M. (2005). Social determinants of health inequalities. *The Lancet*, 365(9464), 1099–1104.

Mathews, F., Johnson, P. J., and Neil, A. (2008). You are what your mother eats: evidence for maternal preconception diet influencing foetal sex in humans. *Proceedings of the Royal Society of London B: Biological Sciences*, 275(1643), 1661-1668.

Marmot, M., Friel, S., Bell, R., Houweling, T. A., and Taylor, S. (2008). Closing the gap in a generation: health equity through action on the social determinants of health. *The Lancet*, 372(9650), 1661–1669.

Maxim, P. S., White, J. P., Beavon, D. and Whitehead, P. C. (2001). Dispersion and polarization of income among Aboriginal and non-Aboriginal Canadians. *Canadian Review of Sociology*, 38(4), 465-476.

Meis, P. J., Rose, J. C., and Swain, M. (1984). Pregnancy alters diurnal variation of plasma glucose concentration. *Chronobiology international*, 1(2), 145-149.

Mendelson, M. (2004). *Aboriginal people in Canada's labour market: Work and unemployment, today and tomorrow*. Ottawa, Ontario: Caledon Institute of Social Policy.

Metzger, B., Vileisis, R., Ravnikar, V., and Freinkel, N. (1982). "Accelerated starvation" and the skipped breakfast in late normal pregnancy." *The Lancet*, 319(8272), 588-592.

Ministerial Advisory Council on Rural Health. (2002). *Rural Health in Rural Hands: Strategic Directions for Rural, Remote, Northern and Aboriginal Communities.* North Sydney, NSW: Ministerial Advisory Council on Rural Health.

Mislevy, R. J. (1988). *Randomization-based inferences about latent variables from complex samples*. ETS Research Report Series, 2, i-71.

Mueller, R.E. (2004). The relative earnings position of Canadian Aboriginals in the 1990s. *The Canadian Journal of Native Studies*, 24(1), 37-63.

Mulatu, M. S., and Schooler, C. (2002). Causal connections between socio-economic status and health: reciprocal effects and mediating mechanisms. *Journal of Health and Social Behavior*, 43(1), 22–41.

Nedjat, S., Hosseinpoor, A. R., Forouzanfar, M. H., Golestan, B., and Majdzadeh, R. (2012). Decomposing socioeconomic inequality in self-rated health in Tehran. *Journal of Epidemiology and Community Health*, 66(6), 495–500.

Nunavut Roundtable for Poverty Reduction (2012). *Understanding poverty in Nunavut.* http://makiliqta.ca/sites/default/files/anti-poverty_content_april18.pdf.

Oaxaca, R. (1973). Male-Female Wage Differentials in Urban Labor Markets. *International Economic Review*, 14(3), 693.

Organization for Economic Co-operation and Development (OECD). (2012). *Literacy, Numeracy and Problem Solving in Technology-Rich Environments: Framework for the OECD Survey of Adult Skills.* Paris: OECD

O'Gorman, M. and Pandey, M. (2015). Explaining low high school attainment in northern Aboriginal communities: An analysis of the Aboriginal Peoples' Surveys. *Canadian Public Policy*, 41(4), 297-308.

Patrinos, H.A. and Sakellariou, C.N. (1992). North American Indians in the Canadian labour market: A decomposition of wage differentials. *Economics of Education Review*, 11(3), 257-266.

Pendakur, K. and Pendakur, R. (1998). The colour of money: Earnings differentials among ethnic groups in Canada. *Canadian Journal of Economics*, 31(3), 518-548.

Pendakur, K. and Pendakur, R. (2011). Aboriginal income disparity in Canada. *Canadian Public Policy*, 37(1), 61-83.

Pickett, K. E., & Wilkinson, R. G. (2015). Income inequality and health: A causal review. *Social Science and Medicine*, 128, 316–326.

Powers, D. A., Yoshioka, H., and Yun, M.-S. (2011). Mvdcmp: Multivariate Decomposition for Nonlinear Response Models. *The Stata Journal: Promoting Communications on Statistics and Stata*, 11(4), 556–576.

Prus, S. G. (2011). Comparing social determinants of self-rated health across the United States and Canada. *Social Science and Medicine,* 73(1), 50–59.

Robinson, T., and Raisler, J. (2005). Each one is a doctor for herself: Ramadan fasting among pregnant Muslim women in the United States. *Ethn Dis*, 15(1 Suppl 1), S1-99.

Safaei, J. (2007). Income and health inequality across Canadian provinces. *Health and Place*, 13(3), 629–638.

Sarfati, H. (2009). Growing unequal? Income distribution and poverty in OECD countries. *International Labour Review*, 148(1/2), 199.

Schultz–Nielsen, M.L., E. Tekin, and J. Greve, (2016). Labor market effects of intrauterine exposure to nutritional deficiency: Evidence from administrative data on Muslim immigrants in Denmark. *Economics and Human Biology*, 21(May), 196–209.

Shomos, A. and Forbes, M. (2014). *Literacy and numeracy skills and labour market outcomes in Australia*. Melbourne, Australia: Productivity Commission.

Standing Senate Committee on Social Affairs, Science and Technology (2011). *Opening the door: Reducing Barriers to post-secondary education in Canada.* Ottawa, Ontario: Senate of Canada.

