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INTERGENERATIONAL TRANSMISSION OF INEQUALITIES: ARE HEALTH INEQUALITIES AT BIRTH THE MISSING LINK?

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Intergenerational transmission of inequalities: Are health inequalities at birth the missing link?*

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Abstract/Résumé

This paper shows that poor health at birth can act as a barrier to upward economic mobility, reinforcing inequality across generations. Using linked administrative data for two Canadian birth cohorts, we find that mothers born with low birth weight (LBW) are significantly more likely to have LBW children. Sibling comparisons reveal that LBW reduces the probability of surpassing parental income rank by 4 percent. We show that ongoing childhood health shocks partly—but not fully—explain this effect, suggesting both direct and indirect pathways. Our findings highlight how policies targeting prenatal and early-life health could help break persistent cycles of disadvantage.

Cet article montre que la mauvaise santé à la naissance constitue un facteur limitant de la mobilité économique ascendante, contribuant ainsi à la perpétuation des inégalités intergénérationnelles. À partir de données administratives appariées portant sur deux cohortes de naissance canadiennes, nous montrons que les femmes nées avec un faible poids à la naissance (FPN) présentent une probabilité significativement plus élevée de donner naissance à des enfants également affectés par un FPN. Des comparaisons intra-familiales entre sœurs indiquent qu'un FPN réduit de 4 % la probabilité pour un individu de dépasser le rang de revenu de ses parents. Nos analyses suggèrent que cette relation est partiellement expliquée par des chocs de santé survenant durant l'enfance, sans toutefois l'expliquer entièrement, ce qui révèle l'existence de canaux à la fois directs et indirects. Ces résultats soulignent le rôle potentiel des politiques de santé ciblant la période prénatale et la petite enfance dans la lutte contre la transmission intergénérationnelle du désavantage socioéconomique.

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1 Introduction

Why do some families escape poverty while others remain trapped across generations? A growing body of evidence suggests that early-life health disadvantages play a central role. Children born into poverty tend to experience worse health at birth, which in turn hinders their cognitive development, educational attainment, and long-term earnings (e.g., Case, Fertig and Paxson 2005). Low birth weight (LBW)—defined as a birth weight below 2,500 grams—is a widely used marker of poor fetal health and serves as a key proxy for assessing how early-life conditions shape later socioeconomic outcomes (e.g., Figlio et al. 2014; Black, Devereux and Salvanes 2007; Bharadwaj, Lundborg and Rooth 2018; Royer 2009).

While much of the existing research shows that LBW reduces absolute educational attainment and income, it remains unclear whether its consequences extend to relative economic mobility—an individual's ability to surpass their parents' economic position. If LBW lowers the likelihood of upward mobility, this would imply that health inequality at birth is a critical mechanism perpetuating intergenerational inequality. This question is especially relevant given that prior work—often using within-family comparisons—focuses on isolating causal effects but seldom quantifies how early-life health shapes mobility.

This paper addresses that gap by leveraging rich administrative data that link two Canadian birth cohorts across generations. We construct an intergenerational dataset that connects children born between 2006 and 2015 to their mothers, who were themselves born between 1983 and 1996, using matched birth certificates and income tax records. This linkage allows us to observe detailed information on health at birth—specifically birth weight and gestational age—for both the mothers and their children. In addition, we can identify sisters within the mothers' generation and link them to their respective children, enabling us to compare outcomes across cousins born to sisters. This design allows us to examine whether LBW is transmitted from mother to child, and whether early-life health disadvantages contribute to a cycle of limited upward mobility. We find that mothers who were born with LBW are about 30 percent more likely to have a child born LBW, providing robust evidence of health transmission across generations. This relationship holds even when comparing cousins born to sisters (using grandmother fixed effects) and when adjusting for potential selection using inverse probability weighting.

Our results further suggest that the intergenerational transmission of LBW is partly mediated by persistent socioeconomic disadvantage. Mothers who were themselves born with LBW occupy lower socioeconomic positions at childbirth, as measured by educational attainment and income. Compared to their normal birth weight sisters, they are more likely to give birth during adolescence, less likely to attain a university degree, and more likely to fall in the bottom quartile of the income distribution. They are also more likely to give birth in the same province or city in which they were born—a novel finding that connects geographic immobility with health and economic persistence, resonating with literature on place and social mobility (e.g., Chetty and Hendren 2018; Chyn and Katz 2021; Laliberté 2021).

Next, we examine the long-run consequences of being born with LBW using a separate sample of individuals whom we follow from birth into adulthood and for whom we can directly observe both parental socioeconomic status during early childhood and their own adult outcomes. This mobility sample includes individuals born between 1993 and 1996 who are linked to their parents' tax records, allowing us to construct precise measures of parental income rank and adult income rank. Consistent with previous evidence, LBW is associated with lower educational attainment and adult income. More importantly, using sibling fixed effects, we find that individuals born with LBW are about 4 percent less likely than their normal birth weight siblings to achieve upward economic mobility—that is, to have an income rank in young adulthood that exceeds the parental income rank they were exposed to in early childhood. These findings are robust to controls for birth order, gestational age, and other birth characteristics.

