Three Essays on Parental Health and Children's Outcomes

by

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ABSTRACT

Does a parent's illness or disability hurt the educational attainment of their children? This dissertation consists of three essays on the impact of negative health events and / or activity limitation experienced by parents on their children's human capital, and how the negative consequences of parental illness can be mediated by public policy. The first essay uses the 1991-2006 Chinese Health and Nutrition Survey (CHNS) and finds poor Chinese children whose parent has a serious illness are much more likely to drop out of primary or secondary school compared to other children whose parents remain healthy. The second essay, using Canada's 1994-2008 National Longitudinal Survey of Children and Youth (NLSCY), discovers a similar "attendance gap" at the post-secondary level between Canadian youth of disabled parents and their peers of non-disabled parents. Thus in both a developing and developed country context, the loss in family financial resources associated with parental illness or activity limitation, as measured by out-of-pocket medical expenditures and long-run equivalent family income, respectively, partially explains children's attendance gap. Finally, the third essay provides a direct estimate of the intergenerational effects of cash transfers. Results exploit variation across provinces and time in disability benefits to demonstrate that higher cash transfers made available to parents with a disability can effectively boost children's math test performance, and facilitate non-cognitive skill development.

LIST OF ABBREVIATIONS AND SYMBOLS USED

ATT Average Treatment Effect on the Treated

BMI Basic Medical Insurance

C/QPP Canada / Quebec Pension Plan

CAP Canada Assistance Plan

CAT/2 Test Canadian Achievement Test, 2nd edition

CEGEP Collège d'enseignement général et professionnel, known officially in English as a "General and Vocational College"

CHNS Chinese Health and Nutrition Survey

CHST Canada Health and Social Transfer

CMS Cooperative Medical Scheme

DD Difference-in-Differences

GIS Government Insurance Scheme

GSOEP German Socio-Economic Panel

LICO Low-Income-Cut-Off

LIS Labor Insurance Scheme

NLSCY National Longitudinal Survey of Children and Youth

PALS Participation and Activity Limitation Survey

PMK Person Most Knowledgeable (about the child)

PSE Post-Secondary Education

SD Standard Deviation

SSP Canadian Self-Sufficiency Project

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CHAPTER 1 INTRODUCTION

A large body of literature suggests health is causally related to an individual's socio-economic status. Ill-health precipitates income drops and wealth depletion over the life course (e.g. Currie and Madrian, 1999; Smith, 1999; Haveman and Wolfe, 2003). It can also be passed on from one generation to another, through poor childhood health, human capital, cognitive ability, personality traits or other non-cognitive development, if the negative health outcomes experienced by parents adversely affect the level or the productivity (effectiveness) of investment in children, and if educational outcomes in childhood help determine success in adulthood (e.g. Case and Paxson, 2002; Almond et al. 2005; Almond, 2006). While much literature has investigated the intra-generational linkage between ill-health and human capital accumulation of adults (e.g. Conley and Bennet, 2001; Loprest and Maag, 2003; Johnson and Shoeni, 2007; Currie, 2007), little attention has been paid to its intergenerational implications.

The first two chapters of this dissertation thesis fill this gap by investigating whether parental poor health and / or activity limitation is a precursor to child (short- and / or long-term) educational achievement in two distinct settings, one emerging economy, China, and one more affluent country, Canada.

In the past three decades, China underwent one of the most significant reforms in modern history, one aspect of which was replacement of its universal health care system with a decentralized heavily market-oriented one. The result of this process is an alarmingly rising share of private financing of health care (self-pay). The first chapter entitled "*Parental Illness and Human Capital Investment – Evidence from Nine Provinces of China*" draws data from a detailed panel of the 1991-2006 Chinese Health and Nutrition Survey (CHNS) to examine the short-term implications of health shocks experienced by parents on households' educational investment and children's school enrolments [1] in such

[1] The child questionnaire of the CHNS provides interview data on a broad range of health-related outcomes for children and adolescents under the age of 18. The question appearing in the English translation of the questionnaire was worded as: "Are you currently at school? (1=yes; 0=no)" However, I am inclined to

a context. By using a conditional logit estimator combined with a propensity score re-weighting procedure to correct for potentially endogenous health and insurance status, this paper finds that when poor parents experience serious illness, children are five to six times more likely to leave school early compared to peers whose parents do not have any health problems. Importantly, the likelihood of dropping out of school increases monotonically with the amount of out-of-pocket medical payments incurred by illness, with the association being strongest for children in families where the father has recently become ill. This research provides evidence on the intra-household decision-making theory and suggests that improving access to both health care and insurance is a mechanism that can generate long-term benefits for affected families and for economic development.

The second chapter entitled, "*Does Parental Disability Reduce Equality of Opportunity?*" uses data on two recent cohorts of Canadian youth aged 18-21 to investigate whether Canadian youth of parents with disabilities are less likely to attend postsecondary education compared to their otherwise similar peers. Findings suggest a considerable achievement gap, as measured by a combination of high school graduation and delay in college attendance, between youth who had a parent suffering from a functional restriction in normal activities, who are disproportionally poor, and their peers with non-disabled parents. This gap is apparent after controlling for both mother and father's education, long-run average family income and a diversity of "child achievement scores" in high school prior to PSE, and is an outcome that is neither equitable nor efficient for the society as a whole. These results highlight the important role that has been, and could be, played by social safety nets to help protect children with disabled parents from the negative consequences of parental disability.

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interprete the response as an indicator of whether the child is enrolled in school at the time of the survey. Firstly, it was embedded in a series of questions asking about basic demographics (i.e. the Background Demographics section): "How many years of formal education have you completed in a regular school? … Are you currently at school? (1=yes; 0=no) … If not, go to the Work Status section." Secondly, judging from the original question in the Chinese manual, this question is perhaps more likely to be interpreted by Chinese respondents as "whether being enrolled in school" rather than "missing school".

The question of how the intergenerational implications of ill-health may be alleviated or exacerbated by government transfer programs is the focus of the third chapter, "*The Inter-Generational Effects of Disability Benefits – Evidence from Canadian Social Assistance Programs*". This paper analyzes the impact of disability benefits made available to parents with a disability on the cognitive and non-cognitive skill formation of their non-disabled children. Exploiting changes in real benefits from ten provinces' Canadian Social Assistance or Disability Benefit Programs as an exogenous source of variation, this paper provides a causal estimate of the effects of benefits. It finds higher parental disability benefits result in substantial gains in children's cognitive and non-cognitive skill development, particularly for children of mothers with a disability. This beneficial effect is largely explained by a change in the non-disabled father's weekly hours of work. This finding provides strong evidence against concerns over "perverse" effects of income transfers and arguments for elimination of cash transfers for persons with disabilities. In addition, it suggests that both monetary and non-monetary (e.g. parental available time) investments are important inputs to child well-being.

CHAPTER 2
PARENTAL ILLNESS AND HUMAN CAPITAL INVESTMENT -- EVIDENCE FROM NINE PROVINCES OF CHINA

2.1 Introduction

Serious illness can be disruptive to household finances and living standards, especially in societies that heavily rely on out-of-pocket payments as the means of financing the health care sector. In order to meet vital health care needs, some households may cut back on expendable consumption items, draw down savings, borrow from friends or relatives; others may be forced to sell core production equipment, or even pull their children out of school. In the latter case, illness not only causes transient poverty but also may have a lasting impact that leads the household into chronic poverty. In this paper, I investigate the possibility that children's probability of dropping out of school / re-entering school is adversely affected by parents' recent experience of major illness onset. This issue is important because it can be seen as a specific instance of the more general issue of how the unequal outcomes experienced by parents influence the inequality of opportunity of children. It is well documented (e.g. Becker and Tomes, 1986) that under incomplete insurance and/or credit markets, investments in children remain unaffected for families with sufficient assets or precautionary savings after a negative income shock. But investments decline for those who cannot borrow against the future higher earnings that educated children will receive. When an illness hits, households that are liquidity constrained must make difficult choices between immediate consumption and investment in children's future. Young children may be withdrawn from school to cut back expenditures on education. Older children may be expected to participate in the labour market to supplement lost earnings, or to stay at home taking care of younger siblings or the sick parent. The finance induced stress can also perturb family dynamics and adversely affect children's performance and contribute to school failure and school dropout.

This analysis is based on six waves of the Chinese Health and Nutrition Survey (CHNS) from years 1991 to 2006. Data on nearly 6,000 school-age children (6-17 years) in two-

parent families are used to assess the association between parents' recent experience of major illness and their children's subsequent probability of attending school. Existing literature suggest that school attendance may be explained by many factors other than parental health. Many of them are not observed by econometricians. By comparing children's school attendance across different types of families (i.e. both parents remained healthy and either of the parents fell sick) and over time (i.e. before and after the parent(s)'s illness), this study first estimates a parametric conditional logit model of changes in a children's schooling status, that is, the probability of dropping out of school or re-entering school associated with the onset of a major illness experienced by their parents. For example, self-reported morbidity status could be correlated with individual tastes, preferences, and attitudes. Looking at school dropout (re-entering) behaviour associated with changes in self-reported severity-of-illness thus takes account of the permanent, unobserved factors that may vary systematically across socioeconomic groups. A semi-parametric technique that applies propensity score re-weighting is further used to correct the biasness that might have otherwise arise in a non-linear fashion. Moreover, the role played by the health insurance system is also examined. Given an initial level of family income and severity of illness, this study investigates whether a child's probability of staying in school varies in accordance with the out-of-pocket (OOP) payments incurred by the parent's illness.

During the observation period, China experienced both rapid economic growth and a fundamental shift from a social-planning economy to a market-based one. As part of this process, inequalities in access to both health care and basic education have risen dramatically. On the one hand, as a result of the collapse of its previous universal health care system, health services in China reverted to primarily private financing (self-pay). Health insurance coverage also declined drastically. On the other hand, basic education remains expensive to most poor families despite the initiation of the Nine Year Compulsory Schooling Law in 1986. [2] In addition to expenses on items such as textbooks

[2] Research conducted by a Chinese scholar (Liu, 2004) in one typical county (Weichang county) of Hebei Province indicates that, in the 1990s, the total expenditure for the nine year compulsory schooling per student amounts to at least about ¥7000 (approximately ¥220 and ¥540 for primary and secondary

and stationery, parents are responsible for various types of miscellaneous fees that are related to schooling. These two factors coupled with a severely constrained credit market, often lead poor parents who cannot sustain themselves in face of major illness to sacrifice their children's education.

Although the role of family income in determining children's school enrolments has been widely explored in the literature, relatively few studies have paid attention to the impact of transitory income shocks on the dynamics of schooling outcomes. Most existing studies focus on parental job loss (Duryea, Lam and Levison, 2007; Rege et al., 2007) parental death (Ainsworth, 2006; Gertler, Levine and Ames, 2003; Case, 1999), and aggregate economic shocks such as rainfall or drought (see Ferreira and Schady (2009) for a comprehensive review).

Almost no empirical research has investigated the role of parental illness, one of the most serious challenges one family may have to face, except for Sun and Yao (2009). Using data from Chinese farm households covering the period 1987-2002, the authors adopt a sequential response model to study the long-term impacts of parental health shocks on children' school attainments. However, they focus only on the rural area of China, and look at 15-year changes that ignore effects that take place over a shorter span of time. This paper thus is the first to use large-scale survey data to examine the role of parental health shocks on children's school enrolments in the short-run.

The rest of paper is organized as follows. In Section 2, I introduce the institutional background regarding China's health care systems and basic education during the study period. Section 3 provides a description of the dataset. Section 4 outlines the empirical strategy. Section 5 presents basic results and Section 6 investigates the potential role played by health insurance and the associated out-of-pocket payments. Section 7 concludes.

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schooling per year, respectively), while the annual income of an average rural household in the same area is around ¥2890-3265, suggesting educational expense is usually not a small easy-to-allocate sum of money for many poor families.

2.2 The China Context [3]

Under China's pre-reform planned economy, its health care system was owned and operated by various levels of the Chinese government. The system was designed to achieve the goal of "equal access to the health care system for all", regardless of ability to pay. Correspondingly, the Chinese government controlled budgets for all sectors in the public health care system and provided funding to each sector to cover its costs of daily operation. Health care providers, including physicians, nurses, and administrators, were paid a fixed salary. To contain public health care spending at an affordable level, the prices of medication and services were set and adjusted periodically by the central government. During this period, almost all citizens were covered by some form of health insurance. In the urban area, state-owned enterprise employees (and their dependents) were covered by the Labor Insurance Scheme (LIS), and civil servants and other government employees (and their dependents) were covered by the Government Insurance Scheme (GIS). The remaining urban residents were covered by poverty aid programs. In the rural area, agricultural workers were covered by the Cooperative Medical Scheme (CMS), a collective economy prepaid health security program. During the 1970s, the CMS covered an estimated 90% of the rural population.

China's transition from a planned to a market economy from 1980 onwards brought dramatic changes to ways in which the health care system is financed and medical service is provided. First of all, the central government replaced the previous flexible cost-reimbursement payment method with block grants. The amount of the block grant to each health system sector was usually much less than the actual operating costs. Medical professions were encouraged to do whatever they could to generate revenues and were allowed to retain the surplus. Furthermore, the government-set schedules for fees and medicines provided physicians with a strong incentive to favour high-tech care over basic care. For basic interventions, the government has set the price below cost so as to make them affordable even to fairly poor patients, while more sophisticated interventions are priced above cost to enable providers to make profits on them that can be used to cross-

[3] This part is heavily drawn from Wagstaff (2005), the World Bank China Rural Health Study Final Report (2004), Ma, Lu and Quan (2008).

subsidize the delivery of basic interventions. The health insurance coverage also was reduced dramatically. Due to the shrinkage of state-owned enterprise, the government merged the LIS and GIS programs and created a new urban employee health insurance program, the Basic Medical Insurance (BMI). The BMI covers all enterprise employees, no matter if they work in state-owned or private enterprises. However, employers only provide their employees a fixed amount of money per month to cover basic health services, and employees are responsible for the remaining costs. In addition, the employee insurance program no longer covers employees' dependents. In rural areas, the de-collectivization of agriculture resulted in an almost total collapse of the CMS. In 1994, less than 10% of the rural population still had CMS coverage.

Figure 2.1 shows the fractions of government, social insurance programs and individual out-of-pocket health expenditures relative to the national health spending. Over time, the out-of-pocket budget share increases from 25% in the 1980s to around 60% in the 1990s.

2. 3 Data

This paper uses data from the Chinese Health Nutrition Survey (CHNS). This survey was conducted by the Carolina Population Center at the University of North Carolina. It collects micro-level information on about 4,400 households (19,000 individuals) in nine provinces of China (Guangxi, Guizhou, Henan, Hubei, Hunan, Jiangsu, Liaoning, Heilongjiang and Shangdong) that vary substantially in geography, economic development, public resources and health indicators (see Figure 2.2 for a map of survey regions). Within each province, the sample was drawn using a multistage clustering design with random procedure employed at each stage. [4] The first round of CHNS was conducted in 1989, and six additional panels were collected in 1991, 1993, 1997, 2000,

[4] Counties within each province were first stratified by income (low, middle and high). Then a weighted sampling scheme was used to randomly select four counties in each province. The provincial capital and a lower income city were selected when feasible. Villages and townships within the counties and urban and suburban neighbourhoods within the cities were selected randomly.

2004, and 2006. [5] This survey consisted of four components: a household questionnaire, an adult questionnaire for individuals aged 18 and older, a child questionnaire for children and adolescents aged from 0 to under 18, and a community questionnaire that collects information on community infrastructure (e.g. water, transportation, electricity), services (e.g. health facilities, retail outlets), and demographic composition. Generally, the household head answered all of the questions in the household questionnaire. If the household head was not available, another adult who was most knowledgeable of the household will complete this questionnaire. The adult questionnaire was completed by every adult in the household. The child questionnaire was completed by every child in the household from age 10 through under 18. For children under age 10, a parent will answer all of the questions for him/her.

The analyses employ data from six waves of the CHNS, 1991, 1993, 1997, 2000, 2004 and 2006. In order to maximize sample size and to allow separate estimates for different types of households, I pooled a series of consecutive-year panels of children (i.e. 1991-93, 1993-97, 1997-2000, 2000-04 and 2004-06). The first 1989 wave was omitted because the variable that indicates child-parents relation and some parents' variables (i.e., smoker or drinker) were not collected. [6]

I used data on children who lived in two-parent families, who answered the survey for two consecutive survey waves, and were aged 6-17 years old in between these two waves. In China, it is most common for children to start elementary school the school year they turn 6 or 7 and graduate from senior high the school year they turn 18 or 19. In order to separate school early leaving from normal graduation behavior, I restrict attention to the sub-sample of children who are one year younger than an average senior high school graduate. Divorce or remarriage can involve dramatic changes in family

[5] In 1997, a new province (Heilongjiang) was added into the survey to replace the one that was unable to participate (Liaoning). The dropped province returned to the study in 2004.

[6] This practice follows Osberg, Shao and Xu (2009), who used the same dataset to study the importance of subsidized food programs in maintaining the health of poor children.

financial circumstance, and also impose enormous stress on children. I thus excluded children of lone parents from the sample as well. [7]

I further adopted an "onset" approach by excluding children either of whose parents reported being sick or injured in the first wave of each respective consecutive-year panel. This means children in families where one or both parents had been always ill, or those who suffered from ill health but then recovered are omitted from the analysis. The comparison is then conducted between children in families where both parents reported being healthy in both years and children in families where at least one parent reported being sick / injured in the second period but both parents reported being healthy in the initial period. In this way this analysis is likely to under-estimate the true impact of parental ill health on children, as those with chronic illness are probably hit the hardest. However, this onset approach possesses important advantages: (1) it avoids combining people who experience onset health problems with people who have always been sick; (2) it differences out permanent characteristics that may be correlated with self-reports and the outcome of interest.

2.3.1 School Attendance

The key outcome this paper focuses on is child's school enrolment. In each wave of the survey, the household respondents were asked whether each member of the household was *enrolled* in school or not at the time of the survey. Figure 2.3 shows the overall school enrolment rates for all children aged 6-17 years pooled from six waves of the CHNS. For the 6-11-year-olds, the average enrolment rate initially increased and then stabilized at 95-97%. However, after the child turned 11/12, this figure dropped drastically. For the 12-14-year-olds, the average enrolment rate decreased to around 90-93%, while the corresponding number for the 15-17-year-olds was only about 60-62%. [8]

[7] Note that this will exclude children whose parents suffered the most extreme health outcome (i.e. death).

[8] Further breaking down the overall enrolment figures by children's gender and survey year (see Table 4.1) suggests that overtime, there has been a marked increase in the school enrolment rates in all three age groups. Boys were slightly more likely to participate in school than girls, but the difference is not statistically different.

Conditioning on the schooling status in the previous survey year, Figure 2.4 shows the school dropout rates for the same group of children who reported being in school in the previous wave but out of school in the next, and Figure 2.5 shows the school re-entry rates. [9] Both figures again reveal the same pattern: For a child who aged 11/12 years and older, his or her school entrant probability is only half of that of a younger child while the school dropout probability almost doubled. Once these children dropped out, few of them came back to school.

2.3.2 Parental Illness

In each survey round, the respondents were also asked questions regarding the morbidity status of each member of the household in a four-week recall window, which I used to construct indicators of parental health shocks. These questions are as follows: "During the past 4 weeks, have you been sick or injured? Have you suffered from a chronic or acute disease?", and if yes, "how severe was the illness or injury?" Respondents were asked to rate the severity of illness on an ordinal scale from 1 to 3: 1=not severe; 2=somewhat severe and 3=quite severe. In this analysis, I used two dummy variables to indicate the state of poor health: *Sick Parent* and *Very Sick Parent*. The *Sick Parent* variable takes the value of one when at least one parent reported mildly ill/injured and zero otherwise. *Very Sick Parent* variable is coded to be one if at least one parent reported moderately or severely ill/injured and zero otherwise.

Based upon morbidity status, three types of households are distinguished: *healthy-parent* households (i.e. both parents reported being healthy during the observation period), *sick-parent* households (i.e. either of the parents reported being mildly sick or injured) and *very-sick-parent* households (i.e. either of the parents reported being moderately or severely sick or injured). Given that children with either parent reporting being sick or injured in the initial period are excluded, the two main analytical samples, *Sick Parent* and *Very Sick Parent* include children whose at least one parents reported being either

[9] The school entrant and dropout probabilities are defined as: entrant ($\Pr(S_{it+1} = 1 \mid S_{it} = 0)$) and dropout ($\Pr(S_{it+1} = 0 \mid S_{it} = 1)$), where S_{it} represents the binary school attendance status of a child i in period t.

mildly or moderately / severely sick in the second period as the treatment group, respectively, and children with two parents remained healthy in both years as the control. [10] Table 2.2 shows the numbers of children in the above two samples. As expected, the vast majority of children lived with parents who remained healthy during this two year interval: 598 children or about 10 percent out of the 6131 children in the sample were with either one parent or both parents who experienced onset health problems. The numbers of children with ill fathers and mothers are almost the same. As well, there is no significant difference between the two severity-of-illness categories.

2.3.3 Covariates

In addition to the key explanatory variable, I included a set of time-varying child and family background variables in the regressions such as child age (two dummy variables indicating the age ranges of the child in the after-shock year: 6-11 and 12-15 years), chronic/acute condition, number of siblings, log of equivalent household income. [11] Income is measured as after transfers before taxes, in 2006 constant dollars. Previous research has noted a potential impact of family size or composition on child's educational attainment (e.g. Becker, 1976; Black, Devereux and Salvanes, 2005). This factor could be particularly important in the China context because of the One Child Policy that was announced in 1979. [12] This policy is generally considered by the literature to have helped parents to become more concerned about their children's education, as family resources will be more concentrated on the only child. To construct this variable, I utilize the set of questions in the CHNS that asked of all married women about the number of daughter and sons that live with them at the time of the survey.

[10] In other words, the analysis throws out the "very sick parents" when estimating the "sick parent" regressions and vice versa.

[11] Luxemburg Income Study (LIS) equivalence scale (i.e. the square root of family size) is applied to calculate the equivalent family income.

[12] This policy was actually implemented in 1978, and enforcement gradually tightened across the country until it was firmly in place in 1980. Under the One Child Policy, individuals can have second birth under special circumstances, such as belonging to minority ethnic groups, residing in remote rural areas etc.

I also control for a set of community characteristics that might help explain a child's schooling decisions. I use the school availability (one indicator for junior high and another one for senior high school) [13] to represent the supply side of education, the percentage of labour force in the village/neighbourhood that works in agricultural sector to capture the community-clustered family preferences, [14] and the prevailing wage rate for an ordinary worker in the neighbourhood/village to signify the opportunity cost aspect of human capital investment as well as a family's position in the neighbourhood/village income hierarchy.

2.3.4 Descriptive Evidence

Table 2.3 presents the means/frequencies of pre-shock characteristics including school enrolment, covariates and a set of confounding variables that may potentially influence the incidence of parental sickness or injury. The set of confounding variables include parent age, years of schooling, health insurance coverage, type of insurance contract, and parent occupations. [15] The differences shown in Table 2.4 then provide us a first look at the "balance" achieved on the covariates between treatment and control groups prior to the health shocks. In general, parents who experienced onset illness were more likely to live in urban areas. They also tended to have more years of schooling and therefore higher annual household income. Those who were moderately or severely ill had a significantly higher coverage of medical insurance compared to the healthy, especially in terms of the commercial insurance and co-operative medical insurance, the two types of insurances that was not primarily linked to one's employment status. This fact suggests that a certain degree of "selection" may have existed prior to the shock. For example, people who faced larger health risks are more likely to get insurance than people who

[13] In China, students can also go to vocational schools for more specialized job trainings after senior high. So the "senior high school" dummy here also includes the availability of vocational schools.

[14] I also have experimented with the percentage of labour force that works outside of the village/neighbourhood, the percentage of labour force the works for enterprises that employ more (less) than 20 people in the village/neighbourhood.

[15] During the study period 1991-2006, the three most prominent insurance contract types in China are: the government insurance (GIS), labour insurance (LIS), insurance for farmers (CMS), workers' compensation and commercial insurance.

faced small risks. Importantly, these factors may exert differential impact on children's subsequent school enrolment between those in families where both parents remained health and families where one or both parents fell sick, and mask the relationship between parental illness and children's schooling outcomes.

It is also worth noting that the results in Table 2.4 are not quite consistent with the commonly accepted findings that "rich people live longer than poor people and they are healthier at every stage of life" (CPHI, 2004). Why are parents with higher income and more education more likely to fall ill or get injured? Some plausible explanations are: (1) I omitted parents with the most severe health conditions, i.e. those who had always been ill from the analytic samples. (2) Insured persons use more preventative and curative health care. This means that the illness or injury may be more likely to be detected and reported (and they may also take fewer measures to prevent the illness/injury). A low income, less educated parent who lived in rural area on the other hand may be more likely to die before the disease is detected and so she would not be counted in the statistics. [16] (3) Parents lived in urban area also have higher risks for lifestyle-related diseases, such as diabetes and cardiovascular disease during China's rapid economic growth and urbanization process. [17]

Figure 2.6 shows a simple stratification of children's school enrolments by their parents' health status. Compared to that of those with healthy parents, school dropout is more common for children whose parents experienced health shocks. The difference is largest for children at the transitions between kindergarten/preschool and primary (7/8), primary and junior higher (12/13), and junior high and senior high schools (15/16). Of course, if

[16] CHNS does not provide information on the cause of death.

[17] Liang (May 2009) uses the CHNS and is the only paper that I found that has also mentioned this trend in self-reported health status. Since the full text is not available online, here are her interpretations provided in the powerpoint slides: (i) occupational structures in both urban and rural areas have changed. Urban residents were more likely to be pushed into occupational categories related to poor health; (ii) unobserved stress associated with a higher level of dynamic happened in urban settings; (iii) health insurance, education, income and marriage; and (iv) state policy contribute to distinctive marketization experiences in urban and rural areas. http://www.baruch.cuny.edu/facultyhandbook/documents/Urban-rural_KeLiang.pdf

any parental or child's characteristics differs systematically with a parent's morbidity status, these cross-tabulation result could be biased. Therefore, further analyses are needed to explore the impacts of parental illness on schooling outcomes while holding as many other factors constant as possible.

2.4 Empirical Strategy

When evaluating the impact of parental health state and insurance status on children's school enrolments, one empirical concern arises. The unobserved factors that affect parents' likelihood of falling ill may also be the same underlying factors that affect health insurance status and perhaps, the children's schooling outcomes. On the one hand, the probability of ill-health varies systematically across socioeconomic groups, even though the actual realization of illness may be random. On the other hand, the less healthy may be more likely to seek insurance. To account for these selection issues both in a linear and non-linear fashion, I adopt a semi-parametric method that applies propensity score re-weighting to the conditional logit estimation.

I first derive an estimate using a standard conditional logit model of changes in children's probability of staying at school. In a two-period setting, the model takes the following general form:

$$Y_{it1} - Y_{it0} = \alpha + \beta(HS_{it1} - HS_{it0}) + (X_{it1} - X_{it0})\delta + (\varepsilon_{it1} - \varepsilon_{it0}) \qquad (1)$$

where t0 and t1 are time indices for periods before (first year) and after (second year) parental health shocks, Y_i is child i's school enrolment. HS_i is a dummy variable for children with at least one parent who experienced a health shock in the second year but had no health problems in the first year. X_i is a vector containing time-varying socio-economic characteristics that may explain children's school dropout, including child's age, child's own health, parent age, family income, availability of public schools and prevailing wage rates in the neighbourhoods / village. Finally, ε is a stochastic error term with the usual assumptions, i.e. normal distribution, zero mean, and finite variance. In my sample, parents reported having health problems in the first year were excluded ($HS_{it0} = 0$ for any i), so $HS_{it1} - HS_{it0} = HS_{it1}$. The estimated parameter β thus measures the average difference in school dropout (or re-entry) between children whose parents

experienced health shocks and those whose parents had "always" been healthy (Tables 2.4-2.6).

In this conditional logit estimation, all time-invariant unobservable characteristics are differenced out, and any children who have never changed school enrollment status, i.e. those who stayed in or out of school during the observation period, are dropped. However it implicitly assumes in the absence of health shocks, the school dropout (or re-entry) behavior would have been the same for children whose parents experienced the shock and those whose parents did not:

$$E(Y_{it1}^{1} - Y_{it0}^{1} \mid HS = 0, X) = E(Y_{it1}^{0} - Y_{it0}^{0} \mid HS = 0, X)$$

Here $E(Y_{it1}^{1} - Y_{it0}^{1} \mid HS = 0, X)$ is the counterfactual expected probability of school enrolment for children whose parents experienced the health shock, and $E(Y_{it1}^{0} - Y_{it0}^{0} \mid HS = 0, X)$ is the corresponding expected value for those whose parents did not. In order to relax the (generalized) linearity assumption imposed by the standard conditional logit estimation, I use the propensity score re-weighting approach to directly estimate the counterfactual mean of the school dropout (re-entry) for the treatment group. The idea of propensity score re-weighting is to first estimate a propensity model of a parent experiencing the health shock as a function of observable variables X, and then construct a weight based on the estimated "probabilities of treatment" or propensity scores ($\hat{\lambda}(X)$) to re-weight the untreated cases ($\omega = \frac{\hat{\lambda}(X)}{1 - \hat{\lambda}(X)}$), so the distribution of the observable variables for the untreated cases X looks the same as those for the treated cases. The conditional logit estimator re-weighted by the estimated propensity scores can be written as (Blundell and Costa Dias (2002) and Nichols (2008)):

$$\begin{aligned} ATT &= E(Y_{it1}^{1} - Y_{it0}^{1} \mid HS = 1, X) - E(Y_{it1}^{1} - Y_{it0}^{1} \mid HS = 0, X) \\ &= \frac{1}{N} \sum_{i \in T} \{(Y_{it1} - Y_{it0} \mid HS = 1, X) - \sum_{j \in C} \frac{\hat{\lambda}_j(Z)}{1 - \hat{\lambda}_j(Z)} (Y_{jt1} - Y_{jt0}) \mid HS = 0, X\} \end{aligned} \quad (2)$$

Here i and j are indices for treated and control observations. T and C indicate treatment and control group. N is the number of treated observations. $\hat{\lambda}(X)$ is the estimated propensity scores as a function of observable variables X. A weighted regression of

outcome on treatment is thus a comparison of means across treatment and control groups, but the control group is re-weighted to represent the average outcome that treatment group would have exhibited in the absence of treatment (Tables 2.10-2.11).