Statistics Canada (2013a). *The Programme for the International Assessment of Adult Competencies, 2012.* Ottawa, Ontario: Statistics Canada.

Statistics Canada (2013b). *Aboriginal peoples in Canada: First Nations People, Métis and Inuit.* Ottawa, Ontario: Statistics Canada.

Statistics Canada (2015). *Aboriginal peoples: Fact sheet for Canada.* Ottawa, Ontario: Statistics Canada.

Statistics Canada. (2016). *Aboriginal Peoples Survey (APS)*. Ottawa, Ontario: Statistics Canada.

Stephens, C., Porter, J., Nettleton, C., and Willis, R. (2006). Disappearing, displaced, and undervalued: a call to action for Indigenous health worldwide. *The Lancet*, 367(9527),

Tait, H. (2008). *Aboriginal Peoples Survey, 2006: Inuit health and social conditions.* Ottawa: Statistics Canada, Social and Aboriginal Statistics Division.

Truth and Reconcilliation Commission of Canada. (2015). *Honouring the Truth, Reconciling for the Future: Summary of the Final Report of the Truth and Reconcilliation Commission of Canada*. Ottawa, ON.

Anaya, S. J. (2015). Report of the special rapporteur on the rights of indigenous peoples in the situation of indigenous peoples in Canada. *Ariz. J. Int'l & Comp. L.*, 32, 143.Van

Doorslaer, E., & Koolman, X. (2004). Health Inequality Explaining the differences in income-related health inequalities across European countries. *Health Economics*, 13, 609–628.

Van Ewijk, R. (2011). Long-term health effects on the next generation of Ramadan fasting during pregnancy. *Journal of Health Economics*, 30(6), 1246-1260.

Veugelers, P. J., and Schwartz, M. E. (2010). Comprehensive school health in Canada. *Canadian Journal of Public Health/Revue Canadienne de Sante'e Publique*, S5-S8.

Walls, M. L., and Whitbeck, L. B. (2012). The Intergenerational Effects of Relocation Policies on Indigenous Families. *Journal of Family Issues*, 33(9), 1272–1293.

Walters, D., White, J. and Maxim, P. (2004). Does postsecondary education benefit Aboriginal Canadians? An examination of earnings and employment outcomes for recent Aboriginal graduates. *Canadian Public Policy*, 30(3), 283-301.

White, J., Maxim, P. and Gyimah, S. O. (2003). Labour force activity of women in Canada: A comparative analysis of Aboriginal and non-Aboriginal women. *Canadian Review of Sociology*, 40(4), 391-415.

Wilson, D., & Macdonald, D. (2010). *The income gap between Aboriginal peoples and the rest of Canada*. Ottawa: Canadian Centre for Policy Alternatives.

World Health Organization. (2009). *Women and Health : Today's Evidence Tomorrow's Agen*da. World Health Organization, Geneva, Switzerland

Yun, M.-S. (2005a). A Simple Solution to The Identification Problem in Detailed Wage Decompositions. *Economic Inquiry*, 43(4), 766–772.

Yun, M.-S. (2005b). Journal of economic and social measurement. *Journal of Economic and Social Measurement* (Vol. 30). North-Holland.

Ziaee, V., Razaei, M., Ahmadinejad, Z., Shaikh, H., Yousefi, R., Yarmohammadi, L., and Behjati, M. J. (2006). The changes of metabolic profile and weight during Ramadan fasting. *Singapore Medical Journal*, 47(5), 409-414.

Ziaee, V., Kihanidoost, Z., Younesian, M., Akhavirad, M. B., Bateni, F., Kazemianfar, Z., and Hantoushzadeh, S. (2010). The effect of Ramadan fasting on outcome of pregnancy. *Iranian Journal of Pediatrics*, 20(2), 181.

Appendix A
Supplementary Material for Chapter 2

Table A1: Regressions for Raw Scores in Literacy, Numeracy, and Technology Skill

	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
	Literacy		Numeracy		Technology without Zero		Technology with Zero	
Females								
First Nations	-0.279**	-0.136**	-0.367**	-0.208**	-0.189**	-0.097*	-0.617**	-0.364**
	(0.047)	(0.038)	(0.059)	(0.052)	(0.058)	(0.049)	(0.090)	(0.088)
Métis	-0.058	0.018	-0.102*	-0.018	-0.045	0.010	0.008	0.120*
	(0.041)	(0.036)	(0.041)	(0.039)	(0.042)	(0.039)	(0.059)	(0.055)
Inuit	-0.619**	-0.319**	-0.718**	-0.395**	-0.394**	-0.230**	-1.212**	-0.702**
	(0.077)	(0.069)	(0.070)	(0.056)	(0.083)	(0.078)	(0.153)	(0.125)
Adjusted R^2	0.059	0.292	0.054	0.291	0.086	0.227	0.087	0.199
Observations	8,393	8,393	8,393	8,393	6,994	6,994	8,393	8,393
Males								
First Nations	-0.309**	-0.143**	-0.405**	-0.216**	-0.215**	-0.119*	-0.526**	-0.237**
	(0.047)	(0.041)	(0.054)	(0.050)	(0.058)	(0.053)	(0.090)	(0.086)
Métis	-0.135**	-0.039	-0.170**	-0.066	-0.110+	-0.032	-0.195*	-0.042
	(0.050)	(0.042)	(0.055)	(0.049)	(0.058)	(0.051)	(0.096)	(0.086)
Inuit	-0.654**	-0.340**	-0.776**	-0.419**	-0.434**	-0.246**	-1.382**	-0.811**
	(0.087)	(0.073)	(0.094)	(0.078)	(0.122)	(0.080)	(0.202)	(0.207)
Adjusted R^2	0.037	0.310	0.037	0.306	0.047	0.234	0.079	0.216
Observations	7,061	7,061	7,061	7,061	5,484	5,484	7,061	7,061
Education/	No	Yes	No	Yes	No	Yes	No	Yes