To shed light on why LBW has such persistent effects on later outcomes, we go beyond perinatal conditions and examine the role of postnatal health shocks. Specifically, we incorporate measures of childhood hospitalizations across three key developmental stages: early childhood (ages 0–5), mid-childhood (7–12), and adolescence (13–17). Our results show that while low birth weight remains a strong predictor of educational attainment and upward mobility, its estimated impact declines when these later health shocks are included. For example, the negative effect of LBW on the probability of achieving upward mobility falls by 13 percent when controlling for subsequent hospitalizations. Moreover, more days spent in hospital at any stage during childhood further reduces the likelihood of upward mobility and university completion. These findings suggest that poor health at birth can trigger a chain of ensuing health challenges that cumulatively hinder human capital accumulation, reinforcing the intergenerational cycle of disadvantage.

Our paper is among the first to examine the intergenerational consequences of low birth weight.[1] While this literature documents substantial intragenerational penalties, less is known about the intergenerational transmission of LBW and its implications for social mobility. Existing evidence confirms that LBW tends to be transmitted from mother to child (e.g., Black, Devereux and Salvanes 2007; Currie and Moretti 2007; Qian et al. 2017; Giuntella, La Mattina and Quintana-Domeque 2023), but few studies investigate whether this transmission also constrains upward mobility. A notable exception is Currie and Moretti (2007), who examine the link between LBW transmission and socioeconomic status (SES) using U.S. data. However, their SES measures are defined at the geographic level, limiting individual-level inference. Moreover, this literature rarely quantifies mobility using income rank—a widely used measure in studies of intergenerational mobility.[2] Our data allow us to directly link mothers and children across generations and to measure both birth weight and individual-level income ranks, enabling a more precise assessment of how health at birth shapes social mobility.

Another exception is Karbownik and Wray (2025), who show that poor child health—beyond the neonatal period—can contribute to occupational rank persistence across generations. While our findings are broadly consistent with theirs, we extend the literature by examining how poor health at birth interacts with socioeconomic status in shaping long-run outcomes. Specifically, we investigate how the long-term human capital consequences of being born at low birth weight contribute to the intergenerational transmission of poor infant health and, in turn, lower social mobility.

Together, our findings suggest that part of the intergenerational transmission of socioeconomic status occurs through birth outcomes. Consequently, policies that improve prenatal health conditions may help break cycles of disadvantage. Supporting this perspective, we provide suggestive evidence that a nutritional assistance program for pregnant women in Québec could raise upward mobility by approximately 14 percent, underscoring the broader potential of prenatal interventions

[1] A large body of research has shown that low birth weight has persistent effects on human capital accumulation through reduced test scores (e.g., Figlio et al. 2014), lower educational attainment (e.g., Johnson and Schoeni 2011; Conley et al. 2003), and impaired cognitive development (e.g., Black, Devereux and Salvanes 2007). These effects may in part operate through subsequent health problems during childhood (e.g., Currie et al. 2010; Elder et al. 2020). Other studies have linked LBW to poorer adulthood outcomes via these early disadvantages (e.g., Bharadwaj, Lundborg and Rooth 2018; Royer 2009; Johnson and Schoeni 2011).

[2] See, for instance, Chetty et al. (2014a), Chetty et al. (2014b), and Corak (2013).

to promote long-term economic opportunity.

The remainder of the paper is organized as follows. Section 2 provides additional background; Section 3 describes the data; Section 4 outlines the identification strategy; Section 5 presents the main results; Section 6 discusses additional analyses; Section 7 considers policy implications; and Section 8 concludes.

2 Why is birth weight important for social mobility, and how?

Birth weight is more than a number on a scale; it is a critical first chapter in the story of one's health and socioeconomic potential. David Barker, a British epidemiologist, pioneered the idea that foetus starvation is associated with increased susceptibility to metabolic syndromes such as hypertension, coronary, and cardiovascular diseases (Barker 1992, 1995, 1999). Since then, research on the *fetal origin hypothesis* has been burgeoning in the medical, epidemiological and economic literatures. The focus among economists has been directed at making causal claims on the relationship between birth weight and educational outcomes and income into adulthood, two important parameters of a person's socioeconomic status. Many published studies have focused on designs exploiting twins-fixed effects to identify the effects of interest.[3] For example, Figlio et al. (2014) show that between twin siblings, the heavier at birth has better test scores across all six grades in Florida. Using the same identification strategy, Bharadwaj, Lundborg and Rooth (2018) find the same result for adult incomes of children born in Sweden. In particular, they find a positive effect of birth weight on permanent income and income at different stages of the life cycle. Similarly, Oreopoulos et al. (2008) use a cohort of children born in the province of Manitoba (Canada) and find a positive relationship between low birth weight and social assistance take-up by age 25. All these results convey that neonatal health plays a role in the transmission of social inequalities. Because there is no direct link between that literature and the one focusing on the determinants of social mobility, the influence of health at birth on social mobility is somewhat inferential. We attempt to fill this gap by examining the effect of low birth weight on social mobility outcomes such as geographic mobility.