This method is appealing but it is not without its own problems. For example, compared to the other algorithms it relies much more on the propensity score and therefore is more sensitive to specification and prediction of $\hat{\lambda}(X)$. Also, the weights involve dividing by $(1-\hat{\lambda}(X))$, which may be very small (<0.01) at the ends of the distribution. This creates very large weights for observations that nearly violate the common support ($(\hat{\lambda}=1 \text{ or } \hat{\lambda}=0)$. In order to guard against the above mentioned potential sources of biases, I performed robustness checks to assess the sensitivity of my results: (1) I implemented an alternative method, the propensity score matching due to Rosenbaum and Rubin (1983), and the matching algorithm used was the nearest neighbour within caliper 0.01. The results are not reported in this paper but they are highly consistent with the ones reported here. (2) I ran the weighted regressions with and without imposing the common support restriction. Again, the results of interest remain largely unchanged.

2.5 Basic Results

2.5.1 A Parametric Conditional Logit Estimation

In Table 2.4, I report the full set of results of the analysis for the *Any Parent Sick* sample and the *Any Parent Very Sick* sample obtained from estimating equation (1). As mentioned in Secition 2.3.2., children who lived with a parent suffering from a mild illness and those with a parent having a serious illness are considered as separate treatment group in the two samples. Column (1) presents the regression results when only the time-varying micro-level socio-economic factors were included, namely the child's age, number of siblings, health condition, log of equivalent family income (after transfer before taxes), and a set of wave dummies. Column (2) reports results from regressions that additionally control for macro-level conditions, including the prevailing wage rate

for an ordinary worker in the neighbourhood (urban area) or village (rural area), and the availability of schools.

The most important finding in Table 2.4 is that the coefficient on parental health shock variables is negative across the two types of families and the two model specifications, suggesting that on average, children from families in which at least one parent experienced the onset of health problems are more likely to drop out of school (or less likely to re-enter school) compared to those from families where both parents remained healthy. Moreover, both the magnitude and statistical significance of the coefficient increases with the severity of the parent's illness, an observation that is consistent with the theoretical predication.

The set of community-level characteristics are insignificant themselves. But the addition of these variables increases the estimated magnitude and/or significance of the parental health shock effects. Importantly, the goodness-of-fit statistics for both samples are improved. The pseudo R squared increases from 0.502 and 0.511 to 0.512 and 0.526 for the *Any Parent Sick* and the *Any Parent Very Sick* samples, respectively. This means community characteristics to some degree do affect a child's access to education and her consequent schooling decisions. Hence, I will adopt this model specification for the rest of analysis.

The remaining covariates have expected signs. For example, the probability of dropping out of school increases considerably as a child nears 17. Children in families with more children are less likely to leave school early. [18] This finding is in line with Qian (2005), who uses the CHNS and finds large *positive* effects of family size on children's school enrolment. The prevailing wage rate for an ordinary worker in the neighbourhood/village, on the other hand, is negatively, although not significantly, associated with the

[18] As discussed in Section 2.3.3, China launched its One Child Policy in 1979. However, this policy was not rigorously implemented in rural areas. People belonging to minority ethnic groups are usually allowed to have two children as well. As a result, nearly half of households in the analytic sample reported more than one child.

probability of a child staying in school. It serves as an indication that family's placement in the income hierarchy of community adversely affects child's educational outcomes. A child could be more likely to drop out of school because of better opportunities outside of school, or the social exclusion that the family experiences as a result of relative poverty when compared with the standards of one's community.

Recognizing the fact that the schooling effect of parental health shocks may be different depending on which parent falls sick, I repeated the analysis for the *Father Sick*, *Father Very Sick*, *Mother Sick*, *Mother Very Sick* and *Both Parent Sick* samples separately. Model specification was the same as Column (2) of Table 2.4. Due to relative low frequencies of families where both parents reported onset problems (Treated Cases = 60), I grouped the two severity categories when running the regressions (Table 2.5, Column 5). Even so, the estimated coefficient is less reliable. Therefore, I would not attach any fundamental importance to this result beyond a simple demonstration of the relative magnitude as compared to other types of families. In the rest of analysis, I will only focus on the results from the other four types of families when reporting the results.
The pattern which emerges from results reported in Table 2.5 is that, after controlling for the gender of the ill parent, as well as a comprehensive set of time-varying socio-economic variables, the coefficient on parental health shocks remains universally negative, and again, its magnitude and statistical significance increases with the severity of the parent's illness/injury. Relative to children whose *one parent* fell sick, those with *both parents* experiencing onset health problems seem to be hit harder (beta =-2.825 and standard error=0.640). All other covariates are similar to those reported in Table 2.4.

It is also possible that there is an independent effect of having one or both grandparents living with or close by the family. To account for this, I experimented with a set of variables that capture the additional help/support that parents can receive from the extended family: (1) the amount of intra-household transfers that the family received from its relatives or friends, both in terms of cash and in-kind gifts; (2) the number of siblings of both parents; (3) the presence of grandparent(s) (including in-laws), whether

the grandparent(s) lived in the household, and if not, how far away the grandparent(s) lived, and whether they needed care themselves.

The first two groups of variables turned out not useable either because of low response rates or because of changes in survey questions during the study period. But I was able to elicit information from the third group of variables, and use them to proxy the degree of social support. Specifically, I constructed two dummy variables, one indicates the presence of any grandparent in the household, and another indicates whether a grandparent lived close by (in the same household, neighbourhood/village, city/township who did not need care herself as compared to those who lived outside the city/township or needed care). I then added these two variables separately into the equations reported in Table 2.5. The results are reported in Table 2.6. As seen in Table 2.6, the grandparent coefficient has mixed signs across family types. It is never significant, and adding this variable does not change the results of interest.

2.5.2 Predicting the Event of Ill Health

The event of health shocks may not be random with respect to factors that also influence a child's schooling outcome. If not all of the unobservable variables are time-invariant, the conditional logit estimates may be biased. I therefore conducted the propensity score analysis to explicitly "estimate" the counterfactual through which to create a more comparable control sample for later analysis.

I first fitted a series of probit models estimating the probabilities that a parent fell ill. I did this for fathers and mothers separately. The covariates included a set of pre-shock variables that are likely to affect, but are not affected by a parent's experience of health shocks. Individuals' self-rated health status is generally considered as the best predictor of ones' longevity, I therefore include the parent's self-assessed health status in the pre-shock year as one of the control variables. This variable ranges from one to four with a higher value indicating poorer health. In addition, whether a person has medical insurance (one dummy for insurance coverage), the family's financial situation (log of equivalent family income, 2006 dollars), the parent's age, formal years of education,

occupation (four categories: farmer/hunter/fisherman, unskilled, [19] skilled,[20] cadre,[21] with no jobs as the base), area of residence (one dummy for rural), health behaviour (drinking frequency), sanitary environment (one dummy for access to tap water) could also contribute to the likelihood of a parent becoming ill. Importantly, when I ran the probit models, the set of province dummies and wave dummies were added into the equation so that the untreated and treated observations, after re-weighting, would be similar in such a way as if they were drawn from the same survey year and same province.

Table 2.7 reports results from the propensity score estimation for the four analytic samples: *Father Sick*, *Father Very Sick*, *Mother Sick* and *Mother Very Sick*. These results are consistent with findings of studies on determinants of health, and the "rural morbidity advantage" hypothesis discussed in Section 2.3.4. Specially, in three out of four cases, parents' self-rated health status on a one to four scale is statistically positively correlated with their later experience of health problems. Fathers who were older, who had medical insurance, lower equivalent family income, and who drank more are more prone to health risks. Mothers with less education and who lived in the urban area are relatively more likely to fall ill. Last but not least, the regional diversity of health outcomes is large. Almost half of the province and wave dummies are highly significant. By constructing a weighting based on the probability of experiencing the health shocks, the selection problem is reduced.

After the propensity score estimation, I constructed the weight based on the estimated propensity scores, and plotted the kernel density distributions of the observed / un-weighted and re-weighted propensity scores side by side for the four analytic samples.

[19] It includes non-skilled worker (ordinary laborer, logger), driver and service worker such as housekeeper, cook, waiter, doorkeeper, hairdresser, counter salesperson, launderer, child care worker.

[20] It includes senior professional/technical worker (doctor, professor, lawyer, architect, engineer), junior professional/technical worker (midwife, nurse, teacher, editor, photographer), office staff (secretary, office helper), skilled worker (foreman, group leader, craftsman), army officer, police officer, ordinary soldier, policeman, athlete, actor and musician.

[21] It includes aadministrator/executive/manager (working proprietor, government official, section chief, department or bureau director, administrative cadre, village leader).

For the sake of brevity, only the case of "*Father Very Sick*" is shown in the paper. The remaining graphs are available upon request. Since the process of re-weighting weighted healthy parents who had a high propensity of falling ill up and those who had low propensity scores down, the distribution of propensity scores for healthy parents are much more similar to that of sick parents after re-weighting (right panel of Figure 2.7) as compared to before (left-panel of Figure 2.7). Specifically, the left panel of Figure 2.6 shows that before re-weighting, the majority of parents who remained healthy are predicted to have lower propensity of falling ill relative to those who became ill, which is consistent with theoretical expectation. [22] Along with the re-weighting, a common support restriction was imposed, so any observations that fell outside the range at which both treated and untreated cases were observed were discarded from analysis. [23]
Tests were conducted to make sure that the re-weighted sample was balanced in the sense that the sick parents and healthy parents have similar pre-shock characteristics (Table 2.8 and 2.9 for samples of fathers and mothers, respectively). As shown in these tables, p-values of the two-tail t-tests are in the range of 0.581-0.999, suggesting that the balancing of pre-shock characteristics was successful.

2.5.3 Propensity Score Re-Weighted Conditional Logit Estimation

Having obtained a comparable control group through re-weighting, I re-ran the conditional logit regressions based on the estimated propensity scores and reported the results in Table 2.10. When running these regressions, the set of child and community characteristics that did not enter the first-stage propensity model, plus the set of variables that entered the first-stage propensity model but may possess explanatory power in children's schooling outcome (e.g. family income variable) are additionally controlled for.

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[22] Compared to the propensity of the healthy parents, the spike of the kernel density for the sick parents is shifted to the right by 2-4 percentage points, depending on individual cases.

[23] In all of the four cases, there is fairly large overlap between the propensities of the sick parents and healthy ones, considering the propensity score analysis is only justified over the common support region.

After correcting for the pre-shock differences between healthy parents and sick parents, the parental health shock coefficients remain universally negative across samples. Compared to the results obtained on the un-weighted samples through equivalent model specification (Table 2.5, Columns (1)-(4)), the estimated magnitudes of school dropout effects increase slightly after re-weighting in all four cases. Having a parent reporting moderate or severe illness, depending on whether it is the mother or the father, increases a child's log odds ratio of attending school by 1.7-1.8 points. Transforming the coefficients shown in the table into odds ratios, it means relative to the school dropout rate among children in healthy-parent families at the same time, having a moderately or severely ill parent in the household increased the odds of their children dropping out of school by approximately 5.4-6.1 times. Compared to mothers' health shocks, *fathers'* health shocks have a larger impact in the sense that father's health shock variables, regardless of severity, are negative and statistically significant.

Thus far this study has focused on children of a fairly board age range. It is possible that the effects of parental health shocks on children's schooling decisions are stronger for older children that younger ones, since school dropout is much more prevalent in the former group (see Section 3). To check this, I repeated the analysis for a sub-sample that only contains children aged 11-17 years in the post-health-shock year. The results are reported in Table 2.11. As expected, the parental health shock impact increases significantly, both in terms of size and statistical significance - adolescents in families where either parent reports a moderate or severe illness are 5.2-10.3 times more likely to leave school than do their classmates. The equivalent family income coefficient becomes significant in three out of four samples, suggesting an increasingly important role of family financial situation in children's human capital investment decisions as they age. Finally, after allowing for heterogeneity across age ranges, the puzzling negative coefficient on the Senior High School dummy has largely disappeared. In three out of four samples, it still has a negative sign, but in no cases is it statistically significant at conventional level.

2.6 The Role of Health Insurance

Having a sick parent in the household can negatively affect a child's development in various different ways. For example, a child may be pulled out of school due to budget reasons. The responsibility of taking care of sick parent can also require a child to spend more time doing home chores which interferes with his or her school work. Additionally, if parental involvement plays an important role in a child's school success, the presence of an ill parent may reduce the total time available helping child with homework. This could indirectly affect a child's school performance, causing failure to advance in school and even eventually dropping out of school. Finally, the stress associated with parents' illness may also impose extra emotional burdens on children that adversely affect their attitudes toward school.

Taken together, observing an adverse association between parents' illness and children's school enrolment does not necessarily mean that more financial resources devoted to these families will result in higher school enrolments. In this section, I explore the direct link between financial burden imposed by parent's illness and the probability of a child dropping out of school, by controlling for the out-of-pocket health expenditure. In the CHNS, patients are asked about the amounts and sources of the treatment costs incurred at the time of the survey. This out-of-pocket health expenditure variable thus represents all payments net of insurance reimbursement paid for related to this illness including hospital registration fees, medicines, treatment fees, bed fees etc. The regression results are reported in Table 2.12. For the ease of comparison, Column (1) replicates results presented in Table 2.11. Column (2) adds the out-of-pocket payment variable into the regression. Column (3) separately identifies this expenditure by the type of medical carer, i.e. whether this amount is paid to a formal medical provider such as hospitals, private clinics or village clinic, and whether this amount is incurred through self-medication.

The first thing to notice is the magnitude of parental health shock effect falls considerably in all four samples. Most importantly, the coefficients on out-of-pocket payment are negative and significant in most of the cases. For families where father reported having mild illness, given an initial level of family income, a ¥1000 increase in out-of-pocket

medical payment is associated with 0.4 percentage point decrease in the children's probability of attending school. While the same amount increase for families in which fathers reported having a moderate or severe illness results in a 4 percentage point reduction in children's probability of staying in school.

For families where mother reported falling mildly ill, the out-of-pocket expenditure due to self-medication is negatively associated with children's schooling status, even though the mother's health shock variable itself is not statistically significant. Children's schooling status in the last type of family where mother had a serious illness however, responds to a lesser extent to the addition of the out-of-pocket payment variable. This is likely when the linkage between mother's illness and children's academic outcomes are not solely due to the budgetary reasons. Plausible explanations include: (1) In China, the mother usually is the parent who does the bulk of childrearing work. These tasks may be important complements to education, for example, help a child get dressed, fed and transported to school. (2) A number of models of intra-household bargaining imply that household decisions such as investments in children are complex averages of each parental preference. In these models, a household member's preferences affect resource allocation in proportion to her contribution to household resources. There is evidence that mothers tend to invest more of the income they control in children than do fathers (e.g. Lundberg, Pollak and Wales, 1997; Phipps and Burton, 1998; England and Folbre, 2002; Woolley; 2004). Thus, a sick mother may not only adversely affect investment in children through an income effect, but also through a substitution effect away from investments in children due to an increasing importance of the preferences of the father (Akerlof and Kranton, 2000 and 2002).

In additional analysis not reported in this paper (available upon request), I examined the mediating role of social support from friends, relatives (characterized by the set of variables mentioned in Section 5), as well as alternative measures of out-of-pocket payments. However, none of them explains this association significantly. Based on this observation, it seems appropriate to attribute it to the roles attached to mother's identity.

2.7 Discussions and Conclusions

This paper uses the 1991-2006 Chinese Health and Nutrition Survey (CHNS) to estimate how a parent's recent experience of major onset illness negatively affects a child's school enrolment. In the CHNS, data on nearly 6,000 school-age children in two-parent families are used for analysis. Recognizing that the probability of ill-health is a function of personal and environmental characteristics, this study exploits the randomness of actual realization of illness among individuals with similar probability of falling sick to identify the causal role of parental illness in children's schooling outcomes. By employing a propensity score re-weighting method, characteristics of healthy-parent families are re-weighted to resemble those of sick-parent families. The econometrics results suggest a parent's recent illness negatively affects a child's probability of attending school. During the observation period, having a parent who falls sick recently increases the odds of a child dropping out school by 5-6 times, which is large in magnitude considering the prevailing school enrolment rate was only 92-92% and 60-90% among 6-11 and 12-17 year olds respectively. The effect is highest for children in families where either parent suffers from moderate or serious illness and for children in families where the father is ill. There is also evidence suggesting that adolescents attending secondary schools (12-17 years) are hit harder than younger children, and consistent with previous research (Qian, 2005), a larger family size is found to be beneficial for children's school enrolments. Finally, this negative impact of parental illness is largely explained by the associated out-of-pocket medical expenditure, especially for children living in families where the father falls sick.

The consequences of dropping out of school can be long-lasting. Research suggests that early school leaving is associated with a number of negative academic and socio-economic outcomes in adulthood, for example, cognitive ability formation, emotional problems, teenage pregnancy, juvenile crime, labour market earnings, and a slowdown in economic growth (Bowles, 1972; Milligan et al., 2004; Lochner and Moretti, 2004; Hanushek and Wößmann, 2007). Many scholars also point out that frequent school interruptions predict dropping out and are directly responsible for a lower eventual educational attainment (e.g. Howell and Frese, 1982; Stroup and Robins, 1972). Findings

of this paper suggest that with the lack of a socially funded formal insurance mechanism, idiosyncratic health shocks experienced by poor parents can result in catastrophic costs not just in terms of lost productivity and medical expenditure, but also reduced human capital acquisition of children, which are likely lead to lower average incomes and a greater degree of inequality within the next generation.

Results in the paper also suggest programs that help families with children to mediate financial hardship arising from health payment that are essential and large. In the past three decades, China gradually replaced its universal health care system with a de-centralized heavily market-oriented one. Along with this process there is an alarming rise in the share of private out-of-pocket payment relative to the national health spending. A recent study on cross-country health equity further points out that China has one of the highest shares of out-of-pocket expenditures for health care and one of the highest probabilities of incurring catastrophic medical expenditure among 14 major Asian countries and territories. In addition, unlike most countries, the financial burden of out-of-pocket payment is mainly concentrated on the least well-off (Doorslaer, 2005). If the high medical costs coupled with liquidity constraints often causes poor parents to sacrifice their children's education in face of major onset illness, the government may have a role in providing more assistance to such families for potentially higher returns in the future.

Table 2. 1 School Enrolment Rates (%) by Children's Age and Gender

		1991	1993	1997	2000	2004	2006	AVERAGE
6-11 Years Olds	Boys	91.36	87.99	96.88	94.03	100.00	95.67	93.37
	Girls	89.95	86.80	96.64	96.47	100.00	96.76	92.99
12-14 Years Olds	Boys	92.26	90.76	94.85	94.39	94.57	97.33	93.57
	Girls	88.39	88.34	93.16	89.39	95.63	95.80	90.94
15-17 Years Olds	Boys	59.77	51.88	67.13	64.18	70.74	65.15	62.69
	Girls	51.36	49.04	64.58	64.16	74.38	82.20	60.62

Notes: The sample uses data from CHNS 1991-2006.

Table 2. 2 Number of Children in the Analytic Sample

	Number of Children	%		Number of Children	%
Father Sick	114	1.86%	Father Very Sick	137	2.23%
Mother Sick	136	2.22%	Mother Very Sick	140	2.28%
Both Parent Sick	45	0.73%	Both Parent Very Sick	26	0.42%
Both Parent Healthy			5533		90.24%

Notes: The sample includes children who lived in two-parent families, who answered the survey for two consecutive survey waves, and were aged 6-17 years old in between these two waves.

Table 2. 3 Pre-Shock Child- and Parent- Characteristics

Means/ Frequencies	*Healthy* Parent Households (1)	*Sick* Parent Households (2)	p-value of diff (3)	*Very Sick* Parent Households (4)	p-value of diff (5)
Child Age	10.08	10.35	0.144	10.35	0.150
Child Female	0.47	0.51	0.165	0.51	0.237
Child Acute/Chronic Condition	0.04	0.02	0.404	0.05	0.503
Number of Siblings	2.29	2.27	0.870	2.12	**0.024**
Rural	0.77	0.73	0.100	0.69	**0.003**
Total Household Income (2006 $)	11889.84	13539.93	**0.021**	11873.77	0.982
Equivalent Household Income (2006 $)	5664.25	6512.97	**0.013**	5717.56	0.873
Primary School in Neighbourhood/Village	0.78	0.74	0.153	0.74	0.144
Junior High in Neighbourhood/Village	0.27	0.32	**0.055**	0.27	0.960
Senior High/Vocational School in Neighbourhood/Village	0.14	0.17	0.331	0.19	**0.062**
Prevailing Wage for Ordinary Worker in Neighbourhood/Village	9.30	11.31	**0.000**	11.08	**0.001**
Father Age	37.34	38.44	**0.003**	37.90	0.137
Mother Age	35.73	36.48	**0.027**	36.34	**0.076**
Father Years of Schooling	7.85	8.13	0.193	8.12	0.209
Mother Years of Schooling	5.96	6.14	0.517	6.60	**0.022**
Father has Medical Insurance	0.20	0.22	0.468	0.25	**0.040**
Mother has Medical Insurance	0.16	0.18	0.317	0.19	0.129
Father Insurance Type: Commercial Insurance	0.01	0.04	**0.000**	0.02	**0.017**
Father Insurance Type: Free Insurance	0.09	0.07	0.191	0.10	0.704
Father Insurance Type: Workers' Compensation	0.04	0.05	0.666	0.06	0.143
Father Insurance Type: Cooperative Insurance	0.05	0.05	0.923	0.07	0.127
Father Insurance Type: Unified Planning Insurance	0.01	0.02	0.293	0.00	0.129
Mother Insurance Type: Commercial Insurance	0.01	0.03	**0.000**	0.02	**0.007**
Mother Insurance Type: Free Insurance	0.06	0.04	0.154	0.05	0.431
Mother Insurance Type: Workers' Compensation	0.03	0.05	0.391	0.07	**0.007**
Mother Insurance Type: Cooperative Insurance	0.05	0.07	0.187	0.07	**0.087**
Mother Insurance Type: Unified Planning Insurance	0.01	0.01	0.493	0.00	0.500
Either Parent Cadre	0.06	0.07	0.356	0.07	0.463
Father Farmer	0.57	0.56	0.818	0.54	0.512
Mother Farmer	0.67	0.64	0.443	0.65	0.654
Father Skilled Worker	0.19	0.13	**0.017**	0.17	0.366
Mother Skilled Worker	0.09	0.09	0.997	0.10	0.575
Father Unskilled Worker	0.70	0.73	0.298	0.66	0.239
Mother Skilled Worker	0.80	0.78	0.577	0.77	0.290

Notes: Columns (1) (2) and (4) show means/frequencies of the pre-shock child- and parent- characteristics for the treatment (i.e. children with sick parents) and control (i.e. children with healthy parents) groups, respectively. Columns (3) and (5) report p-values of t-tests comparing differences between these two groups.

Table 2. 4 School Dropout Effects of Parental Health Shocks (Un-Weighted Sample)

(Dependent Variable: School Enrolment)

	Any Parent Sick		Any Parent Very Sick	
	(1)	(2)	(1)	(2)
Any Parent Sick	**-0.659**	**-0.869**		
	(0.482)	**(0.539)**		
Any Parent Very Sick			**-0.983***	**-1.610*****
			(0.504)	**(0.521)**
Child is Sick/Injured	-0.005	-0.044	0.031	-0.021
	(0.093)	(0.119)	(0.103)	(0.144)
Equivalent Household Income (log)	0.093	0.069	0.111	0.054
	(0.115)	(0.124)	(0.114)	(0.125)
Number of Siblings	0.455***	0.495***	0.448***	0.485***
	(0.164)	(0.177)	(0.164)	(0.176)
Age 6to11	4.379***	4.455***	4.424***	4.523***
	(0.488)	(0.573)	(0.492)	(0.593)
Age 12to15	2.535***	2.662***	2.588***	2.728***
	(0.305)	(0.352)	(0.310)	(0.363)
Neighborhood Prevailing Wage (log)		-0.003		-0.032
		(0.173)		(0.172)
Primary School in Neighborhood		-0.042		-0.147
		(0.294)		(0.299)
Junior School in Neighborhood		-0.047		0.189
		(0.292)		(0.298)
Senior School in Neighborhood		-0.573		-0.724
		(0.427)		(0.481)
Observations	1722	1466	1716	1460
Pseudo R^2	0.502	0.512	0.511	0.526
Wald Test	128.49	106.69	125.82	103.05

Notes: Coefficients reported in the table are log odds ratio. Standard errors in parentheses, clustered at the household level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Wave dummies are included in the regressions, but not reported here.

Table 2. 5 Father's versus Mother's Ill Health (Un-Weighted Sample)

(Dependent Variable: School Enrolment)	Father Sick Sample	Father Very Sick Sample	Mother Sick Sample	Mother Very Sick Sample	Both Parent Sick Sample
Father Sick	**-0.425**				
	(0.616)				
Father Very Sick		**-1.421****			
		(0.709)			
Mother Sick			**-0.808**		
			(0.949)		
Mother Very Sick				**-1.689****	
				(0.733)	
Both Parent Sick (Including *Sick* and *V. Sick*)					**-2.825*****
					(0.640)
Child Is Sick/Injured	-0.004	-0.035	-0.084	-0.023	-0.037
	(0.137)	(0.149)	(0.134)	(0.143)	(0.143)
Equivalent Household Income (log)	0.073	0.085	0.066	0.045	0.105
	(0.127)	(0.126)	(0.123)	(0.125)	(0.124)
Siblings	0.499***	0.490***	0.484***	0.483***	0.465***
	(0.178)	(0.178)	(0.175)	(0.175)	(0.177)
Age 6to11	4.500***	4.458***	4.330***	4.462***	4.415***
	(0.595)	(0.586)	(0.559)	(0.589)	(0.564)
Age 12to15	2.694***	2.696***	2.614***	2.699***	2.635***
	(0.366)	(0.361)	(0.347)	(0.362)	(0.353)
Neighborhood Prevailing Wage (log)	-0.027	-0.024	-0.025	-0.056	-0.012
	(0.175)	(0.174)	(0.172)	(0.172)	(0.162)
Primary School in Neighborhood	-0.103	-0.137	-0.060	-0.145	
	(0.299)	(0.301)	(0.298)	(0.299)	
Junior School in in Neighborhood	0.002	0.104	-0.007	0.159	0.053
	(0.301)	(0.301)	(0.296)	(0.299)	(0.278)
Senior School in in Neighborhood	-0.541	-0.683	-0.765	-0.710	-0.699
	(0.445)	(0.475)	(0.466)	(0.475)	(0.460)
Observations	1424	1422	1422	1426	1446
Pseudo R^2	0.516	0.518	0.506	0.518	0.514
Wald Test	97.13***	99.67***	108.21***	100.13***	95.16***

Notes: Coefficients reported in the table are log odds ratio. Standard errors in parentheses, clustered at the household level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. These models are estimated using model specification (2) in Table 4. Wave dummies are included in the regressions but not reported here.

Table 2. 6 Social Support and Parental Health Shocks

(Dependent Variable: School Enrolment)

	Father Sick Sample		Father Very Sick Sample		Mother Sick Sample		Mother Very Sick Sample		Both Parent Sick Sample	
Parent Sick	-0.430	-0.420	-1.436**	-1.438**	-0.805	-0.728	-1.678**	-1.813**	-2.803***	-2.813***
	(0.617)	(0.617)	(0.714)	(0.723)	(0.955)	(0.972)	(0.756)	(0.859)	(0.638)	(0.646)
Parent Live in Neighborhood	0.003		0.026		-0.014		-0.005		0.017	
	(0.244)		(0.242)		(0.246)		(0.246)		(0.253)	
Parent Live in Household		-0.769		-0.753		-0.796		-0.619		-0.774
		(0.898)		(0.890)		(0.884)		(0.794)		(0.898)
Observations	1422	1422	1420	1420	1420	1420	1422	1422	1426	1426
Pseudo R^2	0.517	0.519	0.519	0.521	0.507	0.510	0.519	0.520	0.513	0.515
Wald Test	96.37***	96.96***	98.85***	99.41***	107.52***	108.72***	98.56***	98.99***	96.39***	95.81***

Notes: Coefficients reported in the table are log odds ratio. Standard errors in parentheses, clustered at the household level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. These models are estimated using model specification in Table 5.