Notes: All regressions include controls for age and age-squared. Education includes indicators for: primary or less, lower secondary, high school degree (base group), trade or community college, professional school degree, Bachelor's degree, Master's degree or higher. Experience includes years of work experience and its quadratic. Jackknifed standard errors are reported in parentheses. Statistical significance is given by: + ten percent; * five percent; and ** one percent. Source: Authors' calculations.

Table A2a: Regressions for Returns to Skills in Employment, by Indigenous Group, Stan dardized Literacy, Numeracy, and Technology Skill

	(1)	(2)	(1)	(2)	(1)	(2)
	Skill=Literacy		Skill=Numeracy		Skill=Technology	
Females						
Skill	0.0775**	0.0335**	0.0947**	0.0570**	0.116**	0.0391
	(0.0101)	(0.0116)	(0.0092)	(0.0108)	(0.0266)	(0.0275)
First Nations x Skill	0.0169	-0.00442	0.0117	-0.00830	0.152	0.102
	(0.0364)	(0.0394)	(0.0366)	(0.0390)	(0.0994)	(0.108)
Métis x Skill	0.0209	0.0118	0.00456	-0.0047	-0.0497	-0.0524
	(0.0435)	(0.0434)	(0.0400)	(0.0402)	(0.103)	(0.101)
Inuit x Skill	0.0468	0.0123	0.0489	0.0143	0.0981	0.0199
	(0.0547)	(0.0525)	(0.0525)	(0.0512)	(0.157)	(0.146)
Adjusted R^2	0.0527	0.0907	0.0685	0.0988	0.0505	0.0940
Observations	8,389	8,389	8,389	8,389	8,389	8,389
Males						
Skill	0.0575**	0.0335**	0.0678**	0.0474**	0.0726**	0.0238
	(0.0078)	(0.0090)	(0.0084)	(0.0095)	(0.0182)	(0.0199)
First Nations x Skill	0.0182	0.0088	0.0213	0.0116	0.118	0.110
	(0.0431)	(0.0436)	(0.0439)	(0.0442)	(0.123)	(0.127)
Métis x Skill	0.0349	0.0323	0.0209	0.0200	0.0087	-0.0121
	(0.0381)	(0.0390)	(0.0364)	(0.0374)	(0.0784)	(0.0795)
Inuit x Skill	0.0170	-0.0038	0.0428	0.0223	0.277	0.197
	(0.0642)	(0.0594)	(0.0573)	(0.0535)	(0.221)	(0.181)
Adjusted R^2	0.0647	0.0855	0.0753	0.0922	0.0574	0.0839
Observations	7,058	7,058	7,058	7,058	7,058	7,058
Basic Controls	Yes	Yes	Yes	Yes	Yes	Yes
Education	No	Yes	No	Yes	No	Yes

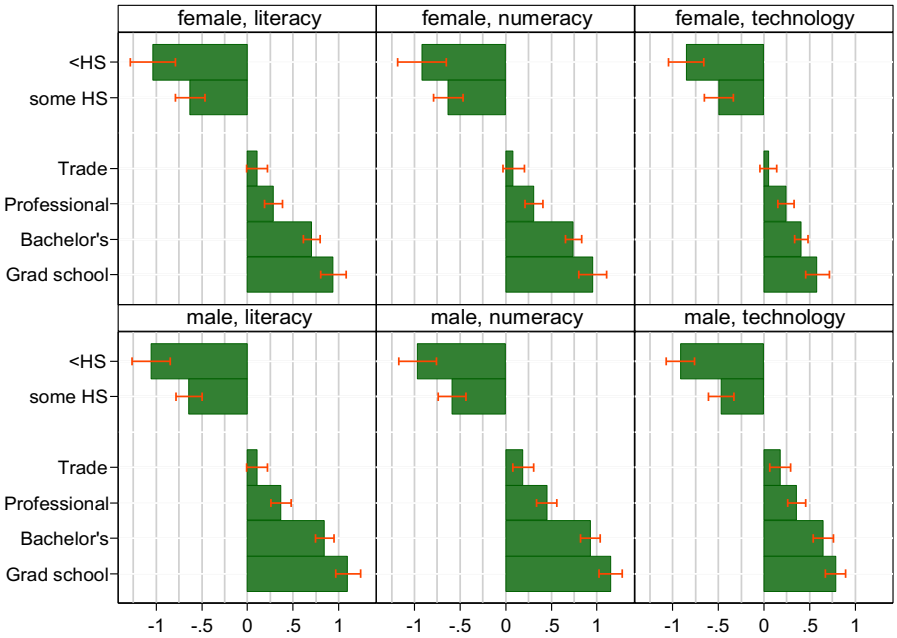
Notes: Basic controls include age, age-squared, and region of residence. Education includes indicators for: primary or less, lower secondary, high school degree (base group), trade or community college, professional school degree, Bachelor's degree, Master's degree or higher. Jackknifed standard errors are reported in parentheses. Statistical significance is given by: + ten percent; * five percent; and ** one percent. Source: Authors' calculations.