[3] See Almond et al. 2005; Almond and Mazumder 2011; Bharadwaj et al. 2018; Black et al. 2007; Currie and Moretti 2007; Figlio et al. 2014; Johnson and Schoeni 2011; Oreopoulos et al. 2008; Royer 2009.

What is the rationale behind the fact that we should trace social mobility back to the beginning of life? Part of the answer lies in the skills formation framework presented by James Heckman and colleagues (e.g., Cunha and Heckman 2007). In their framework, skills acquired in one period (e.g., in childhood) are complementary to skills developed later in life, i.e. 'skills beget skills.' The literature in medicine suggests that low birth weight is often the expression of an inadequate development of brain structure and a deficient immune system (e.g., Avchen, Scott and Mason 2001). In this spirit, recent work by Elder et al. (2020) suggests that neurodevelopmental disability during school age could be a pathway through which birth weight influences cognitive ability in the long run. Hence, children with health vulnerabilities such as low birth weight would more likely accumulate health complications and face educational setbacks in their childhood. This should matter for social mobility; for example Karbownik and Wray (2025) show that health shocks between ages 0 and 12 can be directly linked to a decline in occupational status compared to their parents that healthy siblings do not experience.

Low birth weight could stem from health problems during the gestational period. Economists have documented the causal effect of in utero exposure to nutrient deprivation (e.g., Almond and Mazumder 2011), conflicts (e.g., Quintana-Domeque and Ródenas-Serrano 2017), natural disasters (e.g., Currie and Rossin-Slater 2013; Rosales-Rueda 2018), and air pollution (e.g., Knittel, Miller and Sanders 2016; Palma, Petrunyk and Vuri 2022) on neonatal health.[4] The degree to which these health problems are disproportionately concentrated among disadvantaged families may reflect the transmission of disadvantage. That is, disadvantaged families are more likely to face credit constraints, to live in more polluted environment, and be vulnerable to natural disasters, thus producing more poorly endowed infants on average.

These ideas can be stretched into the flow chart in Figure 1.

[4]For an overview of fetal origin hypothesis research, see the recent review by Almond et al. (2018).

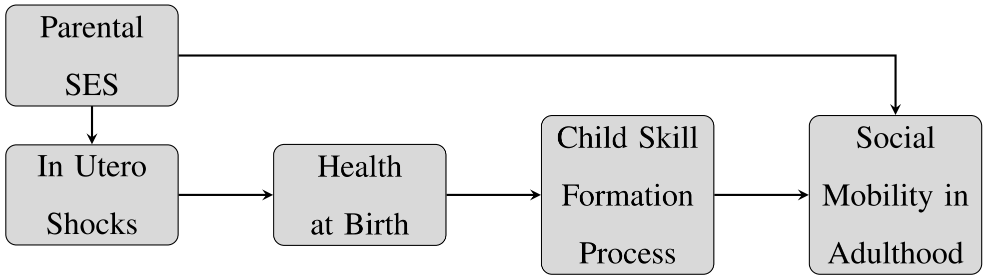


Figure 1: Conceptual framework

3 Data

3.1 Data Source

We use linked administrative data for two Canadian birth cohorts: all children born between 1983 and 1996 and all children born between 2006 and 2015. For both cohorts, we observe detailed birth certificate information, including health at birth (birth weight and gestational age), sex, birth order, and basic parental demographics such as age, marital status, and place of residence at birth.

For the 1983–1996 cohort, we link birth records to hospitalization data (available from 1994 to 2018)[5], postsecondary education records (up to 2019), and annual tax files for individuals who filed income tax returns through 2018. This linkage allows us to follow individuals from birth into early adulthood: up to age 35 for the oldest in the cohort and age 22 for the youngest. For a subset of this cohort—children born between 1993 and 1996—we also observe their mothers' annual tax records from the year of birth through 2018, enabling us to construct measures of parental income during early childhood.

For the 2006–2015 cohort, we use the same birth certificate information to identify the health at birth of the child and link mothers to detailed administrative records, including postsecondary education and annual tax files, which cover periods before and after childbirth.