Table 2. 7 Logit Estimates of the Propensity Scores

(Dependent Variable: Probability of Parental Ill Health)

	Prob (Father Sick)	Prob (Father V. Sick)	Prob (Mother Sick)	Prob (Mother V. Sick)
	(1)	(2)	(3)	(4)
Father Health Status (1 to 4)	-0.310*	0.527***		
	(0.176)	(0.153)		
Mother Health Status (1 to 4)			0.471***	0.621***
			(0.157)	(0.148)
Father has Medical Insurance	0.644**	0.637**		
	(0.300)	(0.312)		
Mother has Medical Insurance			-0.009	0.364
			(0.319)	(0.281)
Father Age	0.035*	0.041**		
	(0.020)	(0.018)		
Mother Age			0.024	0.002
			(0.019)	(0.019)
Father Years Schooling	0.044	0.052		
	(0.041)	(0.037)		
Mother Years Schooling			-0.062**	-0.012
			(0.031)	(0.030)
Father Skilled Worker	-0.091	-0.757*		
	(0.494)	(0.422)		
Mother Unskilled Worker	0.253	-1.458***		
	(0.503)	(0.532)		
Father Farmer/Hunter/Fisherman	0.336	1.162**		
	(0.349)	(0.464)		
Mother Skilled Worker			-0.205	-0.003
			(0.441)	(0.396)
Mother Unskilled Worker			-0.597	-0.445
			(0.379)	(0.378)
Mother Farmer/Hunter/Fisherman			0.142	0.355
			(0.346)	(0.335)
Either Parent Cadre	-0.306	-0.565	0.458	-0.779
	(0.694)	(0.521)	(0.382)	(0.531)
Father Drinking Frequency	0.125**	0.036		
	(0.058)	(0.053)		
Mother Drinking Frequency			0.059	-0.081
			(0.113)	(0.099)
Tap Water	0.209	0.229	-0.346	0.504**
	(0.249)	(0.242)	(0.231)	(0.231)
Rural	0.498	-0.317	-0.670***	-0.087
	(0.309)	(0.239)	(0.232)	(0.230)
Equivalent HH Income (log)	-0.188	-0.227*	0.007	-0.077
	(0.123)	(0.121)	(0.124)	(0.113)
Province: Liaoning	0.595	-0.972	-0.181	-0.106
	(0.755)	(0.641)	(0.530)	(0.470)
Province: Heilongjiang	-0.104	-1.187**	-2.251***	-0.564
	(0.709)	(0.578)	(0.764)	(0.482)
Province: Jiangsu	0.903	-0.191	-0.384	0.312
	(0.590)	(0.400)	(0.406)	(0.365)
Province: Shandong	0.124	-2.102***	-1.245***	-0.399
	(0.662)	(0.754)	(0.483)	(0.427)

Province: Henan	1.478***	-0.694*	-0.410	0.153
	(0.516)	(0.381)	(0.345)	(0.329)
Province: Hubei	1.026*	-0.088	-0.468	-0.690*
	(0.542)	(0.312)	(0.337)	(0.390)
Province: Hunan	1.241**	-0.709*	-1.194**	-0.015
	(0.531)	(0.379)	(0.476)	(0.356)
Province: Guangxi	1.288**	-0.786**	0.168	-0.352
	(0.519)	(0.359)	(0.304)	(0.356)
1993	0.399	0.143	0.459	-0.326
	(0.365)	(0.303)	(0.307)	(0.296)
1997	0.658*	0.121	0.780***	-0.150
	(0.336)	(0.294)	(0.291)	(0.277)
2000	2.006***	1.366***	1.451***	0.922***
	(0.360)	(0.315)	(0.345)	(0.305)
2004	1.831***	0.802**	1.585***	1.254***
	(0.399)	(0.398)	(0.374)	(0.320)
Constant	-6.588***	-4.532***	-4.912***	-4.096***
	(1.559)	(1.400)	(1.510)	(1.402)
Observations	4807	4818	5130	5138
Pseudo R^2	0.091	0.093	0.081	0.068
Wald Test	85.18***	94.46***	89.58***	79.46***

Notes: Standard errors in parentheses, clustered at the household level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 2. 8 Balance Checking of Confounders

(Children with Sick Fathers)

Confounding Covariates	Treatment Type: Father Sick			Treatment Type: Father V. Sick		
	Mean in Treated	Mean in Untreated	p-value for diff	Mean in Treated	Mean in Untreated	p-value for diff
Father Health Status (1-4)	1.96	1.94	**0.834**	2.31	2.28	**0.581**
Father has Medical Insurance	0.22	0.23	**0.924**	0.27	0.27	**0.997**
Father Age	38.07	38.03	**0.945**	38.86	38.84	**0.972**
Rural	0.83	0.83	**0.966**	0.65	0.66	**0.867**
Equivalent HH Income (log)	8.33	8.35	**0.829**	8.29	8.28	**0.969**
Father Years Schooling	8.44	8.40	**0.891**	8.23	8.18	**0.867**
Father Drinking Frequency	4.13	4.12	**0.985**	3.74	3.77	**0.869**
Either Parent Cadre	0.03	0.03	**0.997**	0.07	0.07	**0.913**
Father Farmer/Hunter/Fisherman	0.61	0.61	**0.925**	0.57	0.58	**0.861**
Father Skilled Worker	0.16	0.16	**0.996**	0.20	0.19	**0.896**
Father Unskilled Worker	0.74	0.75	**0.947**	0.63	0.64	**0.872**
Tap Water	0.60	0.59	**0.935**	0.66	0.65	**0.939**
Province: Liaoning	0.03	0.03	**0.986**	0.03	0.03	**0.957**
Province: Heilongjiang	0.04	0.04	**0.973**	0.04	0.04	**0.998**
Province: Jiangsu	0.10	0.10	**0.946**	0.10	0.11	**0.938**
Province: Shandong	0.05	0.05	**0.956**	0.01	0.01	**0.578**
Province: Henan	0.21	0.22	**0.781**	0.10	0.11	**0.940**
Province: Hubei	0.15	0.15	**0.983**	0.24	0.23	**0.767**
Province: Hunan	0.16	0.15	**0.878**	0.10	0.11	**0.966**
Province: Guangxi	0.20	0.20	**0.940**	0.12	0.13	**0.926**
1993	0.18	0.18	**0.944**	0.20	0.20	**0.995**
1997	0.29	0.29	**0.994**	0.23	0.24	**0.766**
2000	0.22	0.23	**0.966**	0.21	0.19	**0.662**
2004	0.15	0.15	**0.891**	0.10	0.11	**0.911**

Source: CHNS, 1991-2006.

Table 2. 9 Balance Checking of Confounders

(Children with Sick Mothers)

Confounding Covariates	Treatment Type: Father Sick			Treatment Type: Father V. Sick		
	Mean in Treated	Mean in Untreated	p-value for diff	Mean in Treated	Mean in Untreated	p-value for diff
Father Health Status (1-4)	2.29	2.29	**0.961**	2.28	2.28	**0.954**
Father has Medical Insurance	0.15	0.14	**0.870**	0.21	0.21	**0.977**
Father Age	36.80	36.89	**0.867**	36.13	36.15	**0.951**
Rural	0.63	0.63	**0.979**	0.70	0.70	**0.977**
Equivalent HH Income (log)	8.44	8.43	**0.864**	8.41	8.42	**0.856**
Father Years Schooling	5.82	5.80	**0.963**	6.37	6.37	**1.000**
Father Drinking Frequency	5.74	5.74	**0.979**	5.69	5.70	**0.954**
Either Parent Cadre	0.08	0.08	**0.972**	0.03	0.03	**0.941**
Father Farmer/Hunter/Fisherman	0.63	0.63	**0.912**	0.60	0.60	**0.980**
Father Skilled Worker	0.08	0.08	**0.959**	0.12	0.12	**0.995**
Father Unskilled Worker	0.74	0.74	**0.916**	0.72	0.72	**1.000**
Tap Water	0.57	0.58	**0.963**	0.68	0.68	**0.949**
Province: Liaoning	0.04	0.04	**0.974**	0.06	0.06	**0.964**
Province: Heilongjiang	0.02	0.01	**0.742**	0.06	0.06	**0.994**
Province: Jiangsu	0.09	0.09	**0.932**	0.13	0.13	**0.999**
Province: Shandong	0.05	0.05	**0.910**	0.07	0.07	**0.948**
Province: Henan	0.13	0.13	**0.912**	0.16	0.16	**0.983**
Province: Hubei	0.15	0.15	**0.970**	0.09	0.09	**0.998**
Province: Hunan	0.05	0.05	**0.854**	0.13	0.13	**0.946**
Province: Guangxi	0.26	0.26	**0.963**	0.13	0.13	**0.980**
1993	0.21	0.21	**0.976**	0.15	0.16	**0.974**
1997	0.30	0.31	**0.926**	0.21	0.21	**0.984**
2000	0.16	0.16	**0.957**	0.17	0.17	**0.998**
2004	0.14	0.13	**0.895**	0.18	0.18	**0.935**

Source: CHNS, 1991-2006.

Table 2. 10 ATT Effects of Parental Health Shocks on Children's School Enrolment (6-17-Year-Olds)

	Sick Father Sample	Very Sick Father Sample	Sick Mother Sample	Very Sick Mother Sample
Father Sick	**-1.239***			
	(0.678)			
Father Very Sick		**-1.759****		
		(0.802)		
Mother Sick			**-0.864**	
			(1.065)	
Mother Very Sick				**-1.850****
				(0.734)
Child Is Sick/Injured	0.192	-0.200	-0.196	-0.153
	(0.204)	(0.171)	(0.207)	(0.231)
Equivalent HH Income (log)	0.102	-0.005	0.143	-0.069
	(0.162)	(0.171)	(0.145)	(0.137)
Number of Siblings	0.728***	0.533**	0.360*	0.500**
	(0.215)	(0.268)	(0.185)	(0.205)
Neighborhood Prevailing Wage (log)	0.102	0.015	0.017	-0.132
	(0.234)	(0.253)	(0.197)	(0.194)
Primary School in Neighbourhood	-0.489	-0.487	0.171	-0.449
	(0.369)	(0.483)	(0.384)	(0.430)
Junior High School in Neighbourhood	0.142	0.296	0.141	0.640**
	(0.323)	(0.371)	(0.292)	(0.307)
Senior High School in Neighbourhood	-1.106*	-1.095*	-0.889	-1.200**
	(0.571)	(0.651)	(0.700)	(0.534)
6-11 Years Old	6.240***	6.136***	5.661***	5.360***
	(0.843)	(0.769)	(0.745)	(0.614)
12-15 Years Old	3.499***	2.981***	3.163***	2.997***
	(0.517)	(0.515)	(0.479)	(0.434)
Observations	1192	1134	1242	1314
Pseudo R^2	0.613	0.599	0.564	0.565
Wald Test	74.48***	85.29***	90.22***	107.45***

Notes: Coefficients reported in the table are log odds ratio. (2) Standard errors in parentheses, clustered at the household level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Child age and wave dummies are included in the regressions but not reported here. Figures shown in the table are log odds ratio.

Table 2. 11 Robustness Check: ATT Effects of Parental Health Shocks on Children's School Enrolment (11-17-Year-Olds in Post-Shock Year)

	Father Sick	Father Very Sick	Mother Sick	Mother Very Sick
Father Sick	**-2.486***			
	(1.308)			
Father Very Sick		**-2.343*****		
		(0.823)		
Mother Sick			**-0.720**	
			(0.716)	
Mother Very Sick				**-1.652***
				(0.852)
Child Is Sick/Injured	0.061	-0.145	-0.245	-0.107
	(0.148)	(0.177)	(0.325)	(0.322)
Number of Siblings	0.389	-0.001	0.086	0.236
	(0.298)	(0.357)	(0.283)	(0.248)
Equivalent HH Income (log)	0.368*	0.666**	0.484**	0.015
	(0.213)	(0.270)	(0.240)	(0.256)
Neighbourhood Prevailing Wage (log of)	-0.150	0.150	0.013	-0.165
	(0.264)	(0.274)	(0.210)	(0.239)
Junior High School in Neighbourhood	0.211	0.718	0.503	0.621*
	(0.451)	(0.458)	(0.408)	(0.363)
Senior High School in Neighbourhood	0.007	-0.723	-0.389	-1.095
	(1.050)	(1.395)	(1.062)	(0.836)
Observations	676	698	760	748
Pseudo R^2	0.599	0.645	0.629	0.576
Wald Test	99.66***	108.55***	148.32***	127.35***

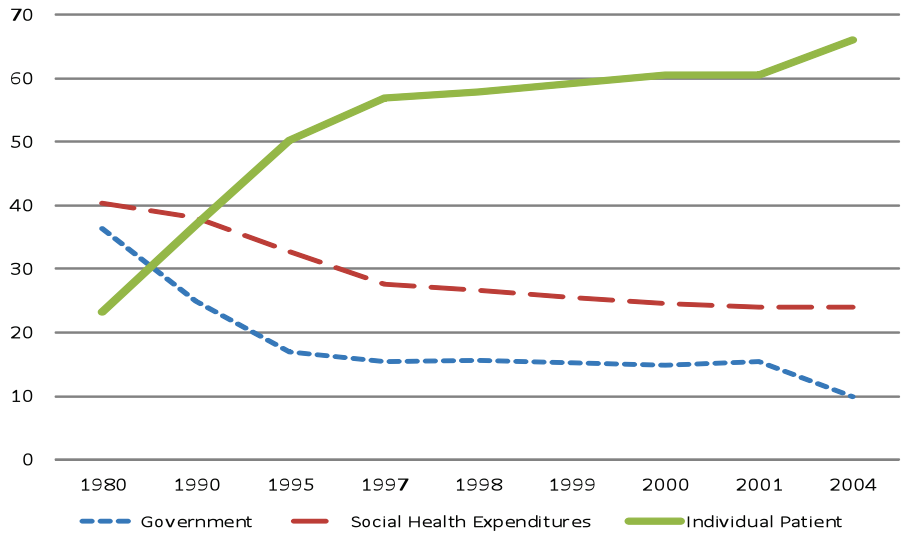
Notes: Coefficients reported in the table are log odds ratio. Standard errors in parentheses, clustered at the household level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Child age and wave dummies are included in the regressions but not reported here. Figures shown in the table are log odds ratio.

Table 2. 12 The Role of Out-of-Pocket Health Expenditure (6-17-Year-Olds)

	Outcome Variable: Child's School Enrolment											
	Father Sick			Father Very Sick			Mother Sick			Mother Very Sick		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Father Sick	-1.239*	-1.266*	-0.739									
	(0.678)	(0.692)	(0.791)									
Father Very Sick				-1.759**	-1.519	-1.362						
				(0.802)	(0.980)	(1.022)						
Mother Sick							-0.864	-0.745	-0.560			
							(1.065)	(1.027)	(1.006)			
Mother Very Sick										-1.850**	-1.632*	-1.611*
										(0.734)	(0.846)	(0.842)
Father Total OOP Payment		**-0.0004*** **			**-0.004***							
		(0.0001)			**(0.002)**							
Father OOP Payment (Treatment Sought)			**-0.0001**			**-0.008****						
			(0.0006)			**(0.004)**						
Father OOP Payment (No Treatment Sought)			**-0.032**			**-0.001***						
			(0.029)			**(0.001)**						
Mother Total OOP Payment								**-0.001**			**-0.000**	
								(0.002)			**(0.000)**	
Mother OOP Payment (Treatment Sought)									**-0.003**			**-0.0002**
									(0.008)			**(0.0006)**
Mother OOP Payment (No Treatment Sought)									**-0.395****			**0.001**
									(0.175)			**(0.002)**
Equivalent HH Income (log)	0.102	0.102	0.101	-0.005	-0.006	-0.007	0.143	0.145	0.149	-0.069	-0.067	-0.066
	(0.162)	(0.162)	(0.162)	(0.171)	(0.171)	(0.171)	(0.145)	(0.145)	(0.144)	(0.137)	(0.137)	(0.137)
Observations	1192	1192	1192	1134	1132	1132	1242	1242	1242	1314	1312	1312
Pseudo R^2	0.613	0.613	0.613	0.599	0.598	0.598	0.564	0.564	0.564	0.565	0.564	0.564
Wald Test	74.48***	112.89***	109.25***	85.29***	86.62***	86.14***	90.22***	90.41***	90.01***	107.45***	110.49***	116.37***

Notes: Coefficients reported in the table are log odds ratio. Standard errors in parentheses, clustered at the household level. * p < 0.1, ** p < 0.05, *** p < 0.01. The model specification used in the table is the same as the one used in Table 10. Other covariates controlled in the regressions include: child's own chronic or acute condition, prevailing wage rate in the neighbourhood/village, availability of schools, child age and wave dummies.

Figure 2. 1 Changes in Health Spending in China (1980-2004), by Source

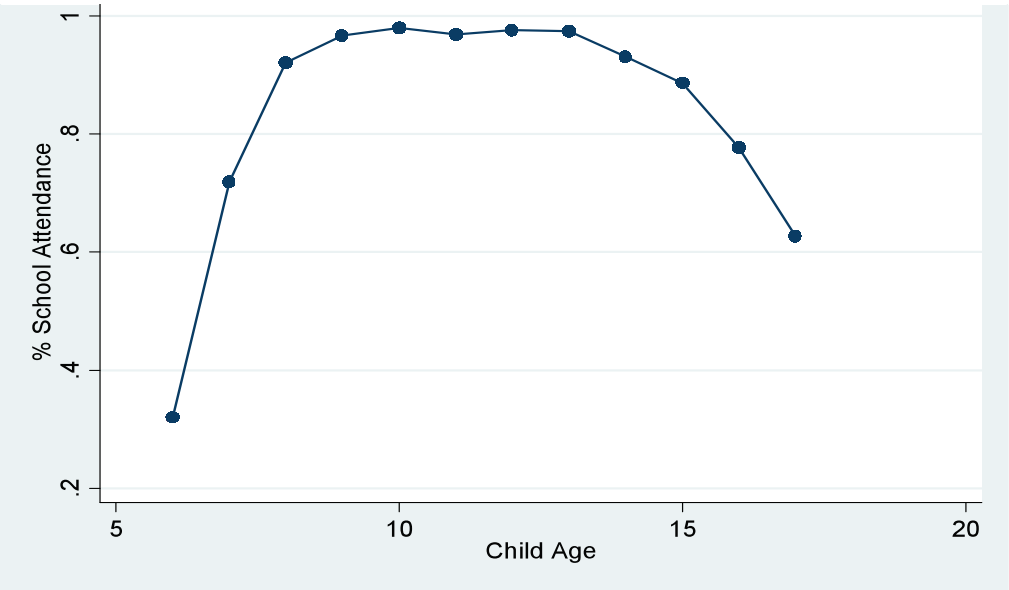


Source: China Ministry of Health, China Health Statistics Yearbook (Beijing: MOH, 2005)

Figure 2. 2 Map of Survey Regions

Source: CHNS website: http://www.cpc.unc.edu/projects/china/proj_desc/chinamap.

Figure 2. 3 School Enrolment Rates (6-17 Year Old)



Source: CHNS, 1991-2006.

Figure 2. 4 Probability of School Dropout (6-17 Year Old)

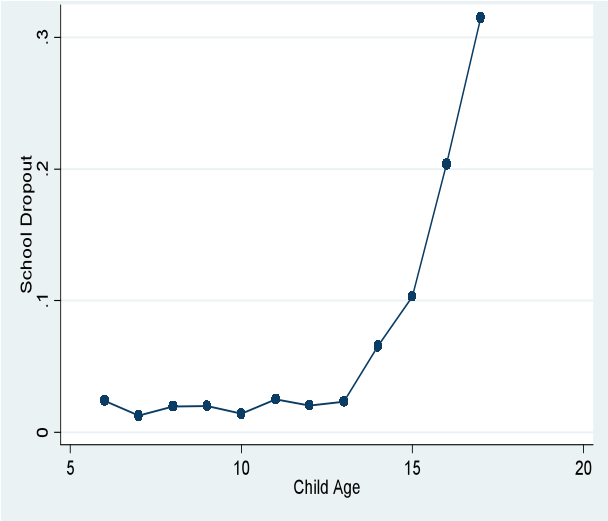
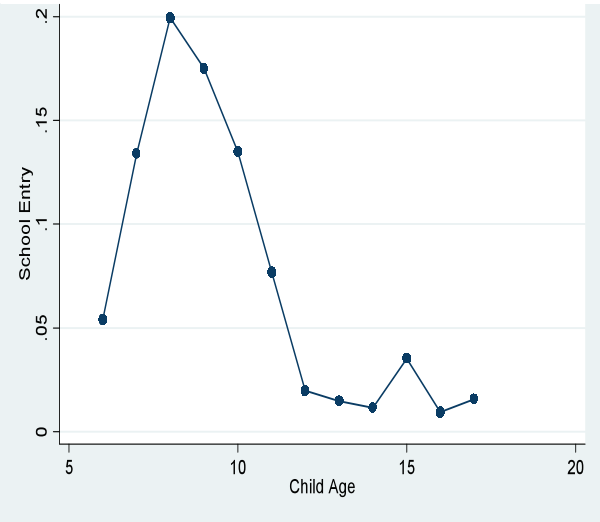
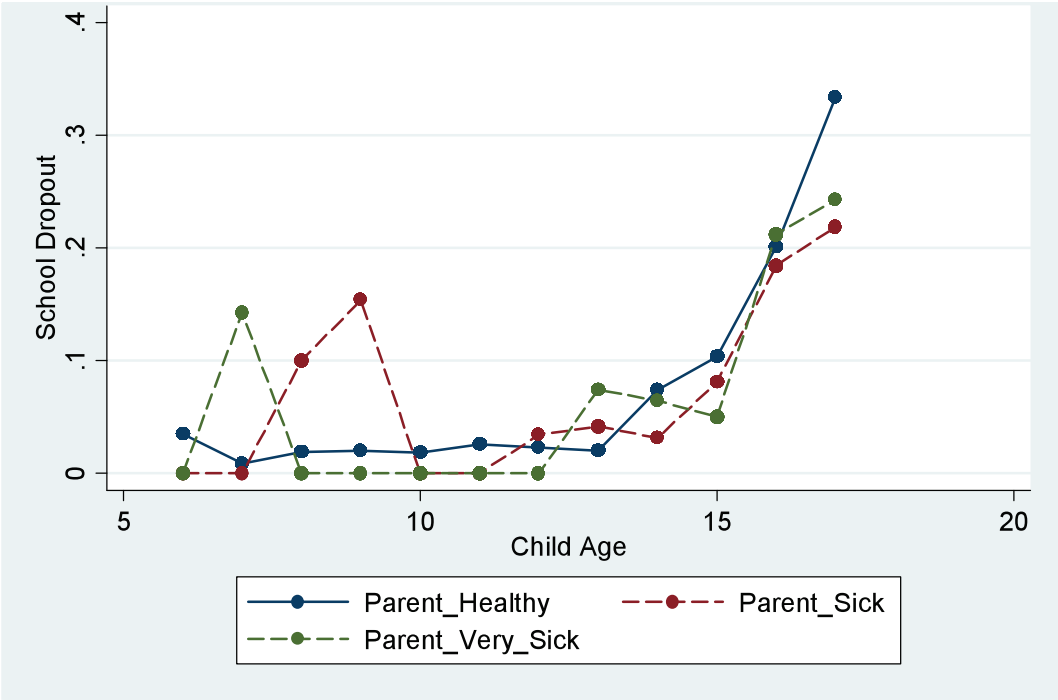


Figure 2. 5 Probability of School Entry (6-17 Year Old)



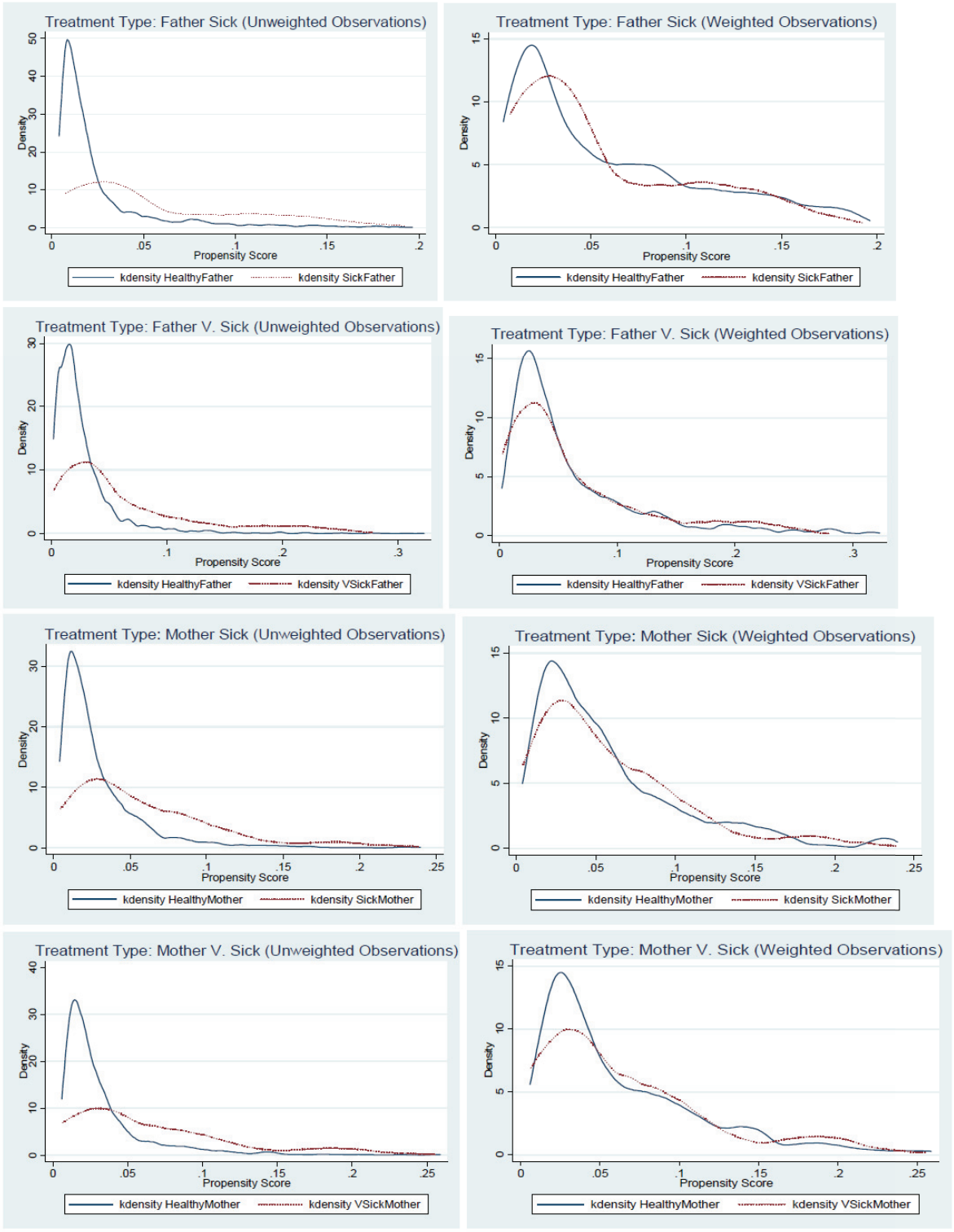
Source: CHNS, 1993-2006.

Figure 2. 6 School Dropout by Parental Illness (Onset)



Source: CHNS, 1993-2006.

Figure 2. 7 Distributions of Estimated Propensity Scores



CHAPTER 3
DOES PARENTAL DISABILITY REDUCE EQUALITY OF OPPORTUNITY? - EVIDENCE FROM CANADA'S LONGITUDINAL SURVEY OF CHILDREN AND YOUTH (NLSCY)

3.1 Introduction

According to the 2006 Participation and Activity Limitation Survey (PALS), 2.8 million working-age Canadians, comprising 12.4% of the total Canadian population, reported at least one physical or mental limitation that impedes their normal activities. Many of them are also parents. The 2006 National Longitudinal Survey of Children and Youth (NLSCY), in the same year counted 1.8 million children under the age of 15, or about one in six, who lived with at least one disabled parent. From a life-cycle perspective (Figure 3.2), as a child ages from 6 until 26 years of age there is a 20% of chance that he / she will live with a parent who has a disability at one point in time, a 6% chance that the parent suffers from a chronic / recurrent disability, and a 9% chance that his / her disability affects activities such as going to school or holding a job.

Given its widespread prevalence, this study analyzes association between parents' functional status and their children's educational attainment at the post-secondary level using data from Statistics Canada's National Longitudinal Survey of Children and Youth (NLSCY). Specifically, this paper asks: (1) Are young adults who had parents ever suffering from an activity limitation in the past less likely to participate in post-secondary education (PSE) as compared with other young adults whose parents were never disabled? (2) Are the parental disability effects different for disabilities of differing duration and functional domain? (3) If so, do adverse outcomes matter primarily because of the limited human capital acquisition in early years, or through other channels, such as loss of financial resources, or time spent caring for the parent?

Past research finds that relative to the non-disabled, families with disabled members are more likely to incur high medical costs, receive low wage rates, experience future job loss, and thus have substantially lower levels of economic well-being in spite of public

income support programs (Currie and Madrian 1999; Haveman and Wolfe 2003). A recent Canadian publication, based on data from the 2006 PALS (Federal Disability Report, 2009, pp37-42), suggests a significant income gap between Canadians with and without disabilities (Figure 3.4). Measured in 2006 constant dollars, the average total income was $25,840 for working-age adults with disabilities and $35,800 for working-age adults without disabilities. Seniors with disabilities also had lower total average incomes than seniors without disabilities, but they seemed to fare slightly better than working-age adults with disabilities both in terms of income level and change over time.

Insufficient income can increase a family's risk of not being able to afford basic necessities such as nutritious food or housing. It can trigger behavioural responses of other non-disabled family members. For example, non-disabled spouses, particularly wives, may alter labour supply (Gallipoli and Turner, 2011) or adult children, especially young women, may change optimal time allocation between human capital accumulation and care-giving (Choi 2010). The additional demands on both family resources (e.g. extra money to build wheel-chair ramps, buy hearing aids, or pay "deductibles" on drugs) and time commitment (e.g. medical appointments or hospital stays) that is not reflected in the total income may also lead to less parental involvement in child-rearing activities when the father is disabled (Morefield, 2011). In fact, a small, but growing body of literature has already found the onset of a negative parental health event adversely affects the skill formation and human capital in early years of childhood, including both cognitive and non-cognitive (e.g. behavioural / emotional) outcomes, for both developing and developed countries (Jacoby and Skoufias 1996; Rosenzweig and Wolpin 1993; Thomas et al. 2004; Chen 2009; Bratti and Mendola 2011). However, little is known yet about the long-term implications of parental disability, particularly for the more severe cases – children who had a parent suffering from a chronic / recurrent disability - that is, to what extent does this early life disadvantage translate into lower future chances of success for children when it comes to post-secondary education?