Table A2b: Regressions for Returns to Skills in Unemployment, by Indigenous Group, Standardized Literacy, Numeracy, and Technology Skill

	(1)	(2)	(1)	(2)	(1)	(2)
	Skill=Literacy		Skill=Numeracy		Skill=Technology	
Females						
Skill	-0.0127*	-0.0071	-0.0188**	-0.0150*	-0.0166	-0.0048
	(0.0059)	(0.0068)	(0.0062)	(0.0068)	(0.0157)	(0.0165)
First Nations x Skill	-0.0017	0.0004	-0.004	-0.0020	-0.0750	-0.0693
	(0.0412)	(0.0423)	(0.0372)	(0.0383)	(0.114)	(0.115)
Métis x Skill	-0.0290	-0.0283	-0.0309	-0.0303	-0.0420	-0.0408
	(0.0280)	(0.0280)	(0.0310)	(0.0310)	(0.0756)	(0.0749)
Inuit x Skill	-0.0275	-0.0228	-0.0431	-0.0398	-0.0138	-0.0035
	(0.0354)	(0.0373)	(0.0347)	(0.0363)	(0.0957)	(0.0962)
Adjusted R^2	0.0147	0.0165	0.0193	0.0198	0.0129	0.0165
Observations	6,813	6,813	6,813	6,813	6,813	6,813
Males						
Skill	-0.0138*	-0.0080	-0.0170*	-0.0124+	-0.0091	0.0039
	(0.0057)	(0.0064)	(0.0062)	(0.0068)	(0.0126)	(0.0145)
First Nations x Skill	0.0383	0.0399	0.00469	0.0057	0.0527	0.0513
	(0.0437)	(0.0436)	(0.0423)	(0.0425)	(0.0938)	(0.0934)
Métis x Skill	0.0062	0.0072	0.0070	0.0072	0.0073	0.0129
	(0.0122)	(0.0124)	(0.0127)	(0.0127)	(0.0240)	(0.0239)
Inuit x Skill	-0.0187	-0.0133	-0.0503	-0.0455	-0.0029	0.0019
	(0.0957)	(0.0962)	(0.0477)	(0.0475)	(0.137)	(0.134)
Adjusted R^2	0.0114	0.0150	0.0137	0.0163	0.0083	0.0136
Observations	6,240	6,240	6,240	6,240	6,240	6,240
Basic Controls	Yes	Yes	Yes	Yes	Yes	Yes
Education	No	Yes	No	Yes	No	Yes

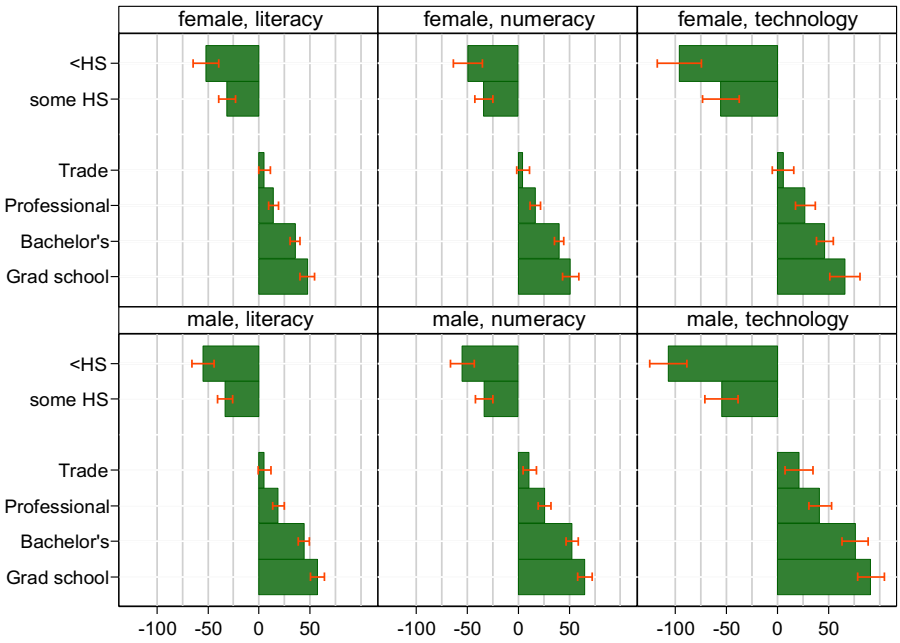
Notes: Basic controls include age, age-squared, and region of residence. Education includes indicators for: primary or less, lower secondary, high school degree (base group), trade or community college, professional school degree, Bachelor's degree, Master's degree or higher. Jackknifed standard errors are reported in parentheses. Statistical significance is given by: + ten percent; * five percent; and ** one percent. Source: Authors' calculations.