This rich dataset makes it possible to examine both the intergenerational transmission of health at birth (linking mothers in the first cohort to their children in the second) and the long-run consequences of low birth weight for individuals' own socioeconomic mobility. We describe how we use these linked cohorts to address our research questions in the section below.

[5]The hospitalization data are not available for those residing in the province of Quebec.

3.2 Sample construction

Our analysis is based on two overlapping samples. The first sample (transmission sample) has fewer observations and consists of mothers born between 1983 and 1996 whose child was born between 2006 and 2015. The second (mobility sample) consists virtually of all births in Canada between 1993 and 1996.

Transmission sample. We begin with the children born to Canadian mothers between 2006 and 2015. Since our focus is on health at birth, we drop observations with missing values on pregnancy duration and birth weight. From approximately 3.5 million births that meet this criteria, we restrict the sample to 591,000 whose mothers were born between 1983 and 1996. Table A.1 in the appendix compares this sample of offsprings with the full population of 2006-2015 births. For instance, mothers in the transmission sample are six years younger, 11 percentage points more likely to have had a teenage pregnancy (ages 13-17) and around 20 percentage points less likely to be married on average than the full set of mothers having given birth to a child between 2006 and 2015. These differences could threaten the validity of our analysis if they result in nonrandom selection on our measure of health inequality (low birth weight). Table A.1 shows that the children born to mothers in the transmission sample are a healthier selected sample of children born between 2006 and 2015. The incidence of low birth weight is 0.6 percentage points lower. To reduce the influence of nonrandom selection, we estimate our main regressions using inverse probability weighting.[6]

Our data also allow us to identify cousins in the cohort of births between 2006-2015. We do so by focusing on children in the transmission sample whose mothers had a sister who was also born between 1983 and 1996. Figure 2 clarifies our sampling frame, and highlights how our identification strategy amounts to comparing outcomes of sisters A and B, and their birth outcomes for cousins A and B. We identify sisters using grandmothers (mothers in the first generation) personal ID. Of the 591,000 children matched to their mothers, 79,000 children are born to sisters. There is no difference in the incidence of low birth weight between the matched sample and the sample of cousins.

[6]Our main specification uses weights based on the predicted likelihood of being matched across generations conditional on low birth weight. We also explore an extended model using a richer set of demographic and health variables. Full details of the weighting procedure and robustness checks are provided in Appendix B.

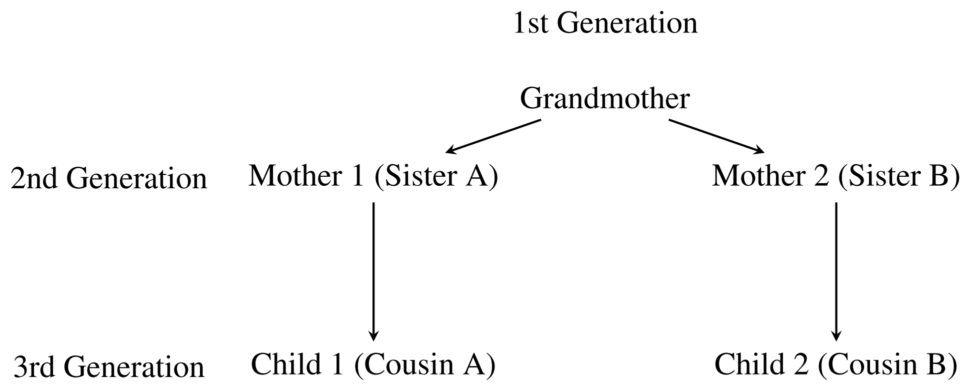


Figure 2: Generations

Mobility sample. To further examine the link between low birth weight and social mobility, we need to have access to both parents' and children's incomes. For individuals born between 1993 and 1996, we have access to most mothers' tax files (from the year of child's birth onwards) and their own (in their twenties).[7] We restrict this sample to those with non-missing information on health at birth. In addition, we drop individuals who could not be matched to a tax file.[8] We also use hospitalization records to construct the number of hospitalizations at different stages of childhood.[9] Finally, out of approximately 1 million of children born between 1993 and 1996, about 30% are born to the same mother. Compared to the transmission sample, the increase in sample size enhances our ability to establish the relationship between health inequality at birth and social mobility with greater statistical precision.

3.3 Variables and summary statistics

Since our goal is to examine the effect of low birth weight on the intergenerational transmission of inequality, we focus on measures of socioeconomic status that capture both income and educational outcomes at the family (mother) and child levels. Below, we define the key variables used primarily in the first part of the paper (transmission sample).[10]

Parental income at childbirth. We measure income at both the mother and the family lev-

[7] Although the complementary sample and the transmission sample may overlap in the sense that children in the mobility sample could be mothers in the transmission sample, we treat the two samples separately given the nature of our analysis.

[8] They represent less than one percent of the sample

[9] We do this only for residents of provinces other than Quebec, amounting to approximately 244,000 individuals.