This study adopts a comprehensive approach that controls for a large number of observables on parental background, family income, and children's educational

aspirations and high school achievement at ages 12-15 (the closest age range when they are observed prior to PSE) in order to address the intergenerational effects of disability on children's PSE attendance, and to investigate the potential mechanisms underlying the PSE attendance / parental disability relationship in Canada. The rationale for this approach is twofold. First, one objective of the study is to identify and estimate the implications for children who had parents suffering from chronic / recurrent disabilities. Therefore, the pre-shock / post-shock empirical strategies used in other studies to tackle unobserved heterogeneity cannot be employed in the current context. Second, studies of PSE participation argue that decisions to pursue higher education, in a developed country setting, are influenced by three main factors (Finnie et al. (2010) for a comprehensive review): information / motivation, academic preparation, and finances. For example, having appropriate knowledge about available programs, standards for admission, costs and benefits associated with PSE participation and future prospects is key for potential students' decision-making, particularly for students facing multiple barriers to participation (Looker and Lowe, 2001; Berger et al., 2007). Whether young people have the desire to go on to PSE is equally important (Berger et al., 2007). In addition, achievement in high school, such as attitudes toward school, involvement in extra-curricular activities, and part-time employment also contribute to the PSE participation decision (Belzil and Hansen, 2006). Finally, family income, PSE costs, as well as the structure of financial aid (i.e. loans versus cash transfers), are the most extensively studied factors, although there is a lack of consensus on the relative importance of financial aid in shaping the PSE attendance / income relationship.

Meanwhile, the literature on the dynamic process of skill formation (Carneiro and Heckman, 2002; Keane and Wolpin, 2001; Todd and Wolpin, 2006) suggests these factors may be entangled. Specifically, high-income parents have stronger preferences and aptitudes for education, which they transmit to their children. Those parents also tend to invest more and better resources in the development of their children's scholastic abilities from the youngest age. Based on this view, investigating PSE participation necessitates taking accounting of differences in academic ability (e.g. the cumulative product of past parental investment, preferences and expectations), access to parental

funds at the time of enrolment (e.g. liquidity constraint), children's own characteristics (e.g. susceptibility of parental inputs), as well as local labour market conditions.

The NLSCY is the best dataset available in Canada for this topic as it contains information on both parents' activity limitation and children's PSE status, irrespective of whether the child is living in the parental home at the time of the survey. A host of variables measuring youth's "ability" and "preferences" at different developmental stages prior to choosing PSE are made available in the NLSCY. Some are computed from objective tests and are not based on any type of recall, as compared, for example, with the YITS dataset (Lefebvre and Merrigan, 2008). Others are reported by the youth and are indicative of non-cognitive skills that have not been thoroughly investigated elsewhere.

Most importantly, the NLSCY enables tracking youth from childhood through early adulthood for 12 years. This longitudinal structure allows for a construction of a history of activity limitation for both the mother and the father, of a long-run average family income measure, as well as allowing for a distinction between "temporary" and "permanent" disability.

Focusing on a sample of Canadian youth in the range of 18-21 observed in 2006 and 2008, who are not disabled themselves, this study finds a considerable adverse impact of parental disability on youth's access to PSE after simultaneously controlling for family income and a host of observable "child achievements" in high school measured at ages 12-15. This is an outcome that is neither efficient nor equitable for society as a whole. [24] Furthermore, the size of the parental disability effect increases when the disability is recurrent or chronic, and when the disability impedes human capital accumulation or productivity on the job. Thirdly, a significant mother-father difference is apparent, with children, especially boys, who had a father suffering from a disability being hit the hardest. Finally, parental disability is strongly associated with a lower family long-run

[24] As noted by Belley et al. (2011), "if borrowing constraints or other barriers (e.g. a lack of information) discourage or prevent economically disadvantaged youth from attending post-secondary institutions, then outcomes are likely to be inefficient as well as inequitable".

income. The loss in financial resources is considerably larger for families with a disabled father, for families where the disabled member suffering from a chronic / recurrent disability, and importantly, parental income plays a significant role explaining PSE attendance across models, which implies that low income is likely the leading mechanism. This result highlights the important role that has been, and could be, played by social safety nets for the disabled in protecting their children from the negative consequences of parental disability. Intervention at early ages directed at children who have parents suffering from disabilities, and measures that help families with a disabled parent to care for the family may also help to increase PSE attendance.

The paper is organized as follows. Section 2 and 3 discuss conceptual issues. Section 3 introduces the dataset, analytic sample, and variables used specifically for estimation. Section 4 describes modelling strategies and regression results. Sections 5 present robustness checks. Sections 6 and 7 conduct a simulation exercise and conclude the paper.

3.2 Measuring Function and Disability

In general, disability is often defined as a physical, mental or psychological condition that impedes a person's activities. In the past it has been viewed as a problem resulting solely from medical conditions, and residing solely in the affected individual, and thus interventions usually included medical rehabilitation and the provision of social assistance. This medical interpretation has recently been replaced by the social model of disability that conceptualizes a person's level of functioning or disability as a dynamic interaction between their health conditions, environmental factors, and personal factors (International Classification of Functioning, Disability, and Health (ICF), World Health Organization). Thus, if the environment is designed for the full range of human functioning and incorporates appropriate accommodations and supports, people with functional limitations would not be "disabled" in the sense that they would be able to fully participate in society. Interventions therefore should not be only at the individual level (e.g. medical rehabilitation) but also at the societal level, for example the introduction of universal design to make infrastructure more accessible, inclusive

education systems, and community awareness programs to combat stigma (Haveman and Wolfe, 2003; Mont, 2007).

The International Classification of Functioning, Disability and Health (ICF) proposes that disability, rather than being an "all or nothing" concept, should be classified according to a description of functional domains. It distinguishes among *impairment*, the physiological and psychological functions of body systems, such as deafness or blindness, *activity limitations* in performing core daily activities, for example getting dressed or climbing stairs, and *participation restrictions* in activities fulfilling different economic and social roles, such as being able to hold a job, do home chores, or care for children. Since the experience of disability is closely shaped by environmental and personal factors, for the purpose of the study, it is more appropriate to use the latter two measures as they focus on functional effects, rather than a condition itself (being medically-diagnosed or not). For example, the loss of limbs may not necessarily translate into an activity or participation limitation if the community accommodates a person's functional status. Alternatively, given a certain chronic condition, it could have a minor impact on someone's life if managed properly, or lead to a series of unnecessary complications.

In addition, different degrees of disablement can have varying impacts on someone's life, for example the duration of the disability, and the severity of the disability (total, severe, partial). Identifying the differential effect of various limitations highlights the heterogeneity of the population of people with disabilities, and also helps policymakers to uncover the most damaging barriers that need to be addressed.

Given the disability information available in the NSLCY, this study focuses on three aspects of disability: incidence, duration, and functional domain. In years 1994, 2000, 2002 and 2004, the survey asked the "Person Most Knowledgeable" or PMK of children under age 15: *"Because of a long-term (i.e. a condition or problem that lasts for more than six months) physical or mental condition or a health problem, are/is ... limited in the kind or amount of activity you/he/she can do: 1) At home? 2) At school? 3) At work? 4) In other activities such as transportation to or from work or leisure time activities? 5) In*

caring for children?" Consequently, an "incidence" measure is constructed if the PMK answered yes to any of the above questions for him/herself or his / her spouse/partner. A set of "duration" indicators are created if a disability was reported on one versus more than one survey rounds. As mentioned in the next section, since the NLSCY is conducted every two years, a disability reported on more than one survey round would correspond to a functional restriction that was recurring or lasted for more than two calendar years. Through the analysis, these parents are labelled as those with "chronic" or "recurrent" disabilities. Finally, a third measure breaks a disability into three functional domains. A disability is "work-limiting" if it limits the respondent at work, in other work- or human capital-based activities, transition to or from work, leisure, or other activities. A disability is "childcare-limiting" if the individual reports being limited in caring for children. A disability is "home-limiting" if it limits other activities at home, but does not directly limit capacity at work, school or transition to and from work.

There are 1,634 youth aged 18 to 21 in the sample who lived in two-parent families, and who did not have a disability themselves (Table 3.1 and Figure 3.3). [25] Out of the total, 29% lived with one parent suffering from a disability at at least one point in time, 8% lived with a parent suffering from a permanent disability that lasted for longer than two years, and 12% had a parent whose disability restricted functions at school, work, transition to or from work, leisure, or other activities. [26]

It is possible that a parent experienced limitations in performing tasks in multiple functional domains. Table 3.2 shows pairwise correlation coefficients among reported parental disability of different functional domains. For both fathers (corr coefficient = 0.77; $p<0.01$) and mothers (corr coefficient = 0.80; $p<0.01$), limitations felt at school /

[25] See also next section for more details on sample selection and rationale etc.

[26] Note the "disability rates" reported in Table 3.1 represent percentages of youth who had disabled parents among total young population of the same age range, since the unit of analysis of the NLSCY is the youth. Furthermore, they reflect "life-cycle" as opposed to "cross-section" prevalence of disability due to the historical perspective taken in this study. Therefore these figures are not directly comparable to those routinely reported by, for example, the Census or the Participation and Activation Limitation Survey (PALS).

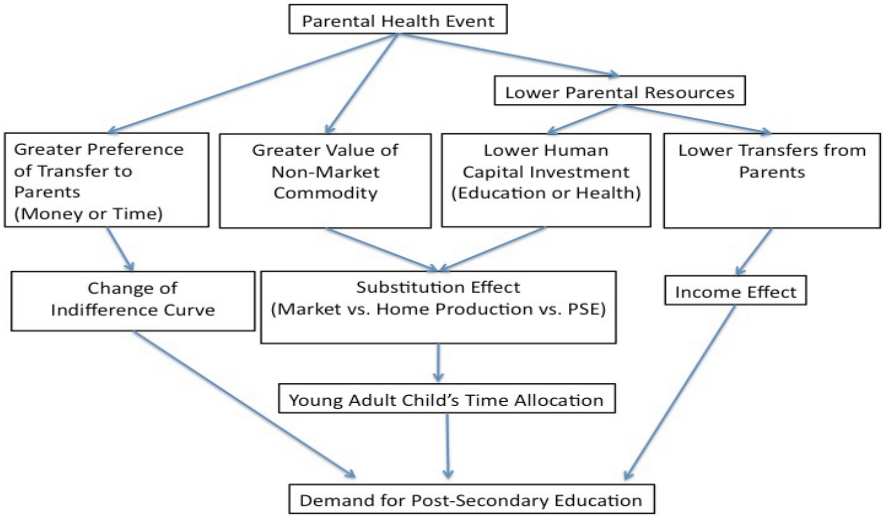
work / transportation are most likely to be associated with limitation felt at home. More than half of fathers (corr coefficient = 0.56; $p<0.01$) and mothers (corr coefficient = 0.65; $p<0.01$) who reported a limitation at home also reported a limitation caring for children. In general, a husband who is functionally limited at work / school / transportation, and home is less likely to have a wife who is also limited in the same domain, and vice versa.

3.3 Health: A Mechanism for Intergenerational Economic Linkage

Parents' resources play a major role in mitigating economic hardship, and can determine the long-term trajectory of children's education, health, and subsequent success in adulthood. For post-secondary education participation, several Canadian studies have found that parental life-course characteristics (e.g. parents' education, family structure, and transitory family income shocks) have a more noticeable effect on post-secondary participation than do child factors, such as Grade Point Average in high school (Finnie et al. 2004; Coelli 2005). However, very little research has explicitly considered the role of parental negative health events in affecting a child's access to post-secondary education.

In an analysis of the intergenerational transfer of time and money, Choi (2010) proposes a theoretical framework of how parents' health events might influence their adult children's schooling choices and/or working status (Figure 3.1). With poor parental health, a child's human capital level is likely lower because of reduced parental resources or diminished productivity of time that parents spend with him/her. Parental illness may also trigger an up-streaming transfer (both time and money) from a child to the parent. Meanwhile, holding market wage constant, a child may be more likely to stay at home caring for the sick parent as productivity in home production may increase due to a greater opportunity cost. These hypothesized changes can reshape the adult child's preferences, constraints, and decisions among market activity, home production, and schooling choices.

Figure 3. 1 Pathways between Parental Health Event and Children's PSE Participation



Source: This flow chart is borrowed from Choi (2010) with minor modifications.

A growing body of literature has found evidence linking children's lower achievement to a negative parental health event in both developing countries and developed countries. In these studies, the health event is often measured by a drop in self-reported over-all health rating or the discovery or diagnosis of a medical condition. Most attention is devoted to the onset of illness in the short-run (e.g. Jacoby and Skoufias 1996; Rosenzweig and Wolpin 1993; Thomas et al. 2004; Chen 2012; Bratti and Mendola 2011; Morefield 2011). Focusing on illness onset creates a methodical advantage by being able to tackle the potential endogeneity of illness with conventional econometrics techniques. However, some very serious conditions may be missed with "onset", for example blindness or deafness at birth. In addition, short-run analysis could well under-estimate the true costs of illness by not allowing a sufficiently long period of time for it to take full effect.

One contribution of this study to the previous literature is thus to make a first attempt to identify this least advantaged group - parents with "permanent" disabilities – and to estimate how differing duration of the disability alters parental investment in children and the resulting schooling outcomes of children. Furthermore, relative to the measures of self-evaluated health, the measures of disability used in this study are derived based on a well-defined checklist of questions, which may provide more comparability across

respondents. [27] Third, this is the first study in the literature of the effects of parental health to explicitly investigate the role of family income after controlling for a host of observable adolescent outcomes in high school, and how it relates to differing disability duration and types. The results are in line with previous studies on the relationship between schooling, ability, and family income.

Haveman and Wolfe (1994), Morefield (2010) and Cuong and Mont (2011) use measures of functional status to examine the intergenerational effects of parental ill-health in either a developed or developing country context. Haveman and Wolfe (1994) study children using the U.S. Longitudinal Panel Study of Income Dynamics who lived with a household head that reports a work-limiting disability at a point in time. Their work suggests that living with a disabled parent for ten years during childhood lowers the probability of high school graduation by 11.8 percentage points and leads to three fewer years of completed schooling. Morefield (2010) investigates the effect of the onset of parental health events measured by the diagnosis of health conditions that limit work activities of the parent on children's cognitive and non-cognitive skill development in the U.S. His results indicate that parental health impairs only non-cognitive skills (when a father is afflicted), and that conditions related to a vascular or cancerous condition bear more negative consequences, and that sons are more negatively affected than daughters.

Defining disability as limitations in basic activities including seeing, hearing, walking, cognition, communication, and self-care, Cuong and Mont (2011) provide evidence from Vietnam that activity limitation among parents reduces the school attendance rate of their school-aged children (6-17) around 8.1 percentage points from 81.3 percent to 73.2 percent. Again, they find the effect tends to be larger for boys, and they find an especially strong effect of parental disability on children aged from 15 to 17.

[27] Plus, while disability can involve pain or poor health, not all people with disabilities are sick. For an instance, people with serious and persistent disabilities often report experiencing (subjectively) a good or excellent quality of life when to others it would appear that their capacity is limited.

The above studies generally find some differences in the maternal versus paternal disability effects and in the effects for sons versus daughters. This is likely, since, as shown by many studies on family economics, the behavioural response to health shocks will be different for women than for men. For example, husbands tend to increase labour supply when wives are disabled, while wives are less likely to alter theirs when husbands are disabled (the nursing effect) (Berger 1983; Berger and Fleisher 1984). Similarly, adult sons and daughters may be affected differently by the same parent's disability if daughters are more likely to assume the role of providing long-term care for disabled parents while sons tend to seek supplementary jobs to compensate for lowered family income (Caputo 2002; Houtven 2009). Given these findings, I examine heterogeneity in the effects of parental disability according to both the sex of the disabled parent and the sex of the child.

3.4 Data

The NLSCY is the best available dataset in Canada to study the intergenerational effects of disability. It is a nationally representative survey of Canadian children and youth with the first cycle being conducted in the fall of 1994 and the spring of 1995, and targeting children aged 0 to 11 years old. Every two years, the original cohort was re-interviewed. A new cohort of children aged 0-1 years were also added to the longitudinal sample and then followed up until they reached the age of 25 in 2008. A unique advantage of the NSLCY is that it provides information on both parents' activity limitation and measures of the social environment, learning, behaviour, and emotional well-being collected from different developmental stages of a child. For each selected child under 17 years of age, a question is asked to identify who in the household is most knowledgeable about the child (PMK). The PMK then provides the information for each selected child and for him/herself and him/her spouse/partner.

3.4.1 Post-Secondary Education Participation

The outcome variable examined in this study is whether youth at ages 18 to 21 go to college. This is the age range when youth traditionally complete high school, and attend / complete a post-secondary education, given all Canadian provincial governments

mandate students to enter grade one the year the child turns 6 (Oreopoulos 2006). [28] This variable is coded to be one if a youth reported having completed a post-secondary education, or being enrolled in a post-secondary program at ages 18-21, and zero otherwise. Post-secondary education here refers to any type of schooling higher than high school, such as two-year colleges, Quebec's CEGEP, or four-year universities. As a result, a non-PSE participant may have repeated grades in high school, chosen to leave school early, stopped after high school graduation, dropped out in the middle of a post-secondary program, or taken time off between high school graduation and post-secondary studies for more than 3 years. In this sense, the probability of PSE attendance analyzed here is unconditional on high school graduation, and therefore represents the total effect of parental disability on both high school completion and post-secondary enrolment. [29]

3.4.2 Adolescent Outcomes

To investigate the role of past achievement, a set of measures on youth's cognitive and non-cognitive skills, behavioural problems, attitudes toward school, educational aspiration and self-assessed academic aptitude are included in the analysis.

Cognitive ability is represented by the standardized math test score. The test is a shorter version of the Mathematics Computation Test from the Canadian Achievement Test (2nd edition) and is designed to measure a child's basic competencies in math (addition, subtraction, multiplication and division of integers, etc.). Children are given different versions of tests based on their school grades. The score ranges from 0 to 750.

[28] It is also common among Canadian youth to delay entry to PSE for a short period of time after high school graduation. The relatively wide age range considered in this paper thus factors in the potential "gap years" taken between high school and post-secondary studies. Besides, though it remains controversial regarding whether a gap year is beneficial, there is clear evidence that the risk of non-completion increases with the length of the gap, especially when the gap years are not well-structured, or the choices are made out of necessity for youth who need extra time to earn and save money for their post-secondary studies.

[29] Depending on provincial legislation, children who started school in provinces that adopted a school entry age cut-off date later than early September and happened to be born after the cut-off date may still be in high school at age18. In a robustness check, I replicate the analysis for the sample that excludes 18-year-olds and find highly similar results.

In the psychology literature, hyperactivity and aggression are considered to have played important roles in child development. The NLSCY derives both measures from youth self-reports to a series of component questions (see Appendix A). The hyperactivity score is derived based on seven statements about whether the child has trouble sitting still or is restless, is easily distracted, is inattentive etc. The physical aggression score is derived from six questions about whether the child gets into many fights, reacts with anger and fights when hurt by someone else, bullies, is mean to others etc. For each component question, a child responds in three categories: none, sometimes, often, which is assigned a value of zero, one, and two, respectively. The final score is a sum of the value received from each component question.

In addition, Heckman et al. (2006) in their analysis of the effect of cognitive and non-cognitive abilities on labour market outcomes and social behaviour use scales of "locus of control" and "self-esteem". Since the emotional quotient is asked only in cycles 5 and 6, and cannot be used in the current analysis, I include two ratings of pro-social behaviours and general-self or self-esteem to capture non-cognitive skills. The pro-social score considers ten dimensions of a child's thoughtfulness, sharing and helpfulness, for example, whether showing sympathy to someone who has made a mistake, trying to help someone who has been hurt, comforting another young person who is crying or upset etc. The overall self-esteem is measured by asking if a child likes the way they are; if things about them are good; if they have a lot to be proud of when doing something, did they do it well etc.

Finally, children's academic aptitude, attitudes toward school and educational aspirations are assessed through the following questions: (1) How well do you do at school? (2) How much do you like school? (3) How far do you want to go in school? For the first two questions, children can indicate their answers as very much/very well, quite/well, a bit/ average, not so much/poorly, and hate/very poorly. For the latter, children have a choice of junior high, senior high, college/CEGEP, university, and more than university. The bottom two categories of each measure are grouped in order to obtain sufficient observations for each cell.

Family income is measured as the average of equivalent family income [30] after transfers before taxes (2008 constant dollars) taken over the years during which a child aged from 6 to 15 years of age. In the main section of the analysis, regression results are reported using two measures of mediators, linear and separate quartiles dummies. The linear form is a finer measure and also enables a more parsimonious model specification. Separate quartiles on the other hand, allow for non-linearity, and to some degree, potentially reduce the multi- collinearity problem that may otherwise arise especially among the set of adolescent outcomes (e.g. the incidence of behavioural problems, math test scores, and subsequent self-image). In the results that are not reported in the paper, alternative specifications of the family income variable (i.e. deciles, quadratic, and cubic) are also tried. These specifications yield qualitatively similar results.

3.4.3 Descriptive Statistics

The empirical analysis is based on data from two cohorts of youth aged between 18 and 21 in 2006 and 2008. For each youth, parental disability status is observed at ages 12-15, and again either in early adolescence at 10-13 or in childhood at 6-9, given the two-year interview interval and missing disability data in years 1996 and 1998. [31] As discussed in Section 2, three measures of parental disability are constructed based on a series of disability questions in the NSLCY to reflect the incidence, duration / recurrent episodes, and functional domain of the disability. [32]

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[30] Luxemburg Income Study (LIS) equivalence scale (i.e. the square root of family size) is applied to calculate the equivalent family income.

[31] In years 1996 and 1998, these questions were only asked of new households or new members of a household to the survey and omitted most respondents in the longitudinal sample.

[32] Due to data limitation, these measures of parental disability are defined slightly differently for the two cohorts. I tested pooling restrictions by adding in interaction terms between parental disability variables and the cohort dummy. No systematic pattern was found using models presented in the main analysis of the paper.

Since the attrition rate of youth between 14/17 and 16/19 years is quite high compared to youth in other age ranges in the NLSCY, [33] and also family structural change (e.g. divorce or re-marriage) is often the most influential factor for children's skill development which would be difficult to separate from the effects of parental disability at the same time, I restrict the analysis to children who stayed in the same two-parent family and were present in the survey up to ages 12-15, and of course, 18-21 of age when the PSE attendance is observed. Moreover, certain disabling conditions can be transmitted through genetics. In order to focus attention on the effect of parental disability, and to avoid its effect being confounded with that of child's own health problems, 66 children who have disabilities themselves are excluded from the analytical sample.

Figures 2.5-2.7 show a cross-tabulation of post-secondary education participation status observed at ages 18-21, family long-run equivalent income averaged over ages 6-15, and standardized math test scores collected at ages 12-15 (the closest age range when they were observed prior to PSE) for sampled youth by their parents' functional status. The post-secondary education attendance rate is significantly lower for youth of parents with disabilities relative to their peers. Noticeably, there is a close correspondence in the pattern of mediators, such as family long-run equivalent income and math test score. Finally, these gaps increase drastically with the length of parental disability.

Table 3.3 provides more descriptive information on adolescent outcomes and basic characteristics of youth by their parents' functional status. In general, growing up with a disabled parent relates to less favourable outcomes, especially for children with chronically disabled parents, and for cognitive skills (i.e. math test scores) and educational aspirations and attitudes toward school. Also significant are the "gaps" in parental socio-economic status. For example, parents in families with a disabled member are much more likely to have lower education than their non-disabled counterparts - 14% and 18% of married mothers and fathers in families with a disabled member dropped out

[33] For example, after excluding non-respondents to the youth questionnaire, child questionnaire and those with unknown educational status at ages 18 to 21, 2,106 youth aged 14 to 17 was in the NLSCY in 2002. However, 1,140 of them dropped out in 2004. These 1,140 youth then returned to the survey in 2006.

of high school whereas the corresponding figures are only 9% and 14% for those in "normal" families. Compared to peers of non-disabled parents, youth living with disabled parents were slightly older. They are more likely to live in step families, have fewer siblings, and have a PMK who was an immigrant.

Based on these descriptive evidence, it is natural to conjecture that there may also be unobserved differences between these families that may have influenced a youth's post-secondary education decision. However, two characteristics of this study lessen the concerns about the effects of unobserved heterogeneity. First, achievement of children is closely linked to the family environment (e.g. investments, genetic endowments, values, similar experience made in life). Particularly, many studies argue that parental investment in children is most important during the early years. Simultaneously controlling for children's achievement before the post-secondary education decision is taken and family long-run average income directly reduces the effects of unobserved heterogeneity. Second, as an aid to assess the extent of potential bias, I examine the patterns among a temporary limitation, chronic disability and the level of family permanent income for families with and without a disabled parent, for families who had parents experiencing different duration of disability, and for only-father-disabled versus only-mother-disabled families.

All regressions employ longitudinal sampling weights to take account of the non-response bias and the sample design. Therefore, the results are representative of the longitudinal cohorts of 18-21 year olds in 2006 and 2008. All standard errors are estimated using the bootstrap weights provided by Statistics Canada (1000 replications), corrected for heteroskedasticity and serial correlation over time at the household level.

3.5 Regression Results

3.5.1 Total Effects of Parental Disability

I start with a total effect of parental disability on PSE participation by estimating a logit model for the pooled sample:

$$\Pr ob(PSE_{i,18/21}) = \Lambda(DIS_{i,6/15}, X_{i,12/15}) \qquad (1)$$

$PSE_{i,18/21}$ is a youth i's post-secondary education attendance observed at ages 18-21, $DIS_{i,6/15}$ represents parental disability history, $X_{i,12/15}$ contains baseline characteristics that potentially affect a youth's decision to pursue post-secondary education. This model is estimated with two specifications. The first specification includes demographics such as youth's age (three dummies for 19, 20 and 21 years, 18 is the base), gender (one dummy for boy), number of siblings, rural residence, the PMK's immigration status, both mother and father's age and age squared, family structure (one dummies for step or adoptive family, two biological-parent family is the base), and cohort dummy. Provincial unemployment is also included to capture local labour market conditions and therefore the opportunity cost aspect of PSE participation. [34] As detailed later, the educational system in Quebec is different from that of the rest of Canada. Additional robustness checks are performed to ensure that the results are not driven by this regional difference. The second specification adds in both parents' education level (three dummies for high school, post-secondary diploma and university degree, less than high school education is the base). For parents suffering from disabilities that limit school activities, lower education itself may be a channel through which children are indirectly affected. Controlling for parental education thus is expected to reduce the observed PSE attendance gap.

Due to data limitation, for variables that have different values over the cycles, such as siblings, step family status, and occasionally, parental education, I use for the estimations the value for ages 12-15. This is the closest age range prior to PSE participation when most children can be observed (as discussed before, attrition rates for youth aged 16-17 are quite high in the NLSCY). Experiments are also conducted using alternative values of

[34] Existing research also suggests that the rate of people experiencing disabilities is higher among the Aboriginal population than in the general population, and that having a disability can compound other disadvantages many Aboriginal people experience. The idea to include a proxy for Aborginal identity in the regression, however, was frustrated by the extremely few Aborginal children present in the sample (less than 1%), given the fact that NLSCY surveys non-institutionalized, civilian child population in Canada's 10 provinces.

these variables: (1) the initial value for these variables when the youth was first observed at ages 6-9, together with indicators for changes in these variables (e.g. ever experienced a change in the family status during 6-15), and (2) averaged value of these variables over past cycles when the data are available. For the sake of brevity, these results are not reported in this paper but they produce similar results to the ones reported in this paper and are available upon request.

Table 3.4 reports odds ratio from estimated logit models. Estimates for the set of basic covariates are fairly stable across disability measures. The age effects are positive and highly significant, in the range of 2.1-5.6, suggesting that more youth manage to participate in PSE over time. There is also a large gender gap in favour of female students. Being a boy predicts one half of the odds to participate in PSE compared with a girl of similar age. More siblings increase the chance of PSE participation significantly. Parental age, family structure, rural residence, and PMK's immigration status do not affect PSE attendance. Both mother's and father's age seem to be positively correlated with the child's chance of participating in PSE though at a decreasing rate. Living in a step / adoptive family is negatively associated with the odds of participating in PSE. Both parents' education levels matter for children's PSE participation. Having a high-school dropout mother or father decreases significantly the probability of PSE participation when compared with children with either mother or father having a university degree. In addition, the effect of a higher educated mother on children's PSE attendance is considerably larger than that of a father with similar qualification, and a mother's education level is among the most important predictors for college-going behaviour of their children. Note the provincial unemployment rate is highly significant across models, suggesting better job prospects, or higher opportunity costs, deter PSE attendance.

Unconditional on parental education, the occurrence of a parent's disability significantly reduces a youth's odds of participating in PSE to 0.62. Most of the results are driven by children who had parents suffering from chronic / recurrent disabilities that lasted more than 2 years (the odds of PSE participation dropping to 0.54). The addition of parental education levels does not change the estimated coefficients substantially, but it slightly

reduces the negative impact of parental disability by increasing the odds of PSE attendance from 0.62 to 0.64 (incidence) and from 0.54 to 0.57 (chronic / recurrent disability).

3.5.2 Adolescent Outcomes and Family Income as Mediators

I then investigate the mediating roles played by adolescent outcomes and family income by adding in the set of adolescent outcomes observed at 12-15 of age and family long-run average income measure:

$$\Pr ob(PSE_{i,18/21}) = \Lambda(DIS_{i,6/15}, A_{i,12/15,} I_{i,6/15}, X_{i,12/15}) \qquad (2)$$

$A_{i,12/15}$ represents a youth i's achievement in high school measured at adolescent years 12/15, $I_{i,6/15}$ is the average of the equivalent family income (after transfers before taxes) taken over the years when the youth was aged 6-15. Table 3.5 reports the results from two models that additionally control for adolescent outcomes and family income. To allow for non-linearity, Columns (3) and (6) further replicate the models using quartiles dummies of math score, hyperactivity, aggression, self-image, pro-social scores, and family long-run equivalent income variable.