Figure A1a: Impact of Education on Skills, Highest Level of Education Coefficients from Table 2, Standardized Skills



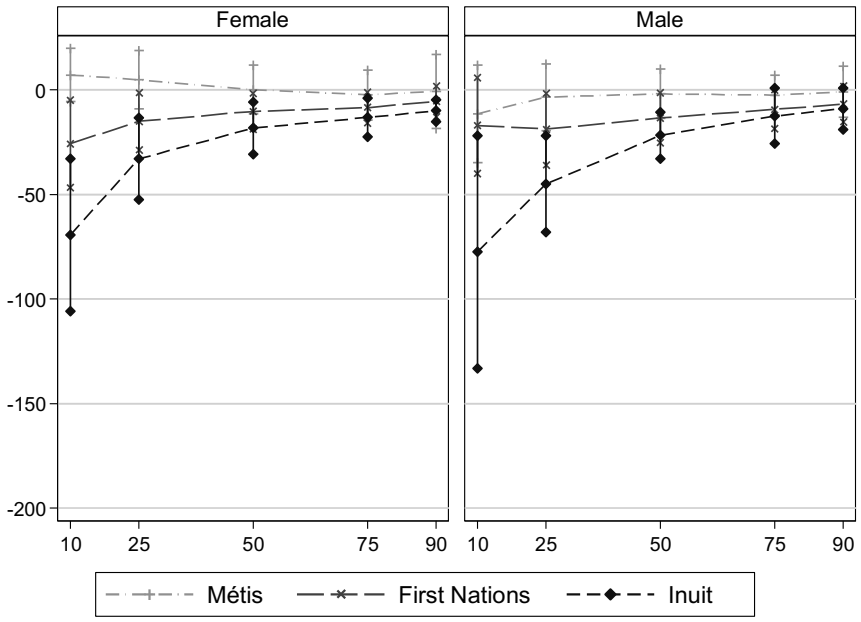
Notes: HS = High School; Grad school = Master's Degree or Higher. The base group is high school. Bars represent 95 percent confidence intervals. Source: Authors' calculations.

Figure A1b: Impact of Education on Skills, Highest level of Education Coefficients from Table 2, Raw Skills



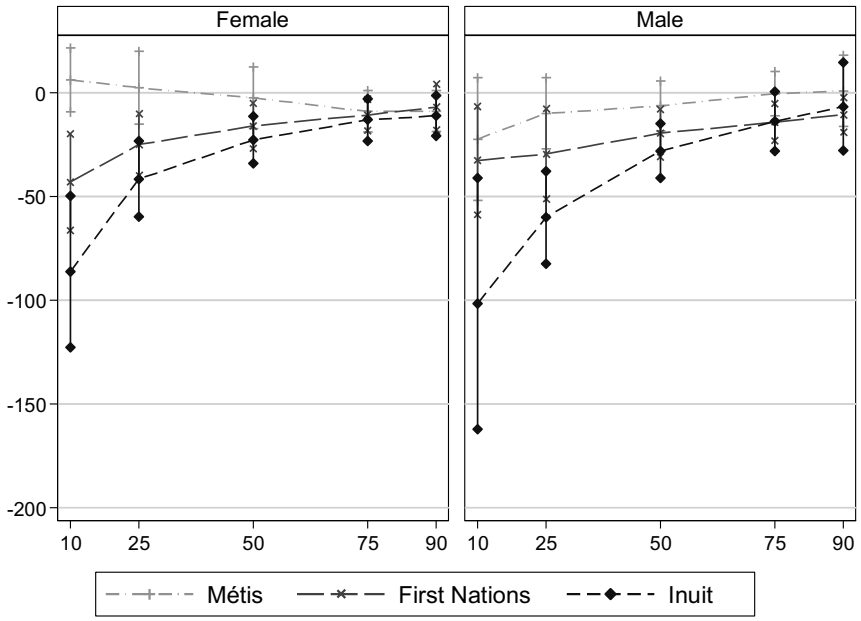
Notes: HS = High School; Grad school = Master's Degree or Higher. The base group is high school. Bars represent 95 percent confidence intervals. Source: Authors' calculations.

Figure A2a: Literacy Score Difference by Quantile with Additional Controls, Raw Scores by Gender



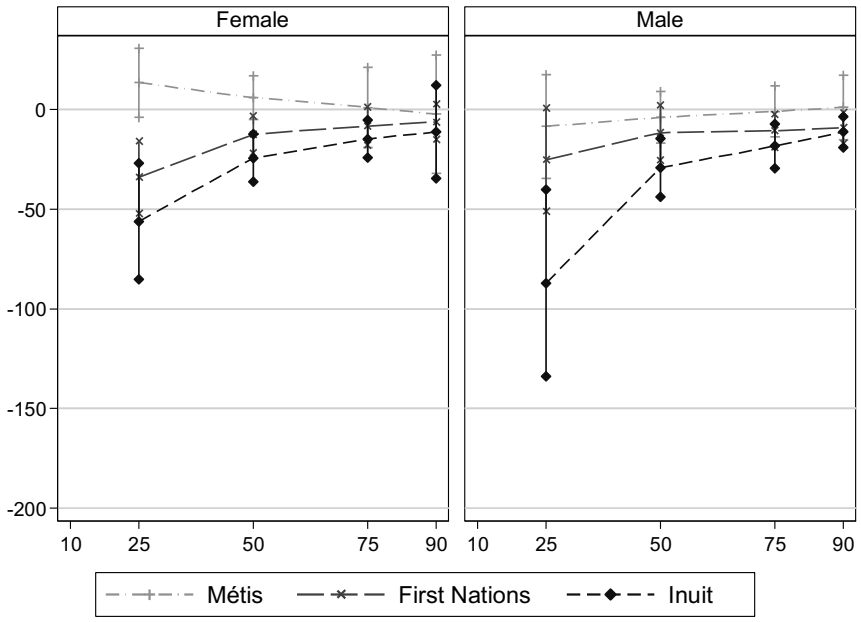
Notes: Bars represent 95 percent confidence intervals. We control for age and age-squared, highest level of education, work experience and its quadratic. Source: Authors' calculations.