[10] Appendix Table C.2 summarizes which variables and family fixed effects apply in each sample.

els. At the mother level, we use total pre-tax income from all sources (labour, investment, self-employment, taxable capital gains/losses). At the household level, our measure consists of the sum of both partners' total income. While family income is what should matter most for children's health, we distinguish between mother and family income in order to indirectly explore the impact of health endowment at birth on assortative matching patterns, i.e. the tendency of individuals to pair up with partners of similar socio-economic status.[11]

In our transmission analysis, we define income at childbirth as the average income over the two years preceding birth. We exclude the year the child was born to avoid accounting for the impact of the child's birth on income (through maternity leave, adjustments in labor supply, etc.; see Kleven et al. (2019)).

Next, we define a low-income indicator for whether the calculated income at childbirth is in the bottom quartile of the income distribution for a given year. For example, this variable will indicate that a mother *i*'s income in the two years prior to delivery was in the bottom quartile of the income distribution for women who gave birth in that same year.

Poor neighborhood. Birth certificates of infant born between 2006 and 2015 also provide the income quintile of the mother's Forward Sortation Area (FSA).[12] We use this information to construct an indicator of lowest income quintile which we consider a proxy for poor neighborhood. We note that there is a strong association between this indicator of low income and our measure of low family income.

Grandparents' low SES. We use the 1986 Canadian Census to extract information on the grandparents' (first generation) socio-economic status at the mother's (second generation) birth. For mothers in the transmission sample, the census division of residence is available in the birth certificate[13] and we use poverty at that geographic level to proxy for grandparents' SES. Particularly , we define grandparents' low SES poverty as a dummy variable indicating whether the poverty rate in the census division in which the grandmothers lived at the mother's birth is in the top quartile of the national poverty rate distribution.

No post-secondary education. We create an indicator for mothers with less than a post-secondary

[11] To account for inflation, we measure income in 2014 Canadian dollars.

[12] FSA are generally determined by the first three characters of the postal code and are equivalent to Census Tract in the US. On average, they count around 8,000 inhabitants each, although there is an important variability across FSAs.

[13] Compared to the postal area, the census division is a larger geographic area, such as municipalities within a province.

education (completed or ongoing) by the year of their child's birth. However, the way it is constructed suggests a more nuanced interpretation. We only observe post-secondary education attainment if the individual's ID appears in the post-secondary education records. Therefore, there is a risk of incorrectly assigning the status "no post-secondary education", as post-secondary institutions attended abroad or private institutions are not recorded in the data. This risk is small given that most post-secondary education institutions in Canada are public (or receive public funding).

Migration or geographic mobility. From the birth certificates of both the transmission and the mobility samples, we have information on census division or the census subdivision in which the children were born.[14] We define migration in our context when the census division of the grandmother[15] does not match the census division of the mother when she herself gave birth. Using census divisions instead of census subdivisions, we consider migration across municipalities, a more significant type of geographic mobility.

Summary statistics. Table 1 shows the descriptive statistics of the key variables. There are three important facts to take from this table.

First, there is no apparent difference in the incidence of low birth weight between the second (the mothers) and the third generations, despite the fact that they were born 24 years apart. This could indicate a low influence of time in our analysis.[16]

The second fact is that we are likely focusing on a sample of people with low economic status. Almost 43% of the mothers in our transmission sample lived in a low-income household (a similar proportion for low-income individuals) when their child was born. However, there is a huge difference between our measure of low income at the individual (family) level and at the geographical level. The proportion of mothers who live in a low-income (or poor) neighborhood is 27.9%. This difference is probably due to the fact that the individual level of low income compares the income of young adult women (who are probably entering the labor market) with that of older women.[17] In addition, 11.8% of the mothers are university educated. Yet, a very small proportion of them participated in STEM programs compared to health-related studies (1.7% vs. 8.3%).

[14] FSAs or postal codes at birth were not available for both samples, making it impossible to use a finer geographical partition.

[15] In other words, when the mother was born.

[16] For example, medical improvements could have decreased the mortality rate of low birth weight.

[17] As mentioned above, there is a five-year gap between the matched sample of mothers and the population of mothers for the period 2006-2015.

Finally, the mothers (second generation) are more likely than the general population of their cohort to have been born in a low-SES area. Indeed, 39% of mothers were born in a high-poverty census division, and 35% were probably raised in an area of low social mobility. This is very interesting given that recent papers suggest that social mobility is low for individuals in areas with higher poverty rates (e.g., Connolly, Haeck and Lapierre 2021).