The inclusion of adolescent outcome measures enhances the negative effects of parental disability on PSE participation for both disability measures. Thus, a parent's functional status is a strong and significant predictor of youth's post-secondary education participation even when comparing youth of similar cognitive and non-cognitive skills, attitudes toward school, and educational aspirations at ages 12-15. Importantly, in addition to cognitive achievement - youth math test scores - the "ability proxy" used in most existing literature, the set of non-cognitive or behavioural outcomes, such as physical aggression and self-assessed school success appear to be significant predictors for PSE attendance, though cognitive achievement is the most influential factor in predicting PSE attendance across models. Specifically, a child who scored in the top two quartiles in math tests is 7 and 2.9 times, respectively, more likely to participate in PSE relative to youth with math scores in the bottom quartiles. Youth who exhibited more signs of conduct disorder / physical aggression also have lower odds of PSE participation.

In this case, most results are driven by children who exhibited the most severe symptoms (possibly clinical levels) of conduct disorder / physical aggressions.

The inclusion of family income measures generally diminishes the negative effects of parental disability on PSE participation by increasing the odds of PSE participation (except for the income quartile specification for chronic / recurrent parental disability). Also noticeable is that the long-run average family income quartiles are positive and significant on their own. Living in a family with long-run average income in the top one and two quartiles predict higher odds of participating in PSE, by approximately 1.6 and 1.8 points, respectively compared to a youth from the bottom quartile of the income distribution. Given the strong correlation between children's achievement in high school and family income, finding a moderate income effect on PSE participation after controlling for the comprehensive set of adolescent outcomes produces promising evidence that family financial resource might be one of the paths that relate parental disability to lower PSE participation.

3.5.3 Effects for Disability of Differing Duration and Functional Domain: Mothers Compared to Fathers

The mother-father pattern of parental disability effect can shed light on pathways that may have been hidden behind the parental disability effects found earlier. In order to obtain the cleanest estimates possible, children who had both parents suffering from disabilities (66 children), the least well-off group, are excluded from the analytic sample.

Table 3.6 reports results from using disability measures of incidence and duration. First, consider the set of conventional determinants of PSE participation. Although not reported in the paper, the significant covariates are almost the same as in the preceding estimations. The next thing to notice is that youth in families in which only fathers are disabled are significantly less likely to participate in PSE than their peers with non-disabled parents. The effect of mother's disability, however, turns out to be much smaller in magnitude and insignificant. Thirdly, the inclusion of long-run average family income measure diminishes the adverse impact of paternal disability for youth who lived with

fathers suffering from a temporary disability, while it enhances the paternal disability effect for youth whose fathers suffered from a permanent disability, suggesting the existence of other channels that operate independent of family financial resources in determining a youth's post-secondary education participation. Finally, family income explains PSE participation only for youth who had fathers suffering from disabilities.

Table 3.7 reports results based on the disability measure of functional domain. Most previous results are driven by youth who had fathers suffering from limitations at school / work / transportation and caring for children.

The distinct effects of a mother's versus a father's disability on PSE participation tends to suggest that the consequences of a father's disability may be primarily monetary in nature. As discussed in the next section, Table 3.9 documents a considerable loss in financial resources that is associated with the father's disability. If youth from high-income families are more likely to participate in PSE, as suggested by many studies (e.g. Corak et al. 2003; Frenette 2007; Drolet 2005), this suggests a mechanism through which fathers' disability might reduce children's PSE participation rate. On the other hand, a mother's disability may be more likely to operate through non-monetary investment, for example, parental nurturance, time spent with children, since mothers may tend to be primarily responsible for childcare. Previous literature on the human capital impact of parental death (Case and Ardington (2006), Adda et al. (2011)), health shock (Bratti and Mendola (2011)), or migration (Cortes (2010)) have found evidence supporting this hypotheis. [35]

3.5.4 Effects for Sons versus Daughters

In the preceding estimations, the gender indicator is also always one of the strongest and most robust predictors for PSE participation. Table 3.8 shows estimated results of parental disability obtained from separate regressions for male and female children.

[35] For example, Case and Ardington (2006) find that, after controlling for endogeneity of parental death, paternal deaths have very small and statistically insignificant effects on children's developmental outcomes. Cortes (2010) shows that children with migrant mothers are more likely to lag behind in school compared to children with migrant fathers, supporting the fact that mother's absence has a stronger detrimental effect on child achievement than father's absence.

The results suggest that, unconditional on family income, a father's disability significantly reduces the probability of attending PSE for both sons and daughter. This pattern holds true across different measures of parental disability.

However, once family long-run average income is included, the estimated effects of paternal disability on sons diminish. Interestingly, given paternal disability, family income predicts boys' college-going decision but not girls'. Local job market prospects also significantly and negatively affect boys' PSE participation whereas girls' behaviour is much muted compared to the estimates for boys.

These results confirm previous findings that adult sons and daughters may be affected differently by the same parent's disability if daughters are more likely to assume the role of providing long-term care for disabled parents while sons tend to seek supplementary jobs to compensate for lower family income.

3.6 Robustness

3.6.1 Evidence on the Endogeneity of Parental Disability

In order to assess the extent to which a parent's disability is endogenously determined by family income, Table 3.9 presents results on the relationship among disability incidence, duration and the level of family permanent income.[36] A priori, we would expect the relationship to become stronger for a more serious or lengthy disability. Also, a father's disability should relate more strongly to the level of family income than a mother's disability. The pattern shown in Table 3.9 generally conforms to this prediction. Relative to families of non-disabled parents, the incidence of both a father's and a mother's disability predicts lower family permanent income. When the duration of the disability is taken into consideration, the effects of a father's disability, especially long-term disability increases substantially. Families with a disabled father who suffers from an activity

[36] When running regressions, a comprehensive set of covariates that are generally considered as "determinants" to a family's long-term family income is controlled. They include child's age and gender, number of siblings, number of adult in family, province of residence, survey year, whether live in rural area, the PMK's immigration status, family structure (i.e. step family), mother and father's education, age, and employment status when the youth aged 12-15. For the sake of brevity, however, only coefficients on parental disabilities are reported.

limitation that lasts for more than two years have 28% lower permanent income than families where neither parent is disabled. Moreover, this impact is more than one third larger than that of a mother's disability. Since the unit of analysis of the NSLCY is the child/youth, the lower panel of Table 3.9 replicates the analysis by randomly keeping one observation per family. As shown, a highly similar pattern is found for this sub-sample.

3.6.2 A More Flexible Model Specification

Todd and Wlopin (2006) stress that the coefficient associated with school achievement should not be restricted to be the same across the child's age for two reasons: (i) to capture the cumulative effect of achievement, and (ii) to allow for heterogeneity in how achievement affects PSE participation with respect to the child's age. With this specification, the coefficient on past achievement, for example, the math test score measure at ages 12 to 15 is allowed to differ when the lag corresponds to the math test score measured at age 10 to 13. As a robustness check, I also estimate a more flexible model specification:

$$\Pr ob(PSE_{i,18/21}) = \Lambda(DIS_{i,6/15}, A_{i,12/15,}A_{i,10/13,}A_{i,8/11}, A_{i,6/9}, I_{i,6/15}, X_{i,12/15}) \qquad (4)$$

The large number of covariates included in this model results in considerably smaller sample size. I therefore do not include results from model (4) in the current version of the paper; but they are qualitatively similar to the ones reported here, and are available upon request.

3.6.3 Excluding 18-Year-Olds and Quebec Respondents

Since all Canadian public schools admit students into school once a year, students born after the provincial entry age cut-off will graduate from high school one year later than those born before the cut-off. Furthermore, compared to the rest of Canada, Quebec has a very different educational system. Students in Quebec begin with college following graduation from Grade 11. They then complete a two- or three-year general program leading to admission to a university, or a professional program leading directly into the labour force. Therefore the usual age of graduation from high school is 17 in Quebec while it is 18 in other Canadian provinces. In order to more accurately identify the group of youth who are actually eligible for PSE enrolment, for the rest of Canada, I perform

two experiments: (1) excluding 18-year-olds who were born outside of Quebec; and (2) excluding Quebec residents observed at ages 12-15. Both generate qualitatively similar results.

3.7 Discussion of the Results

Before proceeding to conclusions, I calculate the marginal effects of key core covariates based on the most comprehensive specification for a "representative" youth that may be useful for policy analysis. Because all of the adolescent outcomes controlled in the regressions are from the time the youth is 12-15, and the family income is averaged over the past twelve years from 6 to 15 years, the results can be interpreted as the differences in the probability of choosing PSE between two youth with the same high school "achievement" or "ability" at 12-15 and the same family income level from 6-15 years of age. Thus, the only difference between the children is parental functional status.

The estimated average parental disability penalty together with marginal effects of other significant predictors in the (logits) models ($p<0.10$) are reported in Table 3.9. The reference case is a hypothetical young man at the age of 21 who likes school quite a bit or very much, thinks him/ herself doing well or very well at school, wants to go to (four-year) university or higher, lives with biological and non-disabled parents, has 1 sibling, with both parents holding a high school degree. Predictions based on the linear model hold all other continuous variables at the national mean, while those based on the quartile model assume the youth is located in the second income quartile, second math quartile, second aggression, self-esteem and pro-social skills quartile.[37]

These results reinforce the conclusions in the previous section. The occurrence of any parent's disability when a child is aged 6-15 diminishes the probability of participating in

[37] For binary variables, I change the value from zero to one, recalculate the probability, and take the difference between the new probability and the baseline case. In the case of continuous covariate, I fix the value at the mean of the variable in the sample and then estimate the effect of a continuous variable by increasing it by one standard deviation, re-computing the baseline probability with this new value and take the difference between this probability and the baseline probability.

PSE at age 21 by 10-13 percentage points from around 80% to 70%. Even a short-term parental disability reduces this probability by 9-11 percentage points, while a long-term disability that lasts for more than two years lowers this probability by 12-18 percentage points.

Cognitive qualifications (math score), behavioural problems (aggression), and self-assessed school success measured at 12-15 of age also appear to be important predictors for PSE participation. It is also interesting to note that the effect of math score is highly non-linear. In particular, increases in probabilities of PSE participation are considerably larger for children in the top quartile than for children in the second or third quartile (i.e. the difference between top and middle quartiles is greater than between bottom and middle quartiles).

Conditional on adolescent outcomes, family income, measured as the mean income of the family when the child was aged 6-15 has a moderate, yet significant impact on PSE participation. Most of the family income effects are concentrated on children from top-half backgrounds (i.e. top two quartiles of the income distribution). These results suggest that financial aid policies or tuition fee waiver programs made available at the time when the PSE participation decision is taken have the potential of helping disadvantaged youth in low income families in terms of boosting PSE attendance, even though the effects might be relatively moderate as compared to that of intervention in early years. More specifically, assuming a half standard deviation increase in the log of equivalent family income potentially increase children's PSE attendance rate by 2.9 percentage points (column 1 of Table 3.10; linear model) from 0.803 to 0.832, it takes around a 1.81 standard deviation increase in the equivalent income per family, approximately $43,000 to boost the PSE attendance to national average for children living with a disabled parent.

In order to gauge the relative importance of the above-mentioned predictors, Figures 3.8 and 3.9 illustrate the marginal effects reported in Table 3.10 in the order of estimated magnitude. Clearly math score is the most important correlate of PSE participation. However, the adverse effect of a long-term parental disability is larger than that of

moving a youth from the bottom to top income quartile. The short-term parental disability penalty is smaller and is similar in magnitude to moving the youth from bottom to the second quartile in the income distribution.

3.8 Conclusion

Growing up with a disabled parent imposes considerable risk of being exposed to financial distress and many other problems that may interfere with child development and skill formation. This paper uses the longitudinal features of Statistics Canada's National Longitudinal Survey of Children and Youth (NLSCY) cycles 1-8 to investigate the long-term consequences of parental disability for children's participation in post-secondary education.

Defining disability to be an activity limitation in usual activities that may result from a physical or mental condition, this study identifies youth who have parents suffering from disabilities of differing duration and functional domains, and separately estimates how parents' different functional status alter post-secondary schooling outcomes of their children.

After controlling for family long-run average income and "achievement" at ages 12-15, results suggest youth who lived with a parent with a disability have a lower probability of PSE participation. The effects of maternal disability are more muted compared to those of paternal disability. Given that paternal disability is associated with considerably more financial loss relative to maternal disability and family income plays a significant role explaining PSE participation, low income / poverty may be one of the underying mechanisms through which fathers' disability reduces children's PSE participation rate.

Parental disability also affects boys and girls differently. The results are consistent with previous findings that adult sons and daughters may be affected differently by the same parent's disability if daughters are more likely to assume the role of providing long-term care for disabled parents while sons tend to seek supplementary jobs to compensate for lowered family income.

These findings have two policy implications. First, policies that aim to improve the financial situation of families with a disabled parent may help to increase PSE participation. Second, targeted income supplement programs alone, may not be able to completely eliminate the observed achievement gap. The specific importance of paternal disability is also likely to be caused by the fact that the father is the traditional breadwinner. If the negative health event that results in activity limitation imposes stress on a father from which he cannot shield the child, or causes a decrease in the potential time and resources a mother can invest into her child's development (e.g. added worker effect), there is scope to introduce measures that support families of fathers affected by disabilities, especially recurrent or long-term disabilities. For example, additional support by external caregivers or more flexible working times for non-disabled mothers in order to care for the family may be effective measures.

Finally, I point out limitations of this study: (1) Even though regressions in this study carefully control for a range of measures for children's cognitive and non-cognitive ability, and also allow for its cumulative effect to vary according to a child's age, the identification is based on the assumption that residuals and unobservable characteristics are orthogonal. (2) Because the disability questions were only asked of parents with children aged 15 or under, I am confined to examine enrolment in post-secondary education, which to some degree, is not a true representation of educational attainment.

Table 3. 1 Life-Cycle Prevalence of Parental Disability

	All Children in the NLSCY (Time of Observation: Aged 6-25 who were also observed in 2006 and 2008)	Children in the Analytical Sample (Time of Observation: Aged 18-21)
Neither Parent Disabled	6510 (73.08%)	1151(70.44%)
Any Parent Disabled	2397 (20.52%)	483 (29.55%)
Any Parent Disabled < 2 Year / Non-Recurrent	1828 (20.52%)	351 (21.48%)
Any Parent Disabled > 2 Year / Recurrent	569 (6.38%)	132 (8.07%)
Only Mother Disabled	1088 (12.21%)	208 (12.66%)
Only Father Disabled	977 (10.96%)	209 (12.72%)
Function Domain (at a point in time)		
- Limited at work	852 (9.56%)	207 (12.66%)
- Limited at home	1114 (12.50%)	259 (15.85%)
- Limited caring for children	474 (5.32%)	118 (7.22%)
- Limited in transportation to and from work or other activities	1023 (11.48%)	248 (15.17%)
Total	8907	1634

Notes: 1. Parental disability (Disability Duration < 2 Years / Non-Recurrent) is defined if a parent reported an activity limitation on one NSLCY survey round when a youth aged between 6 and 15 years. “Disability Duration > 2 Years / Recurrent” refers to youth whose parents reported an activity limitation on two NSLCY survey rounds. 3. The analytical sample includes all non-disabled youth aged 18-21 observed in 2006 or 2008 living in two-parent families with non-missing value to any variables used in the regression. Note the “disability rates” reported in Table 3.1 represent percentages of youth who had disabled parents among total young population of the same age range, since the unit of analysis of the NLSCY is the youth. Furthermore, they reflect “life-cycle” as opposed to “cross-section” prevalence of disability due to the historical perspective taken in this study. Therefore these figures are not directly comparable to those routinely reported by, for example, the Census or the Participation and Activation Limitation Survey (PALS).

Table 3. 2 Correlation among Parental Disability of Different Function Domain

	Mother Limited at Work \ Transportation	Mother Limited at Caring for Children	Mother Limited at Home	Father Limited at Work \ Transportation	Father Limited at Caring for Children	Father Limited at Home
Mother Limited at Work \ Transportation	1.000	-	-	-	-	-
Mother Limited at Caring for Children	0.636*** (0.000)	1.000	-	-	-	-
Mother Limited at Home	0.803*** (0.000)	0.650*** (0.000)	1.000	-	-	-
Father Limited at Work \ Transportation	-0.069*** (0.005)	-0.048 (0.51)	-0.072*** (0.003)	1.000	-	-
Father Limited at Caring for Children	-0.037 (0.133)	-0.026 (0.295)	-0.038 (0.119)	0.538*** (0.000)	1.000	-
Father Limited at Home	-0.064** (0.010)	-0.044 (0.073)	-0.066*** (0.007)	0.773*** (0.000)	0.562*** (0.000)	1.000

Notes: Pairwise correlation coefficients are reported. P-values are in parentheses: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 3. 3 Sample Characteristics and PSE Participation,
by Parental Disability Duration / Recurrent Episode

	Parents Not Disabled	Any Parent Disabled < 2 Years / Non-Recurrent	Any Parent Disabled > 2 Years / Recurrent
	(1)	(2)	(3)
PSE Attendance (18-21)			
PSE Participation (18-21)	0.69	0.61	0.54
	Family Income		
Log of Equivalent Family Long-Run Income (6-15)	45642	41405	33371
Cognitive and Behavioural Scales (12-15)			
Math Score (12-15)	554	552	539
Hyperactivity (12-15)	10.54	9.96	10.65
Aggression (12-15)	8.59	8.55	8.81
Self-Image (12-15)	13.12	12.89	13.06
Pro-Social (12-15)	12.61	12.63	13.43
Attitude, Educational Aspiration, and Self-Assessed School Success (12-15)			
Like School? – No (12-15)	0.43	0.41	0.47
Like School? – Average (12-15)	0.42	0.46	0.37
Like School? – Very Much (12-15)	0.15	0.13	0.16
How far want to go? – HS (12-15)	0.07	0.07	0.13
How far want to go? – College (12-15)	0.17	0.18	0.15
How far want to go? – University (12-15)	0.76	0.75	0.72
Do well at School? – No (12-15)	0.27	0.26	0.26
Do well at School? – Average (12-15)	0.37	0.42	0.32
Do well at School? – Very Much (12-15)	0.36	0.32	0.42
Demographics (12-15)			
Boy	0.44	0.58	0.35
Siblings (12-15)	1.13	1.08	1.01
Child Age 18	0.29	0.33	0.25
Child Age 19	0.23	0.26	0.34
Child Age 20	0.25	0.21	0.14
Child Age 21	0.23	0.21	0.27
Rural (12-15)	0.12	0.12	0.12
Mother University Degree (12-15)	0.22	0.19	0.21
Mother Postsecondary Diploma (12-15)	0.21	0.18	0.18
Mother HS Graduate (12-15)	0.48	0.51	0.44
Mother HS Dropout (12-15)	0.09	0.12	0.17
Father University Degree (12-15)	0.29	0.18	0.21
Father Postsecondary Diploma (12-15)	0.24	0.21	0.10
Father HS Graduate (12-15)	0.33	0.48	0.46
Father HS Dropout (12-15)	0.14	0.13	0.23
PMK is an Immigrant (12-15)	0.11	0.16	0.17
Mother Age	42.32	42.07	41.66
Father Age	44.40	44.87	43.98
Step Family (12-15)	0.08	0.07	0.13
Provincial Unemployment Rate (12-15)	0.074	0.073	0.072
Cohort 2006	0.50	0.49	0.43
Observations	1151	351	132

Notes: These figures are computed for the estimation sample reported in Table 3.4. Definition of the variables is discussed in Appendix A.

Table 3. 4 Estimated Odds Ratio of PSE Participation (Baseline)

	Disability Incidence		Disability Duration / Recurrent Episode	
Any Parent Disabled	0.624**	0.641**		
	(-2.48)	(-2.21)		
Any Parent Disabled < 2 years / Non-Recurrent			0.656*	0.668*
			(-1.92)	(-1.72)
Any Parent Disabled > 2 years / Recurrent			0.546**	0.576*
			(-2.08)	(-1.86)
Boy	0.467***	0.466***	0.463***	0.443***
	(-4.22)	(-4.34)	(-4.23)	(-4.35)
Siblings	1.460***	1.391**	1.459***	1.389**
	(3.26)	(2.52)	(3.24)	(2.50)
Age 19	2.144***	2.416***	2.152***	2.424***
	(3.49)	(3.91)	(3.49)	(3.92)
Age 20	1.886***	2.162***	1.884***	2.159***
	(2.90)	(3.37)	(2.89)	(3.36)
Age 21	4.450***	5.576***	4.483***	5.615***
	(6.17)	(6.46)	(6.20)	(6.48)
Rural	0.820	1.072	0.819	1.069
	(-0.97)	(0.32)	(-0.97)	(0.31)
PMK Immigrant	1.278	1.119	1.285	1.122
	(0.75)	(0.31)	(0.75)	(0.31)
Mother Age	1.278	1.273	1.270	1.265
	(0.83)	(0.78)	(0.80)	(0.76)
Mother Age Squared	0.998	0.998	0.998	0.998
	(-0.54)	(-0.55)	(-0.51)	(-0.52)
Father Age	1.346	1.208	1.356	1.217
	(1.44)	(0.85)	(1.47)	(0.87)
Father Age Squared	0.997	0.998	0.997	0.998
	(-0.134)	(-0.79)	(-1.37)	(-0.82)
Step Family	0.734	0.677	0.741	0.683
	(-1.05)	(-1.33)	(-1.02)	(-1.29)
Provincial Unemployment Rate	1.165***	1.172***	1.165***	1.117***
	(4.22)	(4.30)	(4.20)	(4.29)
Mother University Degree		3.863***		3.837***
		(2.96)		(2.92)
Mother Post-Secondary Diploma		2.270**		2.255**
		(2.36)		(2.32)
Mother High School		1.855**		1.842**
		(2.09)		(2.05)
Father University Degree		3.101***		3.084***
		(2.93)		(2.90)
Father Post-Secondary Diploma		1.080		1.066
		(0.25)		(0.21)
Father High School		1.518		1.505
		(1.46)		(1.43)
N	1634	1634	1634	1634

Notes: 1. Odds ratios from logit regressions are reported. T-statistics are in parentheses and computed based on bootstrapped standard errors (1000 replications). All standard errors are clustered at the household level. 2. Regressions also control for cohort dummy. 3. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 3. 5 Adding Adolescent Outcomes and Family Income as Mediating Factors

	Incidence			Duration / Recurrent Episode		
	Adolescent Outcomes	Family Income (Linear)	Family Income (Quartile)	Adolescent Outcomes	Family Income (Linear)	Family Income (Quartile)
Any Parent Disabled	0.537***	0.566**	0.574**			
	(-2.88)	(-2.58)	(-2.53)			
Any Parent Disabled < 2 years / Non-Recurrent				0.563**	0.588**	0.615*
				-2.21	-1.99	-1.85
Any Parent Disabled > 2 years / Recurrent				0.472**	0.508**	0.474**
				-2.34	-2.15	-2.35
Family Income (Linear)		1.471*			1.463*	
		(1.70)			(1.69)	
Family Income Second Quartile			1.373			1.369
			(1.08)			(1.07)
Family Income Third Quartile			1.695*			1.679*
			(1.74)			(1.72)
Family Income Top Quartile			1.826*			1.803*
			(1.79)			(1.77)
Math Sore (Linear)	1.010***	1.009***		1.010***	1.009***	
	(5.57)	(5.39)		(5.52)	(5.39)	
Math Score Second Quartile			1.536*			1.527*
			(1.69)			(1.66)
Math Score Third Quartile			2.957***			2.964***
			(3.65)			(3.64)
Math Score Top Quartile			8.035***			7.931***
			(4.94)			(4.87)
Hyperactivity (Linear)	0.941	0.945		0.940	0.945	
	(-1.49)	(-1.36)		(-1.50)	(-1.36)	
Hyperactivity Second Quartile			0.845			0.840
			(-0.65)			(-0.67)
Hyperactivity Third Quartile			0.859			0.859
			(-0.51)			(-0.51)
Hyperactivity Fourth Quartile			0.665			0.658
			(-1.14)			(-1.16)
Aggression (Linear)	0.737***	0.729***		0.737***	0.729***	
	(2.98)	(2.89)		(2.97)	(2.89)	
Aggression Second Quartile			0.821			0.832
			(-0.49)			(-0.46)
Aggression Third Quartile			0.632			0.634
			(-1.47)			(-1.45)
Aggression Fourth Quartile			0.496**			0.497**
			(-2.09)			(-2.08)
Self-Image (Linear)	1.072	1.067		1.072	1.067	
	(1.39)	(1.31)		(1.38)	(1.31)	
Self-Image Second Quartile			1.361			1.385
			(1.08)			(1.14)
Self-Image Third Quartile			1.753			1.767*
			(1.87)			(1.91)
Self-Image Fourth Quartile			1.395			1.391
			(0.90)			(0.89)
Pro-Social (Linear)	1.002	1.003		1.003	1.003	
	(0.09)	(0.11)		(0.10)	(0.11)	

Pro-Social Second Quartile			0.650			0.645
			(-1.43)			(-1.45)
Pro-Social Third Quartile			0.893			0.895
			(-0.37)			(-0.36)
Pro-Social Fourth Quartile			0.887			0.885
			(-0.36)			(-0.37)
Liking School? A Bit	0.747	0.751	0.730	0.740	0.746	0.722
	(-1.19)	(-1.17)	(-1.24)	(-1.23)	(-1.20)	(-1.29)
Liking School? Very Much	1.204	1.225	1.205	1.195	1.217	1.193
	(0.54)	(0.58)	(0.53)	(0.52)	(0.56)	(0.50)
Educational Aspiration University	1.638	1.527	1.418	1.638	1.528	1.413
	(1.16)	(1.00)	(0.86)	(1.15)	(1.00)	(0.84)
Educational Aspiration More then University	1.824	1.694	1.643	1.824	1.695	1.639
	(1.46)	(1.28)	(1.27)	(1.45)	(1.28)	(1.26)
Do Well at School Average	1.716**	1.776**	1.878**	1.721**	1.779**	1.885**
	(2.11)	(2.24)	(2.27)	(2.10)	(2.22)	(2.26)
Do Well at School Very Well	2.105**	2.168**	2.339**	2.127**	2.187**	2.379**
	(2.37)	(2.42)	(2.50)	(2.35)	(2.40)	(2.51)
Other Covariates	Yes	Yes	Yes	Yes	Yes	Yes
N	1634	1634	1634	1634	1634	1634

Notes: 1. Odds ratios from logit regressions are reported. T-statistics are in parentheses and computed based on bootstrapped standard errors (1000 replications). All standard errors are clustered at the household level. 2. Statistical significance: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 3. 6 Odds Ratio of PSE Participation: Maternal versus Paternal Disability Effects, by Disability Duration / Recurrent Episode

	All Families		Only Mother Disabled		Only Father Disabled	
Disabled < 2 years / Non-Recurrent	1.272	1.004	1.236	0.982		
(Mother)	(0.71)	(0.01)	(0.66)	(-0.06)		
Disabled > 2 years / Recurrent	0.661	0.624	0.641	0.584		
(Mother)	(-0.99)	(-1.07)	(-1.07)	(-1.25)		
Disabled < 2 years / Non-Recurrent	0.614*	0.637*			0.588**	0.600*
(Father)	(-1.85)	(-1.65)			(-1.98)	(-1.84)
Disabled > 2 years Recurrent	0.518*	0.483*			0.504*	0.470*
(Father)	(-1.68)	(-1.86)			(-1.77)	(-1.95)
Permanent Income (Linear)		1.588*		1.518		1.595*
		(1.83)		(1.54)		(1.66)
Other Covariates	Yes	Yes	Yes	Yes	Yes	Yes
N	1566	1566	1359	1359	1360	1360

Table 3. 7 Odds Ratio of PSE Participation: Maternal versus Paternal Disability Effects, by Function Domain

	All Families	Only Mother Disabled	Only Father Disabled
		Work-Limiting	
Mother Limited at Work / Transportation	0.933	0.858	
	(-0.20)	(-0.44)	
Father Limited at Work / Transportation	0.601*		0.603*
	(-1.77)		(-1.76)
		Childcare-Limiting	
Mother Limited Caring for Children	1.101	0.997	
	(0.19)	(-0.01)	
Father Limited Caring for Children	0.408*		0.407*
	(-1.72)		(-1.72)
		Home-Limiting	
Mother Limited at Home	1.210	1.115	
	0.50	(0.28)	
Father Limited at Home	0.650		0.655
	(-1.33)		(-1.30)
Other Covariates	Yes	Yes	Yes
N	1566	1359	1360

Note: 1. Odds ratios from logit regressions are reported. T-statistics are in parentheses and computed based on bootstrapped standard errors (1000 replications). All standard errors are clustered at the household level. 2. The sample excludes 66 children who had two parents disabled at any point in time. 3. Covariates controlled are identical to those in model (3) and (4) of Table 3.5. 4. Statistical significance: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 3. 8 Odds Ratio of PSE Participation: Effects for Sons versus Daughters

	Boys		Girls	
	By Disability Duration / Recurrent Episode			
Disabled < 2 years / Non-Recurrent (Mother)	1.505	1.199	1.008	0.823
	(0.87)	(0.38)	(0.02)	(-0.47)
Disabled > 2 years / Recurrent (Mother)	0.454	0.437	1.276	1.333
	(-1.25)	(-1.38)	(0.38)	(0.45)
Disabled < 2 years / Non-Recurrent (Father)	0.623	0.725	0.471**	0.421**
	(-1.32)	(-0.88)	(-2.04)	(-2.29)
Disabled > 2 years / Recurrent (Father)	0.349*	0.365*	0.659	0.530
	(-1.81)	(-1.74)	(-0.79)	(-1.15)
Permanent Income (Linear)		2.301**		1.472
		(2.46)		(1.14)
Unemployment Rate at 18/21	1.101**	1.142***	1.026	1.025
	(2.11)	(2.76)	(0.55)	(0.52)
N	743	743	891	891

Note: 1. Odds ratios from logit regressions are reported. T-statistics are in parentheses and computed based on bootstrapped standard errors (1000 replications). All standard errors are clustered at the household level. 2. Covariates controlled are identical to those in Table 3.5. 3. Statistical significance: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 3. 9 Relation of Permanent Family Income with Parental Disability

	All Children	Only Mother Disabled	Only Father Disabled
Incidence - Mother	-0.125***	-0.118***	
	(0.043)	(0.042)	
Incidence - Father	-0.206***		-0.210***
	(0.046)		(0.047)
Disabled < 2 years / Non-Recurrent - Mother	-0.109***	-0.104**	
	(0.043)	(0.043)	
Disabled > 2 years / Recurrent - Mother	-0.174*	-0.162*	
	(0.096)	(0.092)	
Disabled < 2 years / Non-Recurrent - Father	-0.184***		-0.186***
	(0.053)		(0.053)
Disabled > 2 years / Recurrent - Father	-0.274***		-0.283***
	(0.065)		(0.067)
N	1566	1359	1360
	One Observation per Family		
Incidence - Mother	-0.143***	-0.134***	
	(0.048)	(0.048)	
Incidence - Father	-0.224***		-0.225***
	(0.052)		(0.053)
Disabled < 2 years / Non-Recurrent - Mother	-0.134***	-0.126**	
	(0.049)	(0.050)	
Disabled > 2 years / Recurrent - Mother	-0.175	-0.161	
	(0.108)	(0.103)	
Disabled < 2 years / Non-Recurrent - Father	-0.203***		-0.203***
	(0.060)		(0.060)
Disabled > 2 years / Recurrent - Father	-0.287***		-0.294***
	(0.081)		(0.083)
N	1189	1189	1189

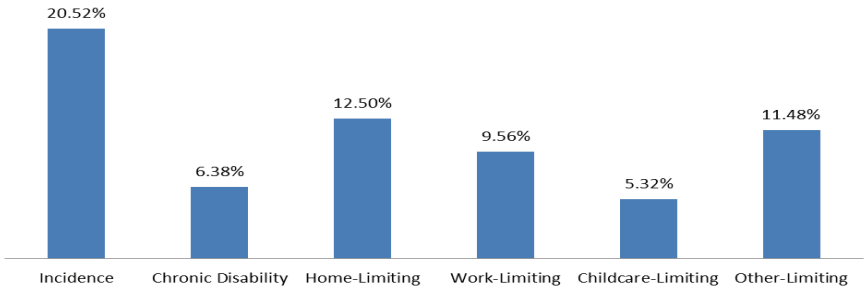
Notes: 1. Coefficients from OLS regressions are reported. Standard errors are in parentheses Bootstrapped errors in parentheses (1000 replications); $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$. 2. The outcome variable is log of real equivalent family income averaged over the past 12 years (2008 constant dollars). 3. Covariates: Child gender, siblings, number of adult in family, child age, rural, PMK immigration status, step mother, step father, mother and father's education, age, and employment, as well as province and survey year dummies.