Figure A2b: Numeracy Score Difference by Quantile with Additional Controls, Raw Scores by Gender



Notes: Bars represent 95 percent confidence intervals. We control for age and age-squared, highest level of education, work experience and its quadratic. Source: Authors' calculations.

Figure A2c: Technology Skill Difference by Quantile with Additional Controls, Raw Scores by Gender



Notes: Bars represent 95 percent confidence intervals. We control for age and age-squared, highest level of education, work experience and its quadratic. Source: Authors' calculations

Appendix B
Supplementary Material for Chapter 3

Table B1: Marginal Effects Obtained from Logistic Regressions for Each Indigenous Subgroup in 2001, 2006 and 2012

	Registered First Nation			Non-registered First Nation			Metis			Inuit		
	2001	2006	2012	2001	2006	2012	2001	2006	2012	2001	2006	2012
Male	-0.00452	0.00254	0.0310	-0.0158	0.0278	0.0267	-0.0341*	-0.0049	0.00669	0.0014	-0.0101	0.0012
	(0.0143)	(0.0146)	(0.0222)	(0.0343)	(0.0224)	(0.0313)	(0.0139)	(0.0099)	(0.0170)	(0.0120)	(0.0189)	(0.0254)
Separated or Widowed	-0.0657**	-0.0310+	-0.0748*	-0.0806*	-0.00792	-0.114**	-0.0151	-0.0265*	-0.0334	-0.0167	-0.0046	-0.0906*
	(0.0172)	(0.0174)	(0.0296)	(0.0363)	(0.0277)	(0.0382)	(0.0160)	(0.0122)	(0.0227)	(0.0160)	(0.0300)	(0.0433)
Single	-0.0477**	-0.0401*	-0.0685**	-0.0521	-0.0311	-0.0883+	-0.0222	-0.0318*	-0.0221	-0.0099	-0.0375+	-0.0507+
	(0.0171)	(0.0168)	(0.0247)	(0.0419)	(0.0291)	(0.0485)	(0.0141)	(0.0132)	(0.0235)	(0.0154)	(0.0212)	(0.0259)
High School Diploma	0.0441	0.0449*	0.0671*	-0.00959	0.0634+	0.0725	0.0687**	0.0553**	0.0895**	0.0364	-0.0313	0.0315
	(0.0274)	(0.0204)	(0.0302)	(0.0447)	(0.0359)	(0.0454)	(0.0169)	(0.0161)	(0.0254)	(0.0227)	(0.0343)	(0.0408)
Some Postsecondary	0.0570**	0.0778**	0.0575*	-0.00464	0.0734**	0.0761*	0.0293*	0.0563**	0.0525**			
	(0.0136)	(0.0156)	(0.0226)	(0.0341)	(0.0270)	(0.0354)	(0.0135)	(0.0116)	(0.0191)			
Bachelor' Degree or	0.139**	0.137**	0.194**	0.0634	0.127**	0.211**	0.190**	0.102**	0.172**			
	(0.0320)	(0.0266)	(0.0446)	(0.0571)	(0.0391)	(0.0555)	(0.0424)	(0.0192)	(0.0346)			
Some Postsecondary										0.0181	0.0462*	0.0332
										(0.0173)	(0.0201)	(0.0266)
Unemployed or Student	-0.0762**	-0.0536*	-0.160**	-0.134**	-0.0283	-0.168**	-0.0521**	-0.0561*	-0.133**	-0.0195	-0.0415	-0.0608+
	(0.0201)	(0.0269)	(0.0295)	(0.0535)	(0.0442)	(0.0456)	(0.0192)	(0.0243)	(0.0262)	-0.0194	-0.0275	-0.033
Not in labour force	-0.162**	-0.141**	-0.171**	-0.182**	-0.190**	-0.205**	-0.142**	-0.136**	-0.168**	-0.046**	-0.0801**	-0.086**
	(0.0146)	(0.0155)	(0.0239)	(0.0319)	(0.0238)	(0.0353)	(0.0132)	(0.0108)	(0.0188)	-0.0145	-0.0194	-0.0315
Log Equivalized	0.0183**	0.0161**	0.0252**	0.00900	0.0404**	0.0370*	0.0220**	0.0163**	0.0256**	0.0165**	0.0046	0.0133
	(0.00393)	(0.00321)	(0.00958)	(0.0109)	(0.0154)	(0.0193)	(0.00517)	(0.00373)	(0.00801)	-0.0054	-0.00579	-0.0146
Hunting, Fishing, Trapping	0.0304*	0.0246+	0.0222	0.0214	0.0593**	0.00453	0.0515**	0.0459**	0.0134	0.0395**	0.0594**	0.0208
	(0.0143)	(0.0148)	(0.0256)	(0.0304)	(0.0234)	(0.0325)	(0.0144)	(0.0104)	(0.0181)	-0.0132	-0.0188	-0.0282
Wild Plant Gathering	-0.0129	0.0169	-0.0524*	-0.00271	-0.0204	-0.0277	-0.00791	0.00501	-0.0245	0.0148	0.0314+	0.0424
	(0.0142)	(0.0142)	(0.0230)	(0.0311)	(0.0229)	(0.0343)	(0.0136)	(0.0110)	(0.0181)	-0.0135	-0.0164	-0.0262
Observations	12,250	6,330	4,840	2,510	2,730	2,010	11,540	6,030	5,730	4,000	3,860	2,630