Table 1: Summary Statistics

	Observations	Mean	SD
A. Child variables			
% Male	591,900	51.3	50
Birth weight (in grams)	591,900	3405	570.8
% Low birth weight (Birth weight < 2500grams)	591,900	5.4	22.6
Gestation age (in weeks)	591,900	38.9	1.9
% Premature (Gestation age < 37 weeks)	591,900	7.4	26.1
Number of siblings	591,900	0.7	2
B. Mother variables			
% Low birth weight	591,900	5.3	22.4
Birth weight (in grams)	591,900	3350	535
% Premature	591,900	5.3	22.4
Mother's age	591,900	23.9	8.6
% Teenage mothers	591,900	14	34
% No post-secondary education	591,900	57.7	49.4
% University-educated	591,900	11.8	32.3
% STEM studies	591,900	1.7	13
% Health related studies	591,900	8.3	27.6
% Income is in lowest quartile	591,900	38.9	48.7
% Family income is in lowest quartile	591,900	42.6	49.4
% Poor neighborhood	591,900	27.9	44.9
% Has migrated	591,900	67.4	46.9
C. Grandparents variables			
% grandparents are in high poverty area	573,800	39.2	48.8
% grandparents are in the low social mobility area	573,800	35.0	47.7

Notes: We use the sample of children born during the period 2006-2015 whose mothers were born during the period 1983-1996. We refer to this sample as our transmission sample.

4 Empirical Framework

To estimate the effect of low birth weight (LBW) on the intergenerational transmission of inequality, we adopt a simple reduced-form approach that exploits rich administrative linkages and within-family variation. Specifically, we estimate:

$$y_{ik} = \beta LBW_{ik} + \gamma X_{ik} + \theta_k + \varepsilon_{ik}, \tag{1}$$

where i indexes individuals born to mother k. The outcome y_{ik} is either an indicator for whether the individual's child was born LBW (for the transmission sample) or a measure of the individual's own socioeconomic outcomes in adulthood (for the mobility sample).

The variable LBW_{ik} equals one if the individual was born with a birth weight below 2,500 grams. The vector X_{ik} includes observable birth characteristics such as gestational age, sex, birth order, parental age, marital status, and additional family SES measures where available.

Our parameter of interest, β, captures the association between being born LBW and later outcomes. To address potential confounding by unobserved family factors (e.g., genetic traits or household background), we exploit within-family variation using family fixed effects, θ_k.

In the transmission sample, our design compares cousins born to sisters, holding constant characteristics shared by siblings of the same grandmother through grandmother fixed effects. This cousin comparison design helps net out time-invariant factors shared across the extended family.

In the mobility sample, we compare siblings born to the same mother, using mother fixed effects, which control for all unobserved traits shared by siblings within the same nuclear family. We cluster standard errors at the family level: grandmother ID for the transmission sample and mother ID for the mobility sample.

5 Intergenerational transmission of low birth weight: how and why?

In this section, we focus on the *transmission sample*, which includes mother-child pairs where the mother was born between 1983 and 1996 and the child was born between 2006 and 2015.[18] Our aim is to examine the extent to which low birth weight (LBW) is transmitted across generations, and to explore whether this relationship is mediated by the socioeconomic status (SES) of the mother at the time of her child's birth.

[18] See Section 3 for details on sample construction.

Our analysis proceeds in two steps. First, we compare the birth outcomes of children born to two sisters—i.e., first cousins—while controlling for unobserved family background using fixed effects at the grandmother level. This allows us to estimate the intergenerational transmission of low birth weight net of shared family-level factors such as genetics or upbringing.

Second, we examine whether LBW in one generation affects maternal SES at the time of her child's birth. To do this, we estimate the following regression model:

$$y_{ijk} = \beta LBW_{ijk} + \gamma X_{ijk} + \theta_k + \mu_{ij} + \varepsilon_{ijk}, \tag{2}$$

where y_{ijk} denotes the outcome of mother i at the birth of child j, born in family k. Our preferred specification also controls for fixed effects for the mother's location (or FSA) at the birth of her child, μ_{ij}. These fixed effects allow us to control for unobserved factors at the neighborhood level that may be correlated with the outcomes of interest and with low birth weight (e.g. access to prenatal care, etc.). In most of our tables, we report estimates for specifications with and without location fixed effects. The vector X_{ijk} includes a set of individual and family-level controls: child's gender, birth year, singleton status, maternal and paternal ages, and parental marital status at birth, as described in Section 4. It also includes characteristics of the grandmother (generation 1), such as her age at the mother's birth, marital status, and year of delivery.

5.1 Is low birth weight transmitted from generation to generation?

Since our main focus is on the intergenerational transmission of health inequality, we report in Table 2 the estimated effect of mother low birth weight on her own child's low birth weight status (panel A) and on her child's birth weight in grams (Panel B). In appendix Table D.3, we also present the effect of the mother's birth weight in grams on her child's birth weight in grams (in levels and logged).