Table 3. 10 Changes in Probabilities of PSE Participation for Key Core Covariates

	Incidence Model		Duration / Recurrent Episode Model	
	(Linear)	(Quartile)	(Linear)	(Quartile)
Predicted Base Probability for PSE Participation	0.803	0.819	0.803	0.827
Parental Disability Variable				
Any Parent (Non-Disabled -> Disabled)	**-0.105**	**-0.136**	**-0.097**	**-0.118**
Any Parent (Non-Disabled -> Temporarily Disabled)			**-0.128**	**-0.183**
Any Parent (Non-Disabled -> Chronically Disabled)				
Family Income Variables				
Family Long-Run Income (Linear) (- + SD/2)	0.029		0.028	
Family Long-Run Income (Q1 -> Q2)		0.077		0.075
Family Long-Run Income (Q1 -> Q3)		0.114		0.111
Family Long-Run Income (Q1 -> Q4)		0.128		0.124
Adolescent Outcomes				
Math Score (Linear) (- + SD/2)	0.136		0.136	
Math Score (Q1 -> Q2)		0.104		0.102
Math Score (Q1 -> Q3)		0.208		0.205
Math Score (Q1 -> Q4)		0.309		0.302
Aggression (Linear) (- + SD/2)	-0.053		-0.053	
Aggression (Q1 -> Q2)		0.126		0.117
Aggression (Q1 -> Q3)		-0.015		-0.020
Aggression (Q1 -> Q4)		-0.026		-0.034
Self-Image (Linear) (- + SD/2)	0.025		0.025	
Self-Esteem (Q1 -> Q2)		0.074		0.078
Self-Esteem (Q1 -> Q3)		0.121		0.121
Self-Esteem (Q1 -> Q4)		0.074		0.073
Do Well at School? (Not So Much/Hate -> A Bit)	0.106	0.155	0.106	0.155
Do Well at School (Not So Much/Hate -> Very Much)	0.095	0.172	0.095	0.172
Demographic Factors				
Boy (Boy -> Girl)	-0.104	-0.187	-0.104	-0.186
Siblings (- + SD/2)	0.160	0.065	0.038	0.063
Age 19 (18 -> 19)	0.076	0.134	0.076	0.133
Age 20 (18 ->20)	0.019	0.057	0.020	0.057
Age 21 (18-> 21)	0.195	0.285	0.197	0.290
Step Family (Intact -> Step)	-0.003	-0.016	-0.002	-0.013
Mother University Degree (Less than HS -> University)	0.084	0.144	0.083	0.142
Mother Post-Secondary Diploma (Less than HS -> Diploma)	0.051	0.039	0.050	0.087
Mother High School (Less than HS -> HS)	0.028	0.042	0.027	0.040
Father University Degree (Less than HS -> University)	0.079	0.120	0.079	0.117
Unemployment Rate (- + SD/2)	0.082	0.133	0.082	0.130
N	1634	1634	1634	1634

Notes: Figures in this table show zero to one change for binary variables (and one standard deviation change for continuous variables, if applicable) in terms of the predicted probability of participating in post-secondary education. Calculations are based on the most comprehensive model specification, and only variables that are significant ($p<0.10$) are reported.

Figure 3. 2. Life-Cycle Prevalence of Parental Disability among All Children (Aged from 6-25)



Source: NLSCY (1994-2008). Note the sample includes all children aged 16-25 in 2006 and 2008 whose parental functional status was observed since 6/9 in the NLSCY.

Figure 3. 3 Life-Cycle Prevalence of Parental Disability among Non-Disabled Children in Two-Parent Families (Children in Analytic Sample, Aged from 6-21)

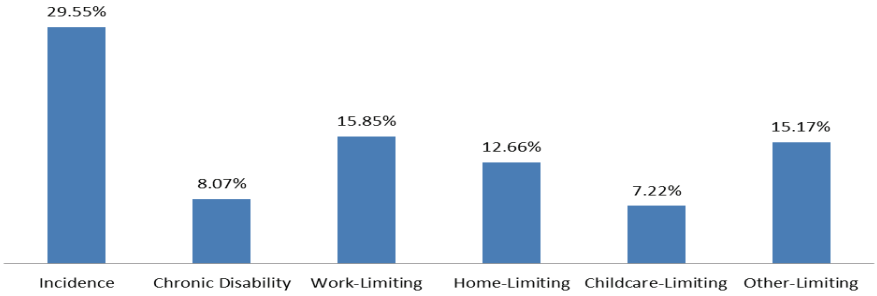
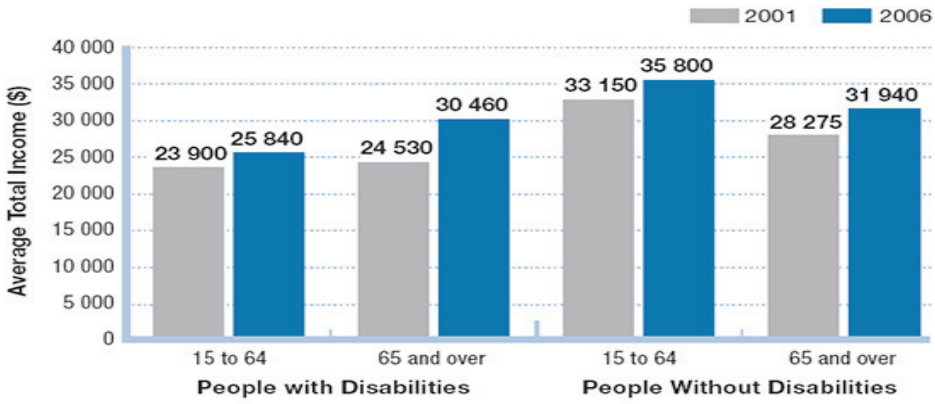
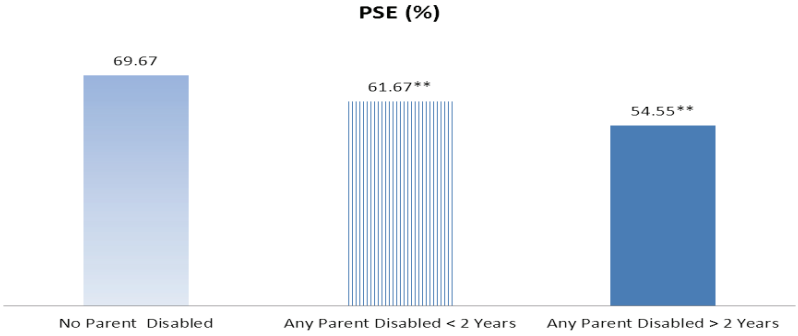


Figure 3. 4 Average Total Incomes by Age and Disability Status, 2001 and 2006



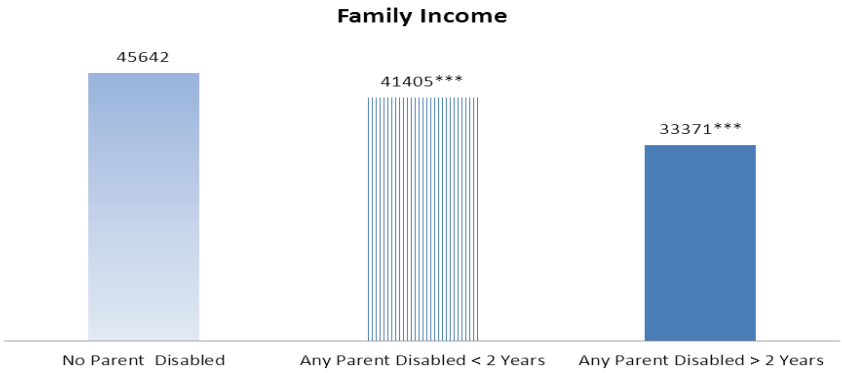
Source: 2009 Federal Disability Report (pp.39) and uses comparable data from 2001 and 2006 Participation and Activity Limitation Survey (PALS).

Figure 3. 5 PSE Participation Rate for Young Adults (Ages 18-21), by Parental Disability Duration / Recurrent Episode



Source: 1994-2008 NSLCY. The stars denote p-values of t-test for group difference: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Figure 3. 6 Family Long-Run Equivalent Incomes (Ages 6-15, 2008 dollars), by Parental Disability Duration / Recurrent Episode



Source: 1994-2008 NSLCY. The stars denote p-values of t-test for group difference: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Figure 3. 7 Standardized Math Test Score (Ages 12-15), by Parental Disability Duration / Recurrent Spisode

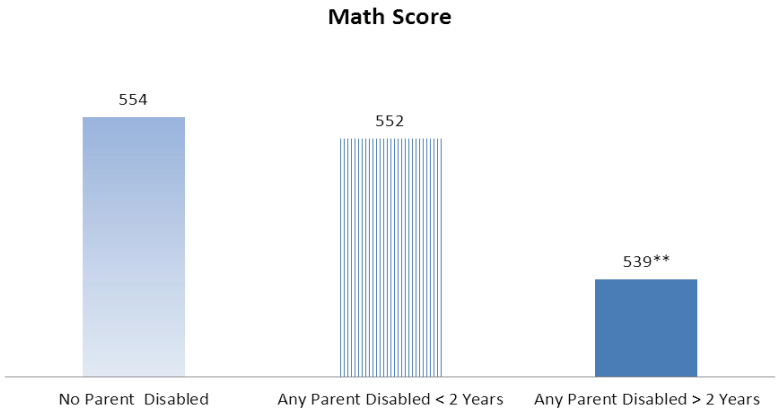


Figure 3. 8 Changes in Probabilities of PSE Participation for Key Core Covariates (Incidence – Linear Model)

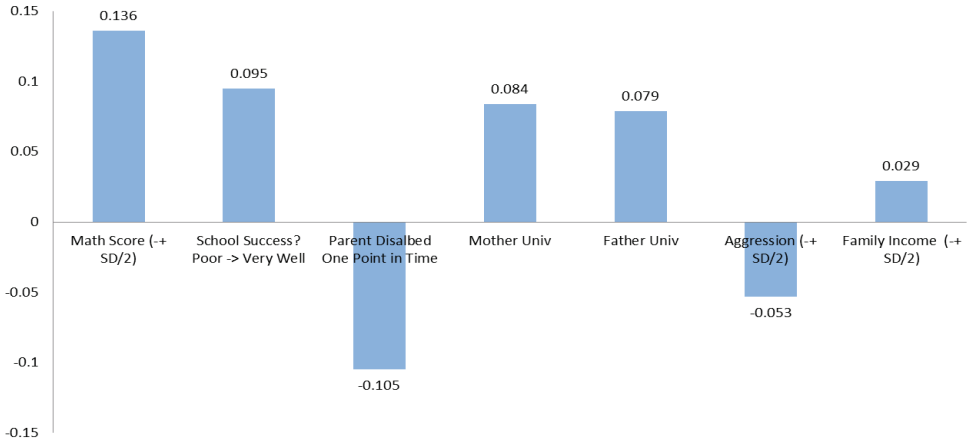
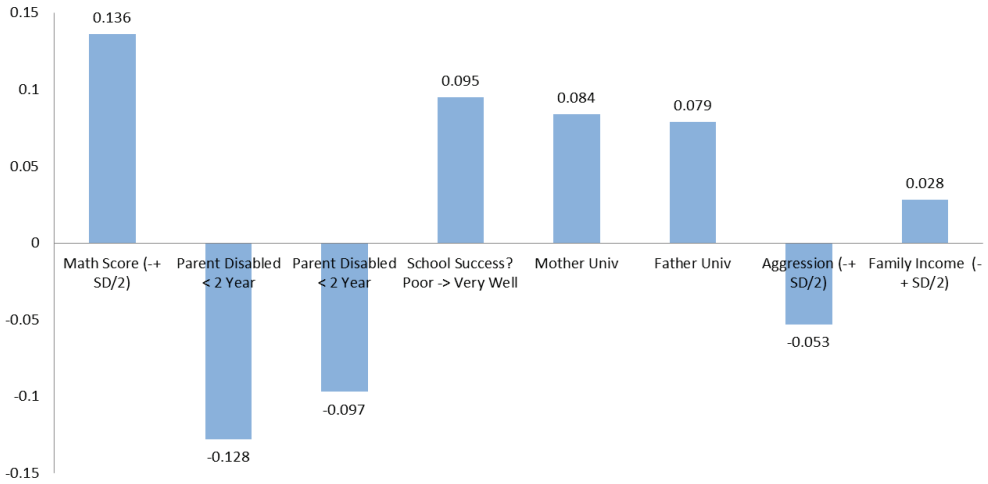


Figure 3. 9 Changes in Probabilities of PSE Participation for Key Core Covariates (Duration / Recurrent Episode – Linear Model)



Note: These figures show zero to one change for variables in terms of the predicted probability of participating in post-secondary education. Calculations are based on the most comprehensive model specification, and only effects of variables that are significant ($p<0.10$) are shown. The baseline case is a hypothetical young men at the age of 21 who likes school, thinks him/ herself doing well at school, and wants to go to (four-year) university, lives with biological and non-disabled parents, have one sibling, with both parents holding a high school degree. The linear model helds all other continuous varaibles at the national mean. The quartile model further assumes the youth is located in the second income quartile, second math, aggression, self-esteem and pro-social score quartile.

CHAPTER 4
INTERGENERATIONAL EFFECTS OF DISABILITY BENEFITS - EVIDENCE FROM CANADIAN SOCIAL ASSISTANCE PROGRAMS

4.1 Introduction

A growing body of literature suggests that children of disabled parents have more developmental problems than children of non-disabled parents (Cuong and Mont, 2011; Bratti and Mendola, 2011; Morefield et al., 2011). For example, Cuong and Mont (2011) find in the 2006 Vietnam Household Living Standards Survey that children of parents with a disability have a lower enrollment rate in primary and secondary school. Morefield et al. (2011) find from the German Socio-Economic Panel (GSOEP) that work-limiting disabilities of either parent significantly increase children's problem behaviours and negatively affect their personality traits. Indeed, parental activity limitation is associated with a number of risk factors that adversely affect child well-being. But why does the acehivement gap between children of non-disabled parents and children of disabled parents differ across provinces within Canada? How can we alleviate the negative consequences of parental disability for children's well-being? Can governments expect to improve children's well-being by increasing cash transfers to parents with disabilities?

This paper attempts to answer these questions by analyzing data from the Statistics Canada National Longitudinal Survey of Children and Youth (NLSCY). The NLSCY is a nationally representative survey that provides intergenerational information on parents and children, including both father and mother's activity limitation and indicators of children's cognitive and non-cognitive skill development. I investigate how children's standardized math test scores, hyperactive and emotional / anxiety symptoms are affected by the cash benefits made available to their disabled parents. Recognizing that disability is not always random, and parental benefit status may be endogenous with respect to children's outcomes, I employ a continuous difference-in-differences (DD) strategy that exploits provincial variation in real benefits as a source of exogeneity. Departed from the traditional DD approach, the continuous DD estimator allows to inestigate average

treatment effects over all possible values of the treatment levels and to study if the effects change when the level of the treatment changes. The identifying assumption is that children's province of residence, hence exposure to parental disability benefits, is independent of unobservable determinants of the child's developmental outcomes. Thus, a positive association between changes in benefits and children's outcomes would imply that higher benefits facilitate children's development.

In Canada, most disability benefits are provided by provincial governments. In administering the programs, each province has the flexibility of setting up its own rules and benefit levels, resulting in considerable heterogeneity across provinces. For example, during 1994-2006 Ontario and Quebec both delivered the most generous benefits in the country. However, Ontario decreased its benefits substantially from $15,054 in 1994 to $12,273 in 2006 (a real reduction of 18%), while Quebec kept its rates roughly constant. In this paper, I use this wide variation in disability benefits across provinces, over time, to construct a continuous difference-in-differences estimator.

Since however, it is possible that there are unmeasured within-province shocks that influence both benefit generosity and children's outcomes, [38] I use children of non-disabled parents who lived in the same province as an additional comparison group and estimate whether children's changes in outcome gaps correspond to benefit changes.

In addition, if the benefit claims, duration, and incidence of self-reported disability are influenced by the generosity of benefits, as suggested by Fortin et al. (2004), then the estimate will exaggerate the benefit effect. Similarly, the identifying assumption may be violated if there is a potential inter-provincial migration response. The richness of the NLSCY allows us to address these sources of bias by constructing a longitudinal sample that tracks each child over time. By using a panel continuous difference-in-differences estimator, I compare only children whose parents are “always disabled" with children

[38] For example, Milligan and Stabile (2011) using data from the Canadian NLSCY conclude that the provincial child tax benefit policies initiated in 1998 have had significant positive effects on educational outcomes, physical health and mental health for the general population of children.

whose parents are “always non-disabled” over the entire period and I exclude those who ever moved inter-provincially. Finally, to check the robustness of the results and our identification strategy, I conducted placebo regressions with less likely eligible samples, e.g. children whose parents are disabled but have higher education.

Overall, findings of this paper suggest higher parental disability benefits lead to substantial enhancement in children's cognitive and non-cognitive skill development. The intent-to-treat estimates of this paper suggest that children with disabled parents living in a province that cut its real annual disability benefits by $3,000, as Ontario did during 1994-2006, would experience a decrease of 3% of one standard deviation in standardized math test scores and 9-10% of one standard deviation reduction in hyperactive and anxiety symptoms. Additional analysis of the transmission mechanism suggests that, although benefit reduction has a qualitatively similar impact on the labour supply of the disabled parent, there is an asymmetric “added worker effect" depending on the gender of the disabled parent. Specifically, lower benefits have a disproportionally larger positive impact on the non-disabled father's full-time employment than on a non-disabled mother's employment. Furthermore, benefit effect estimates for children's math test scores and hyperactivity are substantially reduced when the disabled parent is a father rather than a mother. This is consistent with the “good mother hypothesis" (e.g. Lundberg, Pollak and Wales, 1997; Phipps and Burton, 1998; England and Folbre, 2002; Woolley; 2004) that a mother' income is more likely than a father's income to be spent in ways that benefit the children.

To the best of our knowledge, this study is the first to investigate the effects of disability benefits on children’s well-being. Despite much literature on government benefits programs and child well-being, little is known about whether higher benefits through targeted programs such as disability benefit programs indirectly affect child health and development. This study is also distinguished from most related studies on the family income-child development relationship by including not only indicators of cognitive skills (i.e. math test scores), but also non-cognitive indicators (i.e. children's problem behaviour and emotional well-being). Both types of skills have been shown to have

lasting impacts on individuals' subsequent labour market outcomes (Cameron and Heckman; 1998; Cunha and Heckman, 2010). Finally, the family income and parental employment analysis contributes to a broader economics literature on the labour supply effects of disability benefits. Our estimates of disability benefit effects on weekly hours of work fall roughly within the range of previously published estimates using Canadian data, and are consistent with the "missing added worker" effects found by other studies in North America (e.g. Colie, 2004; Gallipoli and Turner; 2008).

The remainder of this paper is laid out as follows: Section 2 discusses past literature; Section 3 introduces provincial disability benefit programs and proposes a conceptual framework to guide the subsequent empirical analysis; Section 4 describes the empirical strategy, data sources and measures; and Section 5 and 6 present and discuss the results.

4.2 Parental Resources and Children's Well-being

According to economic theory, there are two types of parental resources that affect children's well-being: money and time (Becker and Tomes, 1986). Parents decide how economic resources will be allocated among competing ends, for example, adult consumption, asset accumulation or investments in children. A large body of literature has investigated the causal relationship between family income and children's well-being. Most economists agree that children from low-income families are disadvantaged in terms of education and health (Brooks-Gunn and Duncan, 1997). Reductions in the benefits paid to disabled parents could directly decrease these families' disposable income. A lower family budget restricts the material resources (i.e. goods such as food, clothing and education support) and non-material resources (e.g. social interactions with others) resources that parents can provide for their children. In this way, lower benefits paid to these families may hurt children because the decreased income means parents can invest less in their children's development. Additionally, and more specific to the development of children's non-cognitive skills (Morefield et al. 2010), lower family income may adversely affect children through a "socialization" process such as role models, family functioning and parental practice (e.g. Yeung, 1997).

In addition to money, parental investment of time can also affect outcomes for children. Less time spent with children is associated with children's lower academic standing and psychological problems. A tightened budget could alter optimal behaviours of both the disabled parent and his or her non-disabled spouse. In order to bring more income to the family, the non-disabled spouse may have to work more hours and reduce the time they can spend with children. For example, a non-disabled father may join the labour force or work longer hours. If the disabled mother is herself less able to get involved in her children's learning activities at home or supervise her children's after-school behaviors due to various barriers, such as lack of accessible transportation to visit schools, or lack of training in sign language which limits her communication skills (Cuong and Mont, 2011), the non-disabled father's increased time away from home could impede child development by reduced time that parents spend with their children. Furthermore, long work hours are associated with great stress which may adversely influence children's development by depressing the quality of parent-child relationships (Baum 2003; Ruhm, 2004; Cawley and Liu, 2007; Chatterji et al., 2011).

If both parental income and available family time are important inputs for child development, it is possible that negative impacts on child outcomes through reductions in time available for children resulting from increased paid hours offset gains in real income, particularly for low-income families. Indeed, Morris et al. (2000), based on data from the Canadian Self-Sufficiency Project (SSP), a program that offered welfare recipients the opportunity to receive an income supplement if they obtained full-time employment, found that increased maternal employment results in more problematic behaviour for adolescents, despite increases in family incomes. [39] Most U.S. studies on welfare reforms also find maternal employment is favourable for child development only

[39] They argue that as mothers take on off-hours and shift work, adolescents may have difficulties if left alone after school and into the evening hours. They also found adolescent children may be asked to take on greater household responsibilities and may be encouraged to engage in employment themselves when their single mothers move into employment. While there is limited research on the effects of household chores on children, a high level of employment during adolescence (particularly more than 20 hours of employment) has been linked with children's difficulties in school and increased drug and alcohol use.

when mothers voluntarily choose employment, or they are employed in stable jobs that provide supportive working environments, or the employment results in substantially increased family income (Alessandri 1992; Moore and Driscoll 1997).

4. 3 Provincial Disability Benefit Programs

In Canada, provincial disability benefits are delivered either through the disability component of social assistance programs (Newfoundland and Labrador, Nova Scotia, New Brunswick, Quebec, Manitoba, Saskatchewan and British Columbia) or through the disability support programs that specifically target the disabled (Ontario, Alberta and PEI[40]). These benefits constitute the second largest income support program for the disabled next to the Canada / Quebec Pension Plan (C / QPP) disability benefits. In 2001, of the 3.42 million adults with disabilities in Canada, 10% received income support from provincial disability benefit programs, about the same proportion as those receiving a Canadian/Quebec Pension Plan (Prince, 2008).

Provincial disability benefits provide needs-tested income assistance for people with disabilities who are either ineligible for other benefits or for whom other benefits received are inadequate (e.g. C / QPP disability benefits, the Guaranteed Income Supplement, the Spouse's Allowance, Allowance for the Survivor, or War Veterans Allowance). Eligibility for provincial programs includes a needs-test and a work limiting disability. Given that an applicant family's liquid and fixed assets from non-exempted sources do not exceed the maximum allowable levels, [41] disability benefits are offset dollar-for-dollar with unearned income (e.g. interest income, pensions, or other needs-

[40] The disability support program in PEI provides income support to persons with disabilities on a case-by-case base. In this study, I use data on PEI's social assistance program. Alberta also has a distinct program for persons with disabilities: the Assured Income for the Severely Handicapped (AISH) program. Different from other provincial disability benefit programs, the AISH clients are provided with a flat rate living allowance benefit which is not contingent on family size. Later, the analysis is replicated with children from these two provinces excluded. As are shown, our main results are not substantially affected.

[41] All provincial programs exempt most fixed assets, such as principal residence, vehicles (up to a certain limit), the value of prepaid funerals and property/equipment required for employment, while liquid assets are only partially exempt.

tested transfer income) and earned income that is not exempt. [42] During my study period, only one province changed its basic earnings exemption level, [43] and importantly, neither earnings exemption nor asset limits in any of the provincial programs is indexed for inflation.

It should be noted that besides the requirements on income and assets, each provincial program also made the benefits conditional on an assessment of disability, using its own defined terms (see Appendix B). It is also possible that provincial programs differ in terms of the strictness of the screening process. If larger caseload reductions occurred in provinces with greater initial welfare caseloads, ignorance of the differential approval rates across programs would generate a downward bias in estimates (Mitra, 2009). However, on the grounds that our empirical strategy utilizes variations in benefit levels across ten programs over five survey years, DD estimates are not likely to be affected by this selection bias, unless changes in approval rates happen to co-vary with changes in benefit level. [44]

Disability benefits under every provincial program consist of a basic allowance that is supposed to cover the cost of food, clothing, utilities, personal and household items, and a shelter allowance that covers rent or mortgage. Some provincial programs also provide extra benefits to meet special needs such as drug and dental coverage, vision care, medical transportation, diabetic supplies, assistive devices and mobility device repairs and batteries. Prior to 1996, all provincial programs were funded by the federal government under the Canada Assistance Plan (CAP), which offered a 100% matching

[42] All provincial programs exempt a portion of employment income although using slightly different formulae. For example, Nova Scotia allows its client families to keep the first $200 of earned total income and one-fourth of earnings exceeding $200 per month.

[43] PEI increased its basic earnings exemption level from $600 to $900 per month in 2001.

[44] Furthermore, as are shown in Appendix B, the disability designations by provincial programs are generally very similar, in the sense that: (1) they all require applicants to submit a medical certificate completed by a licensed physician indicating the level of the impairment and the potential for rehabilitation, and (2) the disability must have a substantial impact on the potential recipient's usual activities, and it has to occur on a continuous or recurrent basis (e.g. lasts for at least 3-12 months).

grant for provincial spending. Following 1996, a block grant called the Canada Health and Social Transfer (CHST) replaced the CAP resulting in substantial reduction in the federal government's contributions. In order to accommodate the cuts in federal support, provinces started to make a variety of changes such as reducing welfare benefit levels, tightening eligibility requirements, and imposing work requirements on welfare recipients. As explained in more detail in the next section, in this paper I utilize the dramatic change in benefits that took place over this period to estimate the effects of parental disability benefits on child well-being.[45]

Table 4.1 shows the maximum real annual disability benefits under ten provincial programs for the NLSCY survey years, and measures of both cross-section and time-series variations in benefit schedules. The data are compiled from various volumes of Welfare Incomes by the National Council of Welfare.[46] On average, Ontario, Alberta and Quebec offered the highest annual benefit level at $13,341, $12,194 and $10,316 per person, respectively, whereas the benefits were lowest in New Brunswick, Manitoba and Saskatchewan, which paid $8,913, $9,437 and $9,850 per person annually. In all provinces, the real value of disability benefits decreased over this period. In addition to changes in PEI noted earlier, Nova Scotia, Ontario, Manitoba and Saskatchewan cut their benefit levels by nearly 20% during the 12 year window. By contrast, Quebec, British Columbia and Newfoundland and Labrador kept their maximum payable benefits roughly constant. The huge cross-province variation suggests that estimators that rely on within-province variation in benefits - while having some important advantages - may not be

[45] I use the maximum benefit in the empirical analysis, because I do not know the disability payments that are actually received by individuals, and because these would be endogenous with child outcomes.