Notes: All regressions control for demographic and geographical factors included age and age-squared, marital status and rural/urban and geographical regions. Socioeconomic factors include highest educational degree (less than high school (base group), high school, some postsecondary lower than bachelor's degrees, bachelor's degree or higher), employment status (employed, unemployed or full-time student, not in labour force (base group)) and log equivalized household income. Inuit people's highest educational degree is some postsecondary or higher. Traditional activities include hunting, fishing or trapping, and wild plant gathering. Statistical significance is given by: + ten percent; * five percent; and ** one percent. Source: Author's calculations.

Table B2: The Blinder-Oaxaca Decomposition of Logistic Regression for Each Indigenous Subgroup in 2001, 2006 and 2012

	Registered First Nation			Non-registered First Nation			Metis			Inuit		
	2001	2006	2012	2001	2006	2012	2001	2006	2012	2001	2006	2012
Married	0.0012+	0.0006	0.0075**	-2.23e-05	-0.0012	0.0070	0.0001	0.0008	0.0009	-0.0001	-0.0005	0.0011
	(0.0007)	(0.0005)	(0.0025)	(0.0008)	(0.0023)	(0.0053)	(0.0003)	(0.0007)	(0.0021)	(0.0002)	(0.0004)	(0.0006)
Separated or Widowed	0.0022	0.00037	0.0121**	0.0021	-0.0018	-0.0028	-0.0011	-0.0006	-0.0012	0.0011	-0.0005	0.0056
	(0.0018)	(0.0019)	(0.0048)	(0.0034)	(0.0028)	(0.0036)	(0.0016)	(0.0011)	(0.0031)	(0.0009)	(0.0016)	(0.0038)
Single	-0.00017	-0.0011	0.00054	0.0025	-5.69e-05	-0.0014	-0.0011	-0.0004	-0.0003	0.0003	-0.0024	0.0004
	(0.0007)	(0.0012)	(0.0009)	(0.0043)	(0.0004)	(0.0009)	(0.0009)	(0.0003)	(0.0004)	(0.0006)	(0.0016)	(0.0018)
Less than Hight School	-0.0011**	-0.0039**	-0.0087**	0.0008	-0.0073**	-0.0018	-0.0044*	-0.0031**	-0.0029**	-0.0005	-0.0002	0.0006
	(0.0004)	(0.0013)	(0.0023)	(0.0040)	(0.0028)	(0.0016)	(0.0019)	(0.0008)	(0.0011)	(0.0003)	(0.0006)	(0.0004)
High School Diploma	2.91e-05	-0.0011	-0.0010+	-0.0022	0.0008	-0.00079	2.49e-05	6.10e-05	-0.0001	0.0002	0.0006	-7.13e-05
	(0.0008)	(0.0008)	(0.0006)	(0.0022)	(0.0011)	(0.0015)	(0.0001)	(0.0002)	(0.0008)	(0.0002)	(0.0004)	(0.0002)
Some Postsecondary	-0.0001	-0.0012*	-7.17e-05	0.0042	-0.0008	0.0013	0.0027+	-0.0007*	0.0002+			
	(0.0001)	(0.0006)	(0.0006)	(0.0054)	(0.0011)	(0.0015)	(0.0015)	(0.0003)	(0.00014)			
Bachelor' Degree or Higher	-0.0013	-0.0039*	-0.0051	0.00034	-0.0017*	-0.0026	-0.0014+	-0.0010	-0.0076*			
	(0.0014)	(0.0022)	(0.0044)	(0.0003)	(0.0008)	(0.0023)	(0.0008)	(0.0011)	(0.0035)			
Some Postsecondary or Higher										-1.07e-06	-0.0009**	0.0006
										(0.0005)	(0.0004)	(0.0007)
Employed	0.0131**	0.0097*	0.0121**	0.0127**	0.0043+	0.0061	0.0089*	0.0077*	0.0087*	0.0019*	0.0029*	0.0017+
	(0.0022)	(0.0021)	(0.0028)	(0.0035)	(0.0025)	(0.0043)	(0.0018)	(0.0019)	(0.0023)	(0.0008)	(0.0009)	(0.0010)
Unemployed or Student	1.02e-05	-0.0001	-0.0008	7.77e-05	0.0008	0.0004	0.0009	0.0003	-0.0008	0.0005+	0.0016*	0.0013**
	(0.0005)	(0.0006)	(0.0010)	(0.0014)	(0.0008)	(0.0008)	(0.0007)	(0.0004)	(0.0006)	(0.0003)	(0.0006)	(0.0005)
Not in labour force	0.0156**	0.0113**	0.0125**	0.0176**	0.0096**	0.0034	0.0157**	0.0115**	0.0069**	0.0003	9.25e-05	-0.0002
	(0.0028)	(0.0030)	(0.0041)	(0.0054)	(0.0033)	(0.0029)	(0.0028)	(0.0020)	(0.0027)	(0.0006)	(0.0005)	(0.0004)
Log Equivalized Household	0.0041**	0.0005*	0.0010	-0.0005	0.0102*	0.0021	0.0058**	0.0024*	0.0080**	-2.10e-06	-0.0002	-0.0005
	(0.0013)	(0.0001)	(0.0017)	(0.0010)	(0.0045)	(0.0018)	(0.0015)	(0.0010)	(0.0028)	(0.0004)	(0.0003)	(0.0005)
Hunting, Fishing, Trapping	0.0074**	0.0031	0.0032	0.0101+	0.0078+	0.0052	0.0126**	0.0068**	0.0054	0.0053**	0.0062**	0.0022
	(0.0028)	(0.0028)	(0.0045)	(0.0060)	(0.0043)	(0.0033)	(0.0032)	(0.0021)	(0.0038)	(0.0019)	(0.0020)	(0.0037)
Wild Plant Gathering	0.0009	-0.0002	0.0012	-0.0008	0.0005	0.0006	4.75e-05	0.0002	0.0013	-0.0016	-0.0014**	-0.0019*
	(0.0006)	(0.00051)	(0.0012)	(0.0008)	(0.000454)	(0.0007)	(0.0006)	(0.0003)	(0.0009)	(0.0013)	(0.0007)	(0.0011)
Total Explained	0.0527**	0.0263**	0.0472**	0.0497**	0.0270*	0.0064	0.0512**	0.0239**	0.0216*	0.0030	0.0097	0.0163+
	(0.0072)	(0.0071)	(0.0143)	(0.0172)	(0.0111)	(0.0082)	(0.0087)	(0.0054)	(0.0092)	(0.0057)	(0.0059)	(0.0091)
Observations	12,250	6,330	4,840	2,510	2,730	2,010	11,540	6,030	5,730	4,000	3,860	2,630