Column (1) in Panel A reports the raw correlation between the mother's and her child's low birth weight indicator. It shows that being born low weight is associated with 4.37 percentage point increase in the probability of having a low birth weight child. This is a very large (80 percent) increase compared to the incidence of low birth weight in the third generation (5.4%). This effect is as apparent in column (2) where we control for the demographic characteristics X_{ijk} listed in section 4.[19] In percentage terms, a mother born low-weight is almost 90% more likely to transmit this status on to her child. This estimated transmission of low birth weight masks, as discussed in Section 4, the potential influence of unobserved family-level determinants of health in the two generations. In column (3), we seek to mitigate the role of such determinants by including grandmother fixed effects in our regression. Therefore, we compare the birth weight of the offspring of two sisters with a different low birth weight status. In doing so, the point estimate is considerably reduced by a factor of three, statistically different from the ones reported in columns (1) and (2), but still statistically significant at the 5% level. Our interpretation of this important difference is that genetics and other unobserved family background might account for a great share of the raw transmission of health inequalities at birth. We find that a sister born low-weight is 32% (1.58pp) more likely to give birth to a low-weight baby than her sister born at a normal weight. In columns (4)-(6), we show that this result is robust to the inclusion of both observed and unobserved controls for socioeconomic variables. First, both the point estimates and the standard errors are quite similar when we control for mother's education and income at her child's birth in column (4). Second, when we control more thoroughly for the mother's SES at her child's birth by including current FSA fixed effects in column (5), the effect of mother low birth weight falls by approximately 10%. Last, in column (6) we include fixed effects for the mother's birth location (census division). If the transmission of SES is what drives the transmission of health at birth and not the other way around, one should expect a decrease in the point estimate. We do not observe such a pattern, suggesting that the transmission of health inequality at birth is a potential factor that explains the transmission of SES.

The same pattern emerges when we look at the effect of a mother's low birth weight on her child's birth weight in grams (Panel B). In the most elaborate regression, we find that having a mother born low-weight is associated with a 79-gram decrease in one's own birth weight. To put this result in perspective, the effect of maternal low birth weight is approximately 40% that of the effect of smoking during pregnancy documented by Almond, Chay and Lee (2005). Why should low birth weight be so persistent? Perhaps because low birth weight is related to low SES, which is in turn correlated with unhealthy behaviors such as smoking?

[19] We also control for a quadratic term in parental ages to take into account non-linearity. However, the results are not sensitive to the inclusion or not of quadratic terms.

Table 2: Transmission of birth weight from the mother to the child.

	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent variable					
	Panel A: Child is low birth weight					
Mother is low birth weight	0.0437***	0.0444***	0.0158**	0.0157**	0.0142**	0.0146**
	(0.0020)	(0.0019)	(0.0070)	(0.0070)	(0.0070)	(0.0071)
Mean dependent variable	0.05	0.05	0.05	0.05	0.05	0.05
Mean effect	87.4%	88.8%	31.6%	31.4%	28.4%	29.2%
	Panel B: Child's birth weight in grams					
Mother is low birth weight	−187.3***	−187.1***	−82.26***	−81.786***	−79.04***	−79.08***
	(4.219)	(4.027)	(14.66)	(14.64)	(14.92)	(15.00)
Mean dependent variable	0.05	0.05	0.05	0.05	0.05	0.05
Mean effect	87.4%	88.8%	31.6%	31.4%	28.4%	29.2%
Socio-demographic controls		✓	✓	✓	✓	✓
Grandmother FE			✓	✓	✓	✓
Mother SES controls				✓	✓	✓
Mother current location FE					✓	✓
Mother birth location FE						✓
Observations	591,900	591,900	79,000	79,000	79,000	79,000

Notes: This table reports estimates of the effect of a mother's low birth weight on her child's low birth weight in panel A and on her child's birth weight in grams in panel B. Column (1) presents raw correlation between mother's low birth weight and her child's low birth weight. In column (2) we add basic demographic controls that include indicator for male child, indicator for twin birth, indicator for married mother, year of birth, mother and father's age, and quadratic terms for ages. We add grandmother fixed effects in column (3). We add SES variables at the child's birth such as lowest income indicator, university-educated indicator, and no post-secondary education indicator in column (4). Columns (5)-(6) report estimates when mother's current location and birth location fixed effects are, respectively, added. We proxy past zip code by the census division of residence of the grandmother at the mother's birth. Standard errors are in brackets and clustered at the grandmother level.
Statistical significance: *p<0.1; **p<0.05; ***p<0.01.

5.2 Why is low birth weight transmitted across generations?

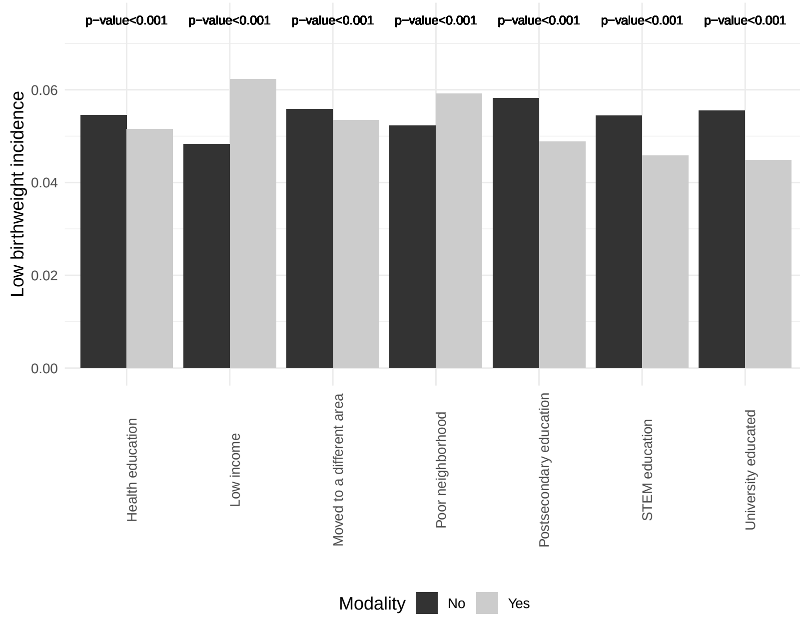
5.2.1 SES determinant of low birth weight

Figure 3 shows stylized facts that support a possible link between the transmission of low birth weight and the transmission of inequalities. First, panel (a) shows a strong correlation between maternal SES at childbirth and low birth weight. Low birth weight children appear to be concentrated among less advantaged mothers. For example, the incidence of low birth weight is almost 6% (while the mean is 5.4%) among mothers with either low income, less than post-secondary education or living in a poor neighborhood. Looking at fields of education, the same pattern emerges.

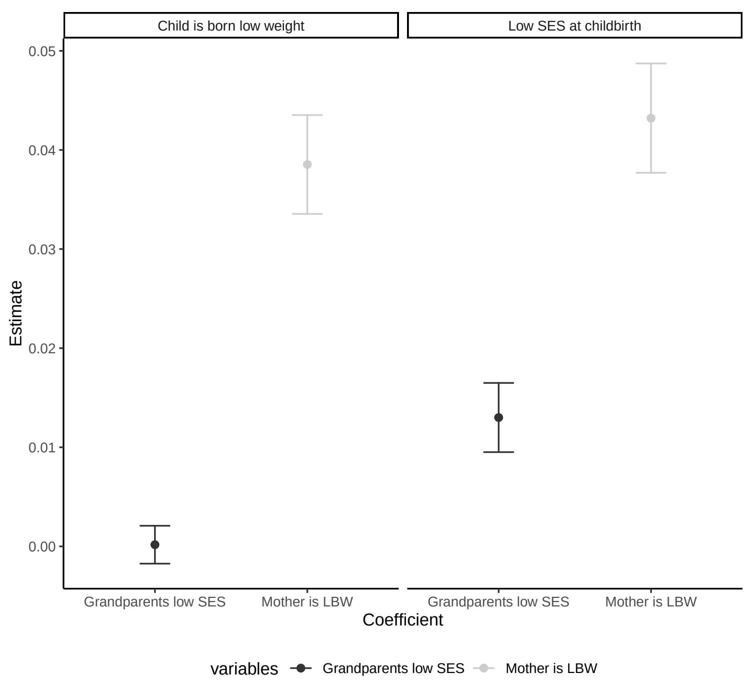
There is a statistically significant difference in the incidence of low birth weight between mothers with STEM education[20] and those without. This difference is even more pronounced than that between mothers majoring in health studies and those majoring in another field or not graduating from university. That picture is consistent with the scenario that high earnings mothers (university educated, STEM education) have better health outcomes. Panel (b) shows that a mother's low birth weight predicts both her child's low birth weight and her SES at childbirth. If less advantaged mothers are more likely to give birth to a low-weight child[21], and if low-birth weight children are more at risk of becoming less socioeconomically advantaged in adulthood, the gradients reported in Figure 3 would be consistent with the transmission of health inequality at birth being a mechanism for patterns of intergenerational poverty. In what follows, we show results consistent with conjecture.

[20] Generally associated with higher incomes and good labor market outcomes (Melguizo and Wolniak, 2012).

[21] For example, because of increased exposure to stress during pregnancy (Matsas et al., 2023) or difficult access to a healthy diet or a higher prevalence of smoking (Alsayeed et al., 2023).



(a) Association between measures of SES and low birth weight



(b) Intergenerational correlation in health and SES

Figure 3: Intergenerational correlation

Notes: Panel (