[46] The National Council of Welfare computes the disability benefits as the sum of the basic assistance rate (i.e. amounts for food, clothing, shelter and utilities, personal and household needs), additional benefits (i.e. supplementary allowances that were automatically provided to persons with a disability), and the provincial tax credit and GST credit that are intended for the disabled. These estimates are based on the following assumptions of a single disabled person who: (1) qualifies for long-term rates of assistance; (2) lives in the largest urban area in the province or territory; (3) goes on disability benefits on January 1 of each year and remains on benefits for the entire calendar year; and (4) is a tenant in the private rental market rather than a homeowner or social housing tenant, and who also does not share accommodation.

able to estimate the effect of disability benefits accurately estimating the effects of disability benefits. [47]

A small number of studies on disability benefits in Canada have investigated their effect on labour supply (Campolieti, 2004) and volunteering work (Campolieti, Gomez, and Gunderson, 2009). However, no study has investigated whether the effect can help children of disabled parents. This paper will fill this gap.

4.4 Empirical Strategy

I use a continuous difference-in-differences estimator to control for potential unobserved heterogeneity associated with parental disability and benefit status. Assuming that the level of disability benefits is determined by provincial legislation and the level can only influence children's outcomes indirectly through individual families' circumstances, correlations between changes in benefit generosity and child outcome measures will imply that increasing parental disability income improves child development. Compared to the standard DD estimator that exploits a binary treatment variable, the continuous DD approach uses information on treatment level to treatment / potentially eligible group to estimate the *average* of the average treatment effects over all possible values of the treatment levels with respect to the whole control group (Blundell, R. & Costa Dias, 2009).

Of course, these assumptions will be violated if there are unmeasured province-specific transitory shocks that are correlated with both benefit generosity and children's outcomes;

[47] In some provinces, actual entitlement to disability benefits may vary according to the circumstances of each individual family, including household size, composition and the children's age. In this analysis, I do not differentiate these family types because of data limitation, i.e. the National Council of Welfare did not produce benefit schedules for couple-families with a disability. Since this paper exploits within-province variations in benefit levels over time, unless there is a systematic legislation change that affects benefit schedules for single persons differently than for couple-families with a disability, it will not affect the results substantially. This practice also has the important advantage of avoiding a potential endogeneity introduced by changes in fertility decisions and living arrangements that may be potentially affected by the generosity of needs-tested benefits (Milligan and Lemieux, 2004; Milligan, 2005).

for example, the implementation of a child tax credit program, or an improvement in school quality. In the literature, a standard way to solve this problem is to introduce a second level of control (Mayer, 1994). I therefore use the children of non-disabled parents who live in the same province as an additional comparison group and test whether the differences in outcomes between the children of disabled and non-disabled parents are related to the benefits changes over time. Specifically, I estimate the following model for a cross-sectional sample, pooling data from 1994-2006 of the NLSCY:

$$Y_{ipt} = \beta_0 + \beta_1 BEN_{pt} + \beta_2 DIS_{ipt} + \delta BEN_{pt} \times DIS_{ipt} + X_{ipt}\theta + \varphi_t + \pi_p + \varepsilon_{ipt} \qquad (1)$$

where i is individual child, p is province and t is survey year. Y represents a child's outcome, DIS is a dummy variable indicating the disability status of a parent, and BEN is a continuous variable capturing the real maximum disability benefit level that prevailed in the previous year. In this regression, π_p includes dummy variables for each of the ten Canadian provinces (i.e. province fixed effects), while φ_t includes dummy variables for years (i.e. year fixed effects). The province fixed effects hold constant unmeasured permanent differences across provinces, such as stable province differences in policies, such as regulations in earnings exemptions and asset limits, cost of living, the degree of discrimination against disabled people, and other disability-related services. The year fixed effects hold constant any time trends that affect all provinces similarly: changes in the federal disability tax credit in year 2004, for example. When running regressions, I also control for all higher order interactions between province and year dummies to allow for differential trends within the provinces.

After centering,[48] β_1 picks up the average difference in outcomes across benefit levels that are common to both the children of disabled and non-disabled parents. β_2 indicates the average difference in outcome level between the children of disabled and non-disabled parents for those who are exposed to the average level of benefits. δ is the coefficient of interest. It captures the extent to which the difference in Y between

[48] Here I subtract the sample mean from each respective benefit level.

children with disabled and non-disabled parents differs in provinces with generous disability benefits, relative to provinces without generous supplements. If higher disability benefits are associated with child outcomes, we should expect to see a statistically significant δ, indicating that the differences in outcomes between the children of disabled and non-disabled parents of the same province are different when the benefit level varies. This model controls for any permanent unobserved differences across provinces by inclusion of province fixed effects. Also, the benefit variable BEN is measured at the province-year level, which allows us to control for unrestricted province-year effects. This absorbs all unobserved linear trends that vary across provinces over time.

Based on theoretical perspectives as well as previously published studies on child well-being, I also add a rich set of explanatory variables to control for potentially confounding effects. The control variables are: child age in month; gender; both parents' age and age squared, parents' immigration status (a dummy that equals one if either parent is an immigrant and zero otherwise), and both parents' education in three categories: less than high school; high school graduate; and post-secondary diploma or some post-secondary education but not a degree. A set of interaction terms between both parents' education and disability status is also added to the model, in order to allow differential impacts of parental education across the two types of families. Importantly, family income and both parents' labour market variables are left out of the equation to avoid the introduction of a mechanical endogeneity.

The use of a continuous treatment variable reduces the impacts of other province-specific factors. Unless the implementation/generosity of other public spending programs varies by province-year coincidentally with the disability benefit level, the resulting estimates will not be affected. There are several possible scenarios in which these identifying assumptions may be violated. First, changes in developmental outcomes of children with disabled parents may be correlated with observed and unobserved parental permanent characteristics, such as attitude and preference that could lead to a downward bias to the estimates. Second, there may be a potential migration response to the generosity of

disability benefits. If parents with disabilities tend to move to provinces that offer relatively more generous benefits, the resulting benefit effects will be over-estimated. Finally, it is possible that benefit claim, benefit duration and the incidence of self-reported disability are positively influenced by the generosity of disability benefits, as suggested by some Canadian studies (e.g. Fortin et al., 2008). If this is the case, it may well be that higher disability benefits do not actually affect child development, but rather change the composition of the disabled population.

I deal with these concerns by first replicating the analysis with a sample that includes a more advantaged group: children of parents with a university degree. For this analysis, I compare benefit effects on outcome gaps between children of parents with and without disabilities and neither of the parents have a university degree, relative to the benefit effects on outcome gaps for children who have at least one parent with a university degree. Parents with a university degree may be more likely to hold skilled, stable jobs and less likely to file for welfare or be influenced by changes in benefits. Finding smaller or non-existent effects among children of parents with a university degree would indicate that provincial shocks have been effectively removed through the research design.

I also take advantage of the longitudinal structure of the NLSCY and create a two-period panel by tracking two cohorts of children, from ages 6-9 to 12-15. These two cohorts of children were first observed in 1994 and 2000, and then again in 2000 and 2006. Included in the sample are children whose parents reported a disability in both periods (i.e. "always disabled"), and children whose parents never reported a disability (i.e. "always non-disabled"). I also exclude children who ever moved inter-provincially during the observation period. Based on this longitudinal sample, I implement a panel DD estimator that essentially estimates:

$$\Delta Y_{ipt} = \beta_0 + \beta_1 \Delta BEN_{pt} + \delta \Delta BEN_{pt} \times DIS_{ip} + \Delta X_{ipt}\theta + \Delta\varphi_t + \Delta\varepsilon_{ipt} \quad (2)$$

Here Δ represents the first difference of any variable between two adjacent time periods. Compared to the level specification for the cross-sectional sample (equation 1), this

model relies on more rigorous identifying assumptions (see Lee, 2004). Any permanent unobserved parental/child characteristics that may potentially influence child developmental outcomes, and consequently the achievement gaps between children of disabled and non-disabled parents across provinces are removed in this first-difference setting.

Before proceeding, it is worth noting that this study uses an intention-to-treat design. In other words, I do not know whether a particular disabled parent filed for or received disability benefits. Rather I am estimating whether a change in the benefit generosity has an impact on the population most likely to be affected. This means that the analytic sample may include ineligible disabled parents as part of the treated group, and also eligible parents who do not actually receive disability benefits (i.e. the average treatment effect). The average treatment effect on the treated (ATT) thus depends on the proportion of eligible parents included in the sample, and the proportion of eligible parents who actually take up the benefits. All reported analyses use sampling weights. The standard errors are clustered at the province level to correct for non-independence of residuals across children of the same province.

4.5 Data, Sample, and Measures

The empirical analysis is based on the 1994-2006 National Longitudinal Survey of Children and Youth (NLSCY), combined with province-level data capturing variations in disability benefit generosity. The NSLCY is an ongoing survey of Canadian children, designed to help analyze child development and well-being. Starting in 1994, it has followed up a nationally representative sample of children aged between 0 and 11 years every two years until they reach the age of 25. At each survey round, a new cohort of children aged 0-1 was added to the longitudinal files. An important feature of the NLSCY is that it provides inter-generational information on parents' activity limitation, and a variety of children's developmental outcomes along with detailed socio-economic characteristics of both parents.

I exclude data from 1996 and 1998 since the set of questions on parental disabilities was not available. I use data from 1994, 2000, 2002, 2004 and 2006, and restrict the analysis to non-disabled children aged between 4 and 15 years old who lived in two-parent families. These are the years when most children should be attending Kindergarten through Grade Ten. Younger children are excluded from the sample to avoid the complex task of differentiating the effects of family income from the effects of schooling. Children aged 16 years or above are also not included because data on parental disability are not available for them either. Divorce/re-marriage can involve non-income-related stress for children and their parents, which would be difficult to separate from the benefit changes at the same time. Hence, I exclude children of single parents. Moreover, certain disability conditions can be transmitted through genetics. In order to focus on the effect of disability benefits only, and to avoid its effect being confounded with that of the child's own health problems, children with disabilities are excluded from the sample. Furthermore, since provincial welfare beneficiaries must be 18-65 years of age, I focus on children whose both parents were between 18-65 years during 1994-2006. Finally, since the needs-tested disability benefits target low-income families and tend to have the largest impact on people with lower education, I limit our primary sample to families where neither parent has a university degree.

This paper focuses on children's developmental outcomes that fall into three domains: cognitive, behavioural and emotional well-being. Cognitive outcomes are measured by children's standardized math test score. The math test in the NLSCY is administered to children in grade 2 to 10 every year. The test (CAT/2 test) is a shorter version of the Mathematics Computation Test taken from the Canadian Achievement Test, 2nd edition, and is designed to measure a child's basic competencies in math (e.g. addition, subtraction, multiplication and division of integers). The scores range from 0 to 750. The behaviour outcome is measured by the hyperactivity score which is derived from six statements by the Person Most Knowledgeable (PMK) about the child having trouble sitting still or being restless, being easily distracted, being inattentive, having trouble sticking to any activity, concentrating, paying attention for long, being impulsive, acting without thinking, having difficulty waiting for his turn in games or groups. The emotional

outcome is measured by the emotional anxiety score which is derived from six statements about the child being unhappy or sad, not as happy as other children, fearful or nervous, worried, crying a lot, being high strung or tense, having trouble enjoying himself or herself. Parents respond to these two scores on a scale ranging from 0 to 14, with 14 indicating the highest level of hyperactivity or emotional anxiety.[49]

Parent's disability is a dummy variable with one indicating disabled, zero non-disabled. In NLSCY: it asks "Because of a long-term physical or mental condition or a health problem, are/is ... ... limited in the kind or amount of activity you/he/she can do: 1) At home? 2) At school? 3) At work? 4) In other activities such as transportation to or from work or leisure time activities? 5) In caring for children?" .If the parent answered 'yes' to one of the above series of questions for herself or her spouse, I coded it as one.

Based on this disability definition, 8.3% of non-disabled children in the full sample lived with a disabled mother, 8.2% lived with a disabled father and 1% lived with two disabled parents.[50] Cross-tabulation for children's outcomes by parental disability status is shown in Table 4.2. There is a significant gap across three developmental outcomes. Having a parent with activity limitation is associated with 5.7% of one standard deviation (S.D.) drop in math scores, 59% and 86% of one S.D. increase in the hyperactive and anxiety symptoms, Corresponding to this gap is a universal worsening of financial situation for families with a disabled parent (Table 4.3). Relative to families of non-disabled parents, the equivalent family income for families with a disabled parent was approximately 14% lower, Taking the Low-Income-Cut-Off (LICO) as an unofficial poverty line shows that having a disabled parent in the household more than doubled the incidence of poverty among these children: 10.69% of children with disabled parents lived below the LICO

[49] Earlier cycles contained an additional question for each scale. I re-constructed these scales by dropping this question so they can be compared consistently across cycles.

[50] Note that the "disability rates" reflected in these samples are not comparable to what have been routinely reported by Statistics Canada because the unit of analysis of NLSCY is the child or youth. So this figure in fact reports the percentages of non-disabled children with disabled parents among all children rather than the percentages of disabled people among the population.

while the corresponding number for children with non-disabled parents was only 5.80%. Results based on the sample that only includes children of parents without any university degrees reveal more or less the same story (lower panel of Table 4.2). Compared to children of fathers with a disability, children of mothers with a disability fare worse (columns 3 and 4 of Table 4.2).

The mean ages for mothers and fathers are 38 and 40, respectively. Noticeably, disabled parents are only slightly older than their non-disabled counterparts, as are their non-disabled spouses. Parents' educational attainments, however, show great disparity. Only 15% and 20% of non-disabled mothers and fathers dropped out of high school, while these figures are 17% and 23% in the corresponding disabled population. Perhaps not surprisingly, their non-disabled spouses do not tend to have less education. Around 27% of fathers in mother-disabled families and 32% of mothers in father-disabled families had some post-secondary education (but not a degree), compared to 27% and 28% of their non-disabled counterparts. On average, disabled parents are much less likely to participate in paid work compared to non-disabled parents, while their non-disabled spouses seem to be slightly more likely to work long paid hours.

Aside from the NLSCY, information on provincial regulations, such as disability benefit levels, is compiled from various issues of Welfare Incomes (2000-2006), Social Assistance Statistics Report (2004-2006), and each provincial program's website. Since most family income and parents' labour market activities in the NLSCY are reported retrospectively over a 12-month period, I use the disability benefit schedule that prevailed in January of the previous calendar year. The program data is then merged to the NLSCY data based on the province of residence reported by individual households. All benefits, income and earnings data are converted into 2006 dollars using the corresponding provincial seasonally adjusted Consumer Price Index. As a result, all data in the paper, aside from those which are presented in Table 4.1 describing the provincial regulations on disability benefits, are in 2006 constant dollars.

4.6 Empirical Results

4.6.1 Effects of Parental Disability Benefits on Non-Disabled Children's Well-being

Table 4.4 presents difference-in-differences estimates of the associations between disability benefits and children's outcomes for the pooled cross-sectional sample. For each outcome, Table 4.4 reports results from three model specifications. Column (1) is based on a specification that adjusts only for year fixed effects, child's age in month, and gender. Estimates from this most basic model reveal a positive association between the generosity of disability benefits and children's math test scores, and a negative association between the benefits and two behavioural scales, where a higher value indicates more behavioural problems. In column (2), indicators that control for province fixed effects and second-order interaction between province and year fixed effects are added to the regressions. If provinces that provide higher benefits tend to be generous in other public spending programs, and if these programs have favourable impacts on children with disabled parents, adding in these controls would reduce the estimated benefit effects. Results in this column lend little support to this hypothesis. There is a moderate drop in the estimated benefit effect on math scores, and the magnitude of the estimates for hyperactive and anxiety symptoms increases slightly. These results suggest that the unmeasured heterogeneity across provinces is unlikely to explain the observed link between the child's outcome gap and parental disability benefits. A set of identical regressions without province-year interactions were also estimated, and the substantive conclusions are unaffected (results are not reported but available upon request). In column (3), the inclusion of socio-economic characteristics of both parents again does not change the results substantially.[51] The size of the benefit effect decreases slightly in all three cases, implying families with a disabled parent on average have lower social attainments than families without disabilities. It is also noteworthy that the fit of the regressions (adjusted R^2) increases significantly as the province fixed effects and parental background are controlled for.

[51] In addition to the model specifications reported in Table 4.4, I experimented a fully interacted model that includes interaction between parental disability dummy and every single covariate in the regression. It produces highly similar results.

Based on the results from the preferred specification (column (3)), a $1,000 reduction in real disability benefits results in a 0.01 S.D. (1.16 point) decrease in math scores, 0.033 (0.11 point) and 0.036 S.D. (0.07 point) increase in hyperactive and anxiety symptoms. Assuming that 35% of children living with parents (whom do not have a university degree) receive benefits from provincial disability programs, all else being held constant, these estimates imply that a cut in real benefits by $3,000, the equivalent of cuts enacted in Ontario between 1994-2000 (i.e. around 10% of the equivalent family income for families with a disabled parent in the sample) will reduce standardized math test scores for children with disabled parents by 0.11 S.D., and increase hyperactive and anxiety symptoms by 0.30 and 0.28 S.D., respectively. It is useful to gauge these estimates in terms of another covariate widely known to be associated with child well-being, namely maternal education. In the preferred specification, having a high school degree is respectively associated with 12%, 13% and 11% of one S.D. improvement in math test score, hyperactive and anxiety symptoms. This implies that the effect of a $3,000 benefit reduction is nearly the same as the magnitude of the association between maternal high school education and math score, and two times as large as the association between maternal high school education and child hyperactivity and anxiety. Relative to gains in cognitive functioning, the effects of disability benefits on the child's behavioural and emotional well-being seem more substantial. This may reflect the fact that cognitive achievement is more likely to be linked to the cumulative process of human capital acquisition (Cunha and Heckman, 2007; Todd and Wolpin, 2007; Currie et al. 2010) as opposed to external shocks, such as variations in family income, or parental stress associated with employment.

The main effects of parental disability suggest that, when exposed to the average level of benefit (i.e. $11,498 in 2006 dollars), children with disabled parents on average score lower in standardized math tests and exhibit more hyperactive and anxiety problems than their peers with non-disabled parents.[52] The main effects of disability benefits, which

[52] I do not attach any fundamental meaning to these estimates since in the presence of interaction terms, their magnitude and significance merely reflect the group difference at the average benefit level and whether For ease of interpretation, children both of whose parents are disabled are omitted, which leads to

capture the average differences in outcomes of interest across benefit levels, are significant in the direction of favouring children's development (model (3)), suggesting children in general tend to do worse in provinces that offer less generous disability benefits. All other control variables in these regressions behave as expected. For example, compared to children of high school dropouts, children of parents with a high school degree or post-secondary education fare significantly better in all three cases. Girls score slightly lower than boys on math tests but are less likely to suffer from hyperactive or anxiety symptoms.

The benefit effects could be different depending on whether it is the mother or father who is disabled. On the one hand, traditional gender roles assign home production and care for children primarily to mothers. Compared to men with observationally equivalent qualifications, women have less opportunity in the labour market. On the other hand, male breadwinner households are quite common in Canada. Disability can take a larger toll on household living standards when the father is disabled, and I might expect to see a larger benefit impact for children from these families. Table 4.5 investigates this hypothesis by separately estimating model (3) in Table 4.4 for children in families with only mother or only the father being disabled.[53] For children of mothers with a disability, the benefit effect estimates are significant across outcomes. Importantly, even though the treated cases are reduced by half, their magnitudes are even larger than the ones reported in column (3) of Table 4.3, suggesting that the favourable impact of benefit changes discovered before is mainly concentrated on children in families where the mother is disabled. Ceteris paribus, a $1,000 benefit reduction results in a 0.02 S.D. reduction in math test scores, and a 0.06 and 0.04 S.D. increase in parent-report hyperactive and anxiety symptoms. In direct contrast, the benefit effect estimates for children of fathers with a disability are all insignificant with considerably smaller magnitudes. These estimates reveal a distinct benefit effect depending on the gender of the disabled parent.

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an exclusion of 453 observations from the analysis. or not this difference is statistically different from zero at this point.

[53] For ease of interpretation, children both of whose parents are disabled are omitted, which leads to an exclusion of 453 observations from the analysis.

To get a full picture of this finding, the next subsection explores pathways through which generosity of disability benefits may affect child well-being.

4.6.2 Exploring Mechanisms for Benefit Effects

Table 4.6 presents DD estimates for models of parental employment (columns (1)-(4)), and family income (columns (5) and (11). As mentioned before, a reduction in disability benefits may affect an individual family's circumstances in two ways. First, as a transfer payment, it directly decreases poor families' disposable incomes. Second, it may induce poor parents to participate more in paid work, which could lead to an increase in earnings and family income. Therefore, a negative association between benefit level and parental paid work for both the disabled parent and his or her non-disabled spouse should be expected. The benefit effect on family income is ambiguous, however, because these two components are intertwined, and it is extremely difficult to empirically separate out their effects. The estimates from this analysis will reflect the combined effects.[54] For the sake of brevity, only the coefficients of benefit effect and parental disability are shown, but all controls included are identical to column (3) of Table 4.3. The upper and lower panel show results for the ``math score sample'' (i.e. parents of children in Grade 2-10 with math scores) and the ``hyperactivity and anxiety sample'' (i.e. parents of children aged 4-11 with reports on hyperactivity and emotional anxiety scores), respectively.

Columns (1)-(2) show a large and negative parental employment impact of disability benefits for the disabled parents. For every $1,000 decrease in annual benefits, disabled mothers and disabled fathers increase their time spent in the labour market by 0.68 and 0.88 hours per week, respectively. The change in paid hours in both cases is mainly driven by an increase in the extent of full-time employment (defined as exceeding 30

[54] The NLSCY contains retrospective information on labour market activities for both parents such as paid work participation, usual weekly hours, and family income received from all sources (before taxes), 12 months prior to the survey. Parents reported their hours of work in six categories: less than 10 hours, 10-19 hours, 20-29 hours, 30-39 hours, 40-49 hours and 50 hours or more. I create a pseudo continuous variable coded at the mid-point of each category to capture the non-linear nature of parental hours, and another indicator variable that identifies a parent's full-time work status (i.e. equal to one if a parent works 30 hours or more), to test the effect of hours of work.

hours per week). Living in a province with a benefit reduction of $1,000 increases the probability of engaging in a full-time job for both disabled mothers and fathers by around 0.02 percentage points. Considering that in our sample mothers' average weekly hours is lower than fathers', the size of benefit effect for own-labour supply is slightly larger for disabled mothers than disabled fathers.

Also apparent is an asymmetric “added worker effect” across disabled fathers and disabled mothers. As suggested by some studies (e.g. Berger and Fleisher, 1984; Berger, 1982), mothers of disabled spouse may be less likely to increase their labour supply relative to fathers of non-disabled spouse because of a ``nursing effect''. Results shown in columns (4)-(5) is consistent with this hypothesis. A $1,000 decline in the disability benefits leads the non-disabled father to increase his time spent in the labour market by 0.44 hours per week (1% of the average hours of work) and increases his chances of participating in full-time employment by one percentage point. In contrast, the effects on non-disabled mothers are much smaller and statistically insignificant. Corresponding to the missing added worker effect for families with disabled mothers, there is a significant and negative association between the ``combined'' family income and benefit generosity, with every $1,000 benefit reduction resulting in 2.7% increase in real equivalent family income,[55] whereas the same relationship is insignificant for families where the father is disabled.

Taken together, the analysis on parental employment and family income provides evidence that deductions in disability benefits during the 1994-2006 period increased the disabled parents' own labour supply by a similar magnitude for disabled mothers and disabled fathers, but also generated a significant spill-over incentive effect for the husband of a disabled wife, in which families I observed poorer child outcomes. If a higher family income benefits children, as is widely agreed by economists, this suggests a way in which lower benefits may hurt a child's development.

[55] Log of family income measure is used in column (6).

To test the importance of parental employment, I re-estimate our original models for children of disabled mothers, additionally controlling for covariates for both mother and father's employment status. If the benefit effect on child development operates through this channel, I would expect the estimated benefit effects to decline under this specification. I am also interested in the explanatory power of interaction between the above covariates and a parental disability dummy, since a significant interaction term would indicate that parental employment plays a role in widening/narrowing the outcome gaps between children of disabled parents and children of non-disabled parents discussed earlier.

After additionally controlling for parental employment (column 2 of Table 4.7), the significance of the benefit effect for children's math test score completely disappears. The interaction between the father's full-time employment and maternal disability is significant on its own in the cases of math test scores and hyperactivity, suggesting that having the father working full-time reduces a child's math test scores by 17% of one standard deviation, and increases his or her hyperactive symptoms by 10% of one standard deviation. However, the inclusion of parental employment variables does not affect the benefit effect for children's anxiety symptoms substantially. One potential explanation is that children's emotional anxiety is affected more through the "socialization" rather than "family resource" channel, by parents', especially the primary caregiver's subjective well-being, as compared to cognitive skills. A father's long work hours could impose stress on a family from which parents cannot successfully shield the child (Burton and Phipps, 2011). It is unfortunately not feasible to estimate a model of parental stress or depression in this scenario, as Milligan and Stabile (2011) did, because depression could well be a cause or result of the mother's disability, or, could even be the mother's dsiability.

Besides the asymmetric employment effect, studies on intra-household resource allocation also put forth a "good mother hypothesis" that might help explain why the developmental returns of parental disability benefits may be larger for children with disabled mothers than children with disabled fathers. It is believed that a mother's income

is more likely than a father's income to be spent in ways that benefit the child. Given the same disability, benefits received by the mother may increase her independent access to family financial resources; enhance her bargaining power in household expenditure decision-making process and thus have a larger positive effect on child well-being .For example, Lundberg, Pollak and Wales (1997) studied the effect of a change in family allowance benefits which decreases father's net income in the United Kingdom in the late 1970s. They find that expenditures on children's clothing increased significantly relative to expenditures on men's clothing as a result of this policy change. Woolley (2004) uses data from Canada and finds that the monthly child tax benefits paid to mothers relieves women's financial dependence and are more likely to be spent on children.

Overall, these results indicate that lower benefits may hurt children's development, in part, through the time constraints and stress associated with the non-disabled father's longer employment. There also seems to be an asymmetric incentive effects on spousal labour supply: as the benefit level declines, fathers of disabled spouse increase their full-time employment and hours of work. By contrast, mothers of disabled spouse do not behave differently. The pattern is consistent with previous research on the effect of spousal ill-health on labour supply in particular, husband's health on wife's labour supply in North America (Haurin, 1986; Berger and Fleisher, 1984; Berger, 1982; Gallipoli and Turner 2008), and studies related to spill-over effects of public transfer payments in the U.S. (e.g. Colie 2004). However, cautions should be taken in interpretation since the unit of analysis in the NLSCY is the child instead of the adult. Even though the results can be replicated when one parent per child is randomly selected,[56] further analysis using alternative data sources is needed.

4.7 Additional Robustness Tests

In this section, I present tests of the identifying assumptions and robustness of the main findings. Table 4.8 shows results from province fixed-effects models of association between disability benefits and child outcomes for children neither of whose parents has

[56] Results are not reported in the paper but available upon request.

a university degree (column (1)) and children either of whose parents has a university degree (column (2)) (more details are discussed in Section 4.4). The model specification is the most comprehensive and identical to the one used in column (3) of Table 4.3. As discussed before, for children neither of whose parents has a university degree, there is a favourable and statistical significant association between changes in children's outcome gaps and changes in disability benefits. The results presented in column (2) for children either of whose parents has a university degree, however, are strikingly different. Despite the qualitatively similar estimates for the main effects of parental disability and disability benefit levels, the coefficients on their interaction terms are small in magnitude and insignificant at any conventional level across outcomes. In some cases, the signs of the estimated effects are even reversed. This sharp contrast suggests that most of the associations between disability benefits and children's developmental outcomes are driven by children whose parents have lower education. Since this triple difference comparison non-parametrically absorbs heterogeneity associated with parental disability, it provides additional comfort to the main findings.

Table 4.9 conducts the second robustness check by presenting panel DD results for a two-period longitudinal sample that includes children with ``always'' disabled and non-disabled parents. The use of child fixed effects in the regressions eliminates the bias in the cross-sectional estimates attributable to potential sample composition change and unobserved permanent omitted factors that vary across families and children. For this analysis, I consider only math test scores, because this is the only outcome measure for which I have sufficient sample in each year to enable comparisons over time.[57]

Column (1) shows the results from child-fixed effects for the full sample. The benefit effect estimate in this case is substantially larger in magnitude and highly significant. A $1,000 decrease in disability benefit leads to 9.3% of one standard deviation (9.77 point) reduction in math test scores. This may reflect a combination of two potential effects: (1) children of parents with a longer-term disability are the least well-off and most likely to

[57] As part of Early Child Development (ECD) initiative, the NLSCY dropped many young children aged between 6 and 10 from its cross-sectional sample in later cycles.

be affected by the needs-tested disability benefits; and (2) lower statistical power arises from a relatively small sample size (n=3224) where the number of children with disabled parents is around 250. For this reason, results in this section should be taken with care and I am inclined to treat results from repeated cross-sectional samples as our preferred estimates. Results in columns (2)-(4) are based on samples that exclude children who ever moved from one province to another, children who resided in Alberta and PEI during the observation period (details are discussed in Section4.3). The benefit effects estimates are highly similar to the ones reported in column (1), suggesting that the potential migration response is not extensive in this analysis and does not in fact drive the main findings.

4.8 Conclusions

This paper has addressed the following questions: 1) Do children of disabled parents have worse outcomes? 2) Do higher disability benefits alleviate negative consequences of parental disability on children's well-being? 3) If so, are the benefit effects different depending on the gender of the disabled parent? 4) Finally, what are the mechanisms that drive these differences? Using changes in real benefits under ten disability benefit programs in Canada as an identification strategy, I find higher parental disability benefits indirectly protect child development and cognitive skill formation. Specifically, the gaps in developmental outcomes between children of disabled parents and children of non-disabled parents grow wider in provinces that decrease their benefits compared to provinces that do not. In addition, the benefits have stronger effects on children's behaviour problems and emotional anxiety, than on children's cognitive ability as measured by standardized math test scores. I interpret these estimates as causal effects of parental disability benefits, because a family's exposure to benefits affects the parents' income and employment, while it is independent of unmeasured characteristics.