Notes: All regressions control for demographic and geographical factors included age and age-squared, marital status and rural/urban and geographical regions. Socioeconomic factors include highest educational degree (less than high school (base group), high school, some postsecondary lower than bachelor's degrees, bachelor's degree or higher), employment status (employed, unemployed or full-time student, not in labour force (base group)) and log equivalized household income. Inuit people's highest educational degree is some postsecondary or higher. Traditional activities include hunting, fishing or trapping, and wild plant gathering. Statistical significance is given by: + ten percent; * five percent; and ** one percent. Source: Author's calculation

Appendix C
Supplementary Material for Chapter 4

Table C1: Effect of Ramadan exposure on birth weight (in grams)

	Full sample		Females		Males	
	Overlap	Overlap X Muslim	Overlap	Overlap X Muslim	Overlap	Overlap X Muslim
First month	0.696	-0.818	0.477	-5.199	0.929	3.353
	(0.867)	(4.459)	(0.946)	(6.104)	(1.226)	(5.635)
Second month	0.642	-0.0640	0.657	4.134	0.619	-4.237
	(0.872)	(5.896)	(1.238)	(6.926)	(1.353)	(8.834)
Third month	-0.266	-4.858	-0.111	-5.582	-0.397	-4.200
	(0.899)	(5.032)	(1.293)	(7.702)	(1.256)	(8.742)
Fourth month	-0.519	5.141	-0.228	3.283	-0.797	6.733
	(0.942)	(7.352)	(1.195)	(8.142)	(1.643)	(9.130)
Fifth month	0.728	-5.674	-0.433	-3.370	1.854	-7.730
	(0.900)	(5.282)	(1.580)	(6.859)	(1.274)	(8.747)
Sixth month	-1.625+	-1.572	0.123	-4.032	-3.308*	0.556
	(0.862)	(5.970)	(1.476)	(9.023)	(1.359)	(7.643)
Seventh month	1.805*	-4.922	-0.158	-3.459	3.694**	-6.337
	(0.800)	(5.891)	(1.451)	(5.928)	(1.090)	(8.006)
Eighth month	-0.708	3.457	0.426	6.653	-1.800	0.310
	(0.767)	(6.098)	(1.112)	(6.994)	(1.130)	(10.37)
Ninth month	0.381	-5.456	0.127	-6.597	0.620	-4.398
	(0.865)	(4.849)	(1.364)	(6.892)	(0.970)	(5.159)
Observations	6,068,200		2,977,760		3,090,440	
R-squared	0.036		0.014		0.015	
Clusters	98		98		98	
P-values from F-test of Overlap X Muslim coefficients						
$B_1=B_2=\ldots=B_9$	0.204		0.178		0.014	
$B_1=B_2=\ldots=B_9=0$	0.234		0.239		0.020	

Notes: Birth weight is in grams. All regressions condition on mother's age-30 and its square, a Muslim indicator, Census Division fixed effects and year and month fixed effects. A gender dummy is also included when the regressions include both genders. Base mean is for non-Muslim babies whose gestation period did not overlap with Ramadan and who born to 30-year old mothers in January 1990. Statistical significance is given by: + ten percent; * five percent; and ** one percent.

Appendix D
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11 January 2019

Hu, Min
Department of Economics - Dalhousie University
6214 University Avenue
Halifax, NS
Canada B3H 4R2
MinHu@Dal.Ca

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