Although parental disability is self-identified by parents through a checklist of questions, there is little evidence suggesting that the results are driven by sample composition change, unobserved family-level heterogeneity associated with parental disability, or potential inter-provincial migration response to the generosity of disability benefits. A

"placebo" type of DD estimator for the less likely eligible (i.e. university educated) sample lends additional support to the main finding.

I also find a difference in the effects of benefits by the gender of the disabled parents: lower benefits have strong detrimental effects for children with a disabled mother, while the effects are small and insignificant for children with disabled father. For families with a disabled mother, benefit reductions significantly increase a non-disabled father's full-time employment. The increase in the father's time away from home leads to a substantial decline in children's math test scores and an increase in behavioural problems. Thus, it appears that higher benefits may facilitate child development mainly through parents' potentially available family time and the reduced stress associated with employment. This finding is in line with related Canadian studies which indicate both parental time and money are important inputs to the well-being of children (Curtis and Phipps, 2000; Burton et al.,2006). While a tight family budget directly limits the material resources that parents can afford for children (i.e. Mayer and Jencks, 1993; Mayer, 1997,2007), parents' long hours of work reduce the amount of time parents can spend with children, erode parental health, and increase stress levels, all of which negatively affect the well-being of children.

Since the mid-1990s, Canadian policy makers have made significant changes to welfare programs, in the general direction of connecting cash transfers to labour market participation. Findings of this paper tend to suggest an inadequate income support to parents with disabilities may have resulted in an unintended consequence for the well-being of children. In particular, children of disabled parents in provinces with lower benefits may have faced a double inequality of opportunity due to both the province of residence and the disability of their parents.

Living with a disabled parent is not a rare event. Based on data from the NLSCY, in 2006, 1.8 million Canadian children aged under 15, about one in six, lived with at least one disabled parent. Out of this total, around 1 million were adolescents aged 10-15. As governments in Canada implement public policies, it is essential that mechanisms are put

in place to measure the effects of these policies on the entire family, particularly the large number of children who will potentially be involved. Losing sight of the fact that children who live in poor households also may grow up poor could result in important negative outcomes for the future society.

While the overall findings support the hypothesis that more generous assistance should be provided through these income support programs to families with disabled parents, more definitive policy conclusions require further replication, more thorough analysis on underlying mechanisms, possibly with these and perhaps other data resources.

In particular, I have used the maximum credits as a measure for disability benefit incomes. It is a relatively conservative strategy which avoids upward bias that could occur if poorer and sicker parents are more likely to claim the benefits. However, this may involve some measurement error. It may generate downwardly biased estimates if larger caseload reductions occurred in provinces with greater initial welfare caseloads.

In addition, I am not aware of any published estimates of what percentage of eligible parents take up provincial disability benefits. But based on estimates by Prince (2008), in 2001, of the 3.42 million adults with disabilities in Canada, 10% received income support from provincial disability benefit programs. In the future, it is desirable to use data containing both benefit income and child outcome information to test the effects of more nuanced measures of disability benefits.

Table 4. 1 Real Maximum Annual Disability Benefits (2006 Constant $)

	NL	PEI	NS	NB	QB	ON	MB	SK	AB	BC	Canada
1994	10783	11975	11291	10531	10301	15054	10749	11148	13443	11479	11675
2000	10175	10330	10566	8182	10410	… … 13846	9548	9948	12871	10999	10688
2002	9983	10050	9456	8357	10334	… … 13062	9213	9713	11848	10826	10284
2004	9498	9616	9420	8356	10305	… … 12471	8914	9420	10971	10391	9936
2006	9905	9400	9082	9143	10234	… … 12273	8765	9075	11841	10843	10056
Real % change, 1994-2006	-8.14	-21.50	-19.56	-13.18	-0.65	-18.47	-18.46	-18.60	-11.91	-5.54	-13.87
% difference from national average, 1994	-7.64	2.57	-3.29	-9.80	-11.77	28.93	-7.93	-4.52	15.14	-1.69	--
% difference from national average, 2000	-4.79	-3.34	-1.14	-23.45	-2.60	29.55	-10.66	-6.92	20.43	2.92	--
% difference from national average, 2002	-2.93	-2.28	-8.06	-18.74	0.49	27.01	-10.41	-5.55	15.20	5.27	--
% difference from national average, 2004	-4.41	-3.22	-5.19	-15.90	3.71	25.51	-10.29	-5.20	10.41	4.57	--
% difference from national average, 2006	-1.50	-6.52	-9.68	-9.08	1.77	22.04	-12.84	-9.76	17.75	7.82	--
Provincial Average	10068	10274	9963	8913	10316	13341	9437	9860	12194	10907	10527

Note: Disability benefit information is collected from Welfare Incomes (1993-2005) and the AISH website. Consumer Price Index (CPI), 2001 basket content, is from Statistics Canada E-Stats Table 326-0002.

Table 4. 2 Children's Developmental Outcomes by Parental Disability

	No Parent Disabled	One Parent Disabled	Only Mother Disabled	Only Father Disabled
	(1)	(2)	(3)	(4)
Non-Disabled Children (Neither of Parents has a University Degree)				
Standardized Math	377	365***	366**	373
Score	(170)	(153)	(171)	(153)
(Grade 2-10)	[10,932]	[2,493]	[1,040]	[1,000]
Hyperactive	3.62	4.06***	4.17***	4.00***
Symptoms	(0.93)	(0.88)	(0.86)	(0.87)
(Age 4-11)	[11,897]	[2,279]	[920]	[906]
Emotional Anxiety	2.24	2.59***	2.61***	2.58***
(Age 4-11)	(0.35)	(0.31)	(0.35)	(0.32)
	[11,917]	[2,261]	[916]	[892]
Non-Disabled Children (Full Sample)				
Standardized Math	379	369***	367***	373***
Score	(179)	(162)	(162)	(162)
(Grade 2-10)	[13,757]	[3,137]	[1,309]	[1,258]
Hyperactive	3.47	3.91***	3.94***	3.85***
Symptoms	(0.85)	(0.81)	(0.80)	(0.79)
(Age 4-11)	[14,887]	[2,852]	[1,151]	[1,134]
Emotional Anxiety	2.22	2.55***	2.59***	2.52***
(Age 4-11)	(0.39)	(0.35)	(0.37)	(0.35)
	[14,931]	[2,833]	[1,148]	[1,118]

Note: The sample includes non-disabled children in two-parent families during 1994-2006 in the NSLCY. Children both of whose parents were disabled (around 15% of all children with a disabled parent), are excluded from the mother-disabled and father-disabled samples. Number of observations and robust standard errors are in square bracket and parentheses, respectively. The number of stars denotes the p-value of a t-test for group difference. *p<0.1; **p<0.05; ***p<0.01.

Table 4. 3 Sample Characteristics

	Parents Not Disabled	One Parent Disabled	Only Mother Disabled	Only Father Disabled
	(1)	(2)	(3)	(4)
		Child Characteristics		
Child Age (in Month)	127	133	135	131
	(0.502)	(0.946)	(1.400)	(1.338)
Child Female	0.49	0.50	0.50	0.50
	(0.006)	(0.012)	(0.019)	(0.017)
		Family Characteristics		
Equivalent Family Income	37076	34266	36949	36718
	(373)	(589)	(350)	(709)
Either Parent Immigrant	0.181	0.190	0.182	0.200
	(0.005)	(0.120)	(0.020)	(0.016)
		Mother Characteristics		
Mother Age	38.24	39.13	39.00	39.13
	(0.071)	(0.161)	(0.216)	(0.217)
Mother Post-Secondary Diploma	0.28	0.19	0.28	0.32
	(0.005)	(0.012)	(0.015)	(0.016)
Mother High School Degree	0.56	0.52	0.54	0.49
	(0.006)	(0.012)	(0.018)	(0.017)
Mother High School Dropout	0.15	0.18	0.17	0.18
	(0.004)	(0.009)	(0.014)	(0.013)
Mother Employment Status	0.80	0.72	0.68	0.79
	(0.004)	(0.011)	(0.017)	(0.014)
Mother Weekly Hours	27.53	24.60	22.81	27.60
	(0.205)	(0.458)	(0.699)	(0.622)
Mother Weekly (Hours 30 +)	0.56	0.50	0.46	0.57
	(0.006)	(0.012)	(0.019)	(0.017)
		Father Characteristics		
Father Age	40.33	41.88	41.26	42.16
	(0.077)	(0.188)	(0.264)	(0.243)
Father Post-Secondary Diploma	0.27	0.27	0.27	0.29
	(0.005)	(0.010)	(0.016)	(0.016)
Father High School Degree	0.52	0.49	0.52	0.46
	(0.006)	(0.012)	(0.018)	(0.017)
Father High School Dropout	0.20	0.22	0.20	0.23
	(0.004)	(0.009)	(0.014)	(0.014)
Father Employment Status	0.95	0.85	0.95	0.79
	(0.002)	(0.008)	(0.007)	(0.013)
Father Weekly Hours	42.84	37.84	43.12	34.68
	(0.128)	(0.408)	(0.362)	(0.635)
Father Weekly (Hours 30 +)	0.93	0.82	0.94	0.75
	(0.002)	(0.009)	(0.002)	(0.014)
Number of Observations	17,603	4,054	1,804	1,797

Note: The sample includes non-disabled children aged between 4 and 15 years in two-parent families whose parents did not have any university degree. 453 children with two disabled parents are excluded from the mother-disabled and father-disabled samples

Table 4. 4 DD Estimates of the Association between Parental Disability Benefits and Children's Developmental Outcomes

	Math Score			Hyperactivity			Anxiety		
	M1	M2	M3	M1	M2	M3	M1	M2	M3
Benefit x Disability	2.393***	1.860***	1.159***	-0.108***	-0.115***	-0.107***	-0.064*	-0.077**	-0.072*
	(0.559)	(0.339)	(0.290)	(0.022)	(0.019)	(0.016)	(0.032)	(0.029)	(0.033)
Parental Disability	-7.867***	-6.550***	-8.937	0.553***	0.586***	0.058	0.432***	0.460***	0.020
	(1.456)	(1.181)	(6.103)	(0.061)	(0.057)	(0.211)	(0.107)	(0.102)	(0.222)
Benefit	-4.063*	5.865***	5.381***	-0.034	-0.122***	-0.121***	0.012	-0.281***	-0.289***
	(2.064)	(0.137)	(0.272)	(0.031)	(0.002)	(0.009)	(0.036)	(0.004)	(0.006)
Child Age in Month	1.659***	1.475**	1.563**	-0.013***	-0.013***	-0.011***	0.005***	0.005***	0.008***
	(0.471)	(0.572)	(0.539)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Child Female	-1.655	-1.687	-2.143	-1.058***	-1.046***	-1.056***	0.056	0.063	0.071
	(3.505)	(3.527)	(2.991)	(0.061)	(0.057)	(0.048)	(0.051)	(0.053)	(0.065)
Either Parent Immigrant			3.130**			0.182			0.028
			(1.221)			(0.122)			(0.063)
Mother Diploma			18.32***			-0.369***			-0.065
			(2.377)			(0.088)			(0.085)
Father Diploma			9.856***			-0.071			0.048
			(3.017)			(0.079)			(0.121)
Mother High School			12.17***			-0.397***			-0.228**
			(1.243)			(0.087)			(0.075)
Father High School			5.865*			-0.141			0.00012
			(2.928)			(0.094)			(0.093)
Mother Age			2.937			-0.055			-0.100**
			(2.426)			(0.120)			(0.042)
Mother Age Squared			-0.026			0.0004			0.001
			(0.030)			(0.0014)			(0.0005)
Father Age			0.299			-0.067*			0.016
			(1.708)			(0.034)			(0.014)
Father Age Squared			-0.0003			0.0007**			-0.0004
			(0.019)			(0.0002)			(0.0002)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province Fixed Effects		Yes	Yes		Yes	Yes		Yes	Yes
Year x Province		Yes	Yes		Yes	Yes		Yes	Yes
Sample Mean		449			3.822			2.192	
Sample S.D.		104			2.989			2.151	
Adjusted R^2	0.633	0.641	0.651	0.050	0.057	0.066	0.012	0.025	0.037
N		13,425			14,176			14,178	

Notes: DD estimates for cross-sectional samples, pooling data from the 1994-2006 NLSCY. Robust standard errors (in parentheses) are clustered at the province level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4. 5 Children in Mother-Disabled versus Father-Disabled Families

	Math Score		Hyperactivity		Emotional Anxiety	
	Mother Disabled	Father Disabled	Mother Disabled	Father Disabled	Mother Disabled	Father Disabled
Benefit x Disability	2.433**		-0.179***		-0.101**	
	(1.032)		(0.033)		(0.043)	
Benefit x Disability		0.476		0.021		-0.023
		(0.919)		(0.036)		(0.056)
Parental Disability	-0.789	-19.30**	0.080	-0.004	-0.098	-0.002
	(11.77)	(6.519)	(0.627)	(0.217)	(0.341)	(0.202)
Benefit	3.632***	4.979***	-0.021	-0.145***	-0.110***	-0.324***
	(0.321)	(0.306)	(0.017)	(0.008)	(0.009)	(0.005)
Child Age in Month	1.586**	1.580**	-0.011***	-0.011***	0.009***	0.008***
	(0.582)	(0.574)	(0.001)	(0.002)	(0.001)	(0.001)
Child Female	-1.756	-1.867	-1.053***	-1.031***	0.087	0.067
	(3.324)	(3.464)	(0.041)	(0.046)	(0.079)	(0.054)
Either Parent Immigrant	2.313	3.946***	-0.156	-0.122	0.035	0.059
	(1.263)	(1.079)	(0.115)	(0.097)	(0.057)	(0.043)
Mother Diploma	17.94***	17.972***	-0.358***	-0.360***	-0.057	-0.0607
	(2.219)	(2.104)	(0.092)	(0.092)	(0.086)	(0.093)
Father Diploma	9.895***	9.819**	-0.070	-0.069	0.049	0.055
	(2.961)	(3.108)	(0.078)	(0.077)	(0.122)	(0.118)
Mother High School	12.14***	12.17***	-0.397***	-0.389***	-0.226**	-0.224**
	(1.258)	(1.307)	(0.089)	(0.086)	(0.073)	(0.079)
Father High School	6.156*	5.986*	-0.144***	-0.135***	-0.001	0.005
	(3.001)	(2.966)	(0.090)	(0.092)	(0.092)	(0.090)
Mother Age	3.441	4.155	-0.062	-0.036	-0.059	-0.102**
	(2.247)	2.239)	(0.121)	(0.112)	(0.044)	(0.036)
Mother Age Squared	-0.034	-0.044	-0.0005	0.0001	0.0004	0.001*
	(0.026)	(0.027)	(0.011)	(0.001)	(0.0006)	(0.0005)
Father Age	-0.567	-0.299	-0.078**	-0.098**	-0.007***	-0.003
	(2.044)	(1.938)	(0.031)	(0.036)	(0.0003)	(0.026)
Father Age Squared	0.011	0.008	0.0008*	0.001***	-0.00008	-0.0002***
	(0.022)	(0.022)	(0.0004)	(0.0003)	(0.009)	(0.000003)
Sample Mean	449	449	3.789	3.775	2.155	2.147
Sample S.D.	104	104	2.971	2.962	2.138	2.125
Adjusted R^2	0.652	0.653	0.065	0.063	0.038	0.037
N	11,972	11,932	12,803	12,817	12,809	12,824

Notes: DD estimates for cross-sectional samples, pooling data from the 1994-2006 NLSCY. Robust standard errors (in parentheses) are clustered at the province level. * $p < 0.1$, $p < 0.05$, *** $p < 0.01$

Table 4. 6 Disability Benefit Effects on Parental Paid Work and Family Income

	Mother-Disabled Families					Father-Disabled Families				
	Own Hours		Spousal Hours		Family Income (LPM)	Own Hours		Spousal Hours		Family Income (LPM)
	Hours (OLS)	Hours 30+ (LPM)	Hours (OLS)	Hours 30+ (LPM)		Hours (OLS)	Hours 30+ (LPM)	Hours (OLS)	Hours 30+ (LPM)	
	"Math Score" Sample (Parents of Children in Grade 2-10)									
BEN x DIS	-0.684***	-0.019***			-0.027***	-0.885***	-0.019***			-0.014
	(0.194)	(0.005)			(0.006)	(0.244)	(0.005)			(0.008)
BEM x DIS			-0.449***	-0.009***				-0.138	-0.003	
			(0.125)	(0.002)				(0.289)	(0.007)	
DIS	-0.100*	-5.727**	-1.922	-0.059***	-0.114	-13.965***	-0.294***	-5.768	-0.068	-0.271***
	(0.051)	(2.307)	(1.492)	(0.001)	(0.089)	(2.810)	(0.063)	(3.252)	(0.051)	(0.006)
Adjusted R^2	0.067	0.088	0.081	0.068	0.166	0.110	0.099	0.086	0.065	0.171
N			11,438					11,434		
	"Hyperactivity and Anxiety" Sample (Parents of Children in Aged 4-11)									
BEN x DIS	-1.009***	-0.026***			-0.024***	-0.628**	-0.012***			-0.008
	(0.225)	(0.004)			(0.005)	(0.202)	(0.004)			(0.007)
BEM x DIS			-0.415***	-0.009***				-0.523	-0.009	
			(0.116)	(0.004)				(0.289)	(0.006)	
DIS	-3.831	-0.057	-0.778	-0.031	-0.121*	-14.271***	-0.311***	-5.313	-0.052	-0.266**
	(2.634)	(0.060)	(1.142)	(0.024)	(0.056)	(3.698)	(0.081)	(4.283)	(0.088)	(1.196)
Adjusted R^2	0.094	0.073	0.096	0.084	0.175	0.123	0.112	0.094	0.072	0.178
N			11,006					11,959		

Note: DD estimates for cross-sectional samples, pooling data from the 1994-2006 of NLSCY. Robust standard errors (in parentheses) are clustered at the province level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4. 7 Non-Disabled Father's Full-Time Employment as a Mechanism for Benefit Effects

	Math Score		Hyperactivity		Anxiety	
	M1	M2	M1	M2	M1	M2
Benefits x Parental Disability	2.433**	2.185	-0.179***	-0.170***	-0.101**	-0.103**
	(1.032)	(1.261)	(0.033)	(0.026)	(0.043)	(0.044)
Father Hours (30 +) x Disability		-18.072**		0.299**		-0.010
		(5.763)		(0.121)		(0.172)
Mother Hours (30 +) x Disability		-7.821		-0.246		-0.066
		(13.02)		(0.272)		(0.117)
Father Hours (30 +)		-1.198		-0.300		-0.199
		(6.432)		(0.442)		(0.348)
Mother Hours (30 +)		0.356		0.293***		0.061
		(1.841)		(0.078)		(0.072)
Mother Disability	-0.789	19.447*	0.080	-0.053	-0.098	-0.081
	(11.77)	(10.53)	(0.627)	(0.613)	(0.341)	(0.253)
Benefit	3.632***	4.577***	-0.021	0.031*	-0.110***	-0.132***
	(0.321)	(0.444)	(0.017)	(0.015)	(0.009)	(0.013)
Adjusted R^2	0.652	0.653	0.065	0.068	0.038	0.040
N	11,972	11,925	12,803	12,714	12,809	12,720

Note: Robust standard errors (in parentheses) are clustered at the province level. * p < 0.1, ** p < 0.05, *** p < 0.01

Table 4. 8 Robustness -- Children of Parents with Higher Education

	Math Score		Hyperactivity		Anxiety	
	Low Education	High Education	Low Education	High Education	Low Education	High Education
Benefit x Disability	1.159***		-0.107***		-0.072*	
	(0.290)		(0.016)		(0.033)	
Benefit x Disability		0.135		-0.037		0.037
		(2.155)		(0.060)		(0.038)
Disability	-8.937**	-43.92**	0.058	0.085	0.020	1.066*
	(2.064)	(17.342)	(0.211)	(1.549)	(0.222)	(0.579)
Benefit	5.381***	1.229	-0.121***	0.528***	-0.289***	0.173***
	(0.272)	(1.761)	(0.009)	(0.014)	(0.006)	(0.013)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Province Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year x Province	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.641	0.651	0.057	0.066	0.025	0.037
N	13,425	6,037	14,176	5,848	14,178	5,851

Note: Robust standard errors (in parentheses) are clustered at the province level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4. 9 Robustness -- Child Fixed Effects

	Full Sample	No Inter-Provincial Movers	No Children in Alberta	No Children in PEI
Benefit x Disability	9.765**	9.538**	9.131**	9.538**
	(3.864)	(3.817)	(3.634)	(3.817)
Parental Disability	2.458	2.473	3.406**	2.473
	(1.393)	(1.391)	(1.095)	(1.391)
Year Fixed Effects	Yes	Yes	Yes	Yes
Year x Province	Yes	Yes	Yes	Yes
Adjusted R^2	0.641	0.651	0.057	0.066
Number of Children	1612	1564	1470	1564
N	3224	3128	2940	3128

Note: Child fixed-effects estimates for the effect of parental disability benefits on children's math test scores. When running the regression, I include a slightly different set of covariates to control for the initial condition, since all time-invariant variables will be dropped out of the regression, including a dummy indicating cohort, and higher order interactions between province and year fixed effects. Robust standard errors (in parentheses) are clustered at the province level. $^{*}\ p < 0.1$, $^{**}\ p < 0.05$, $^{***}\ p < 0.01$

CHAPTER 5 CONCLUSIONS

Understanding the mechanisms by which the life chances of children are either positively or adversely affected by the circumstances and behaviours of their parents is an essential part of developing effective polices to give children equal opportunities in life. The essays of this dissertation show that a significant disadvantage is imposed on children by parents' illness or disability during early years of skill development and that this disadvantage extends into young adulthood. This linkage of intergenerational transmission of disadvantage is found both in a developing country, China, that heavily relies on self-pay for medical treatment, and in an affluent country, Canada, with universal healt care and income supports for people with disabilities.

Sickness is among the key objective economic risks named in the United Nations' Universal Declaration of Human Rights (Article 25; Osberg and Sharpe, 2012).[58] Given its widespread prevalence, the research findings of this thesis point out a potential mechanism that underpins the intergenerational mobility of income, through which parents' health status precipitates economic status, and the economic status of parents gives children advantages or disadvantages that may continue later in life.

Finding of this dissertation also suggest that the extent of children's achievement gap associated with parental illness can be mediated by improved access to health care, better insurance coverage, and higher cash transfer made available to affected parents to promote better children's outcomes. Therefore, targeted government programs, such as Social Assistance for persons with a disability, and Employment Insurance sickness benefits that help cushion parents' fall due to serious illness or disability may indirectly protect children from the negative consequence of parental sickness. Compared to universal programs, these targeted programs are easier to implement yet, according to current research, likely to produce long-term benefits that may exceed the additional costs.

[58] The other named economic risks are unemployment, widowhood, disability, and old age.

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APPENDIX A: CONSTRUCTION OF ADOLESCENT OUTCOME MEASURES

Variable Name	*Component Questions*
Standardized Math Score (Grades 2-10) Range: 0-750	The test is a shorter version of the Mathematics Computation Test from the Canadian Achievement Test (2nd edition) and is designed to measure a child's basic competencies in math (addition, subtraction, multiplication and division of integers, etc.). Children are given different versions of tests based on their school grades. Consequently, the NLSCY releases two types of math scores: a raw score which is the sum of the number of questions that are correctly answered by a child, and a standardized score which is a scaled version based on a normative sample chosen by the Canadian Testing Center. This study uses the standardized math test score.
Hyperactivity Score Scale: 0-14	The score ranges from a minimum of zero (no hyperactivity) to fourteen (high hyperactivity). • Cannot sit sill, is restless of hyperactive • Is distractible, has trouble sticking to any activity • Cannot concentrate, cannot pay attention for long • Is impulsive, acts without thinking • Has difficulty awaiting turn in games or groups • Cannot settle to anything for more than a few minutes • In inattentive
Physical Aggression / Conduct Disorder (10-15 year olds) Scale: 0-10	The score ranges from a minimum of zero (no aggression) to ten (high aggression). • I get into many fights. • When another young person accidentally hurts me I assume that he/she meant to do it, and I react with anger and fighting. • I physically attack people. • I threaten people. • I bully or am mean to others. • I kick or hit other people my age.
Pro-Social Score (10-19 year olds) Scale: 0-20	High score indicates behaviour associated with pro-social behaviour. • I show sympathy to (I feel sorry for) someone who has made a mistake. • I try to help someone who has been hurt. • I offer to help clear up a mess someone else has made. • If there is an argument, I try to stop it. • I offer to help other young people (friend, brother or sister) who are having difficulty with a task. • I comfort another young person (friend, brother, or sister) who is crying or upset. • I help to pick up things which another young person has dropped. • When I am playing with others, I invite bystanders to join in a game. • I help other people my age (friends, brother or sister) who are feeling sick. • I encourage other people my age who cannot do things as well as I can.
General-Self Score (10-19 year olds) Scale: 0-16	In general how do you feel about your life • I like myself • I have confidence in myself • I often wish I was someone else • I would change how I look if I could • think you are good-looking • feel helpless • feel confident in yourself
How far do you want to go to school? (10-15 year olds) Scale: 1-4	Top two categories are grouped in order to obtain sufficient observations in each cell. • Middle / Junior or Senior High School • College / CEGEP • University • More than University

How much do you like school? (10-15 year olds) Scale: 1-4	The scale provided by the NLSCY is reversed so a higher value indicates a better outcome. Bottom two categories are grouped in order to obtain sufficient observations in each cell. • Not so much /Hate • A bit • Quite a bit • Very
How well do you do at school? (10-15 year olds) Scale: 1-4	The scale provided by the NLSCY is reversed so a higher value indicates a better outcome. Bottom two categories are grouped in order to obtain sufficient observations in each cell. • Poorly / Very Poorly • Average • Well • Very well

APPENDIX B: DISABILITY DESIGNATIONS IN TEN DISABILITY BENEFIT PROGRAMS

Province/Disability Benefit Programs	*Disability Designation*
NL[59] (Income Support Program)	A person who, because of a persistent and permanent physical, sensory, speech, communication, psychological, psychiatric, developmental or other disability, demonstrates significant challenges in accessing education, training, or employment.
PEI[60] (Social Assistance Program)	A person in need "who has an ongoing intellectual, mental or physical impairment".
NS[61] (Employment Support and Income Assistance)	Refers to severe and persistent restriction or impairment that results in an inability to perform an activity in the range or within the range considered normal for someone of the same age, gender, and culture. It describes a functional limitation (versus a diagnosis) and is ongoing in nature.
NB [62](Social Assistance Program)	The Medical Advisory Board considers an individual for certification (of disability) who suffers from a major physiological, anatomical, or psychological impairment, which severely limits the individual in normal living activities, and which is likely to continue indefinitely without substantial improvement (i.e. totally and permanently disabled).
Quebec[63] (Social Solidarity Program)	A person who, because of a persistent and permanent physical, sensory, speech, communication, psychological, psychiatric, developmental or other disability, demonstrates significant challenges in accessing education, training, or employment.
ON[64] (Ontario Disability Support Program)	A person with a disability is defined as a person who has a substantial physical or mental impairment that is continuous or recurrent and is expected to last one year or more. The impairment must result in a substantial restriction in one or more activities of daily living (ability to attend to personal care, function in the community or function in a workplace), taking into account the person's age, level of education and employment experience/work history.
MB[65] (Employment and Income Assistance)	(A person who suffers from) physical or mental ill health, or physical or mental incapacity or disorder that is likely to continue more than 90 days is unable to earn income to meet basic necessities or unable to care for themselves.
SK[66] (Saskatchewan Assistance Program)	Clients with a disability are those whose employment or training capabilities are limited and no change is expected within one year.
AB[67] (Assured Income for the Severely Handicapped)	Applicants and clients must have a severe handicap that substantially limits their ability to earn a living; and is likely to remain permanent. There is no training, medical treatment or therapy that would improve the person's ability to earn a living.
BC[68] (BC Employment and Assistance Program)	Refers to cases which include a person 18 years of age or over with a severe mental or physical impairment, which restricts the person`s ability to perform daily living activities. The person must require an assistive device, the help or supervision of another person, or the services of an assistance animal to perform daily living activities.

[59] NL: Income and Employment Support Regulations. www.hrle.gov.nl.ca/hrle
[60] PEI: Social Assistance Policy Manual http://www.gov.pe.ca/sss/index.php3?number=1028464&lang=E
[61] NS: http://www.gov.ns.ca/coms/disabilities/documents/GlossaryofTerms.html
[62] NB: Social Assistance Policy Manual. http://www.gnb.ca/0017/Policy%20Manual/POL-E/policy1.htm#blind
[63] Quebec: Individual and Family Assistance Act. http://www.mess.gouv.qc.ca/solidarite-sociale/programmes-mesures/assistance-emploi/index_en.asp
[64] Ontario: Income Support Directives. http://www.mcss.gov.on.ca/en/mcss/programs/social/directives/ODSP_incomesupport.aspx
[65] MB: Income Assistance for Persons with Disabilities. http://www.gov.mb.ca/fs/pwd/iapd.html#content
[66] SK: SAP Policy Manual. http://www.socialservices.gov.sk.ca/SAP-policy-manual.pdf. In addition, a separate disability support program, Saskatchewan Assured Income for Disability (SAID) was initiated since 2009
[67] AB: AISH Policy Manual. http://www.seniors.alberta.ca/aish/PolicyManual/Policy/Eligibility/Eligibility_Criteria.htm
[68] BC: Persons with disabilities. http://www.hsd.gov.bc.ca/factsheets/2004/pwd.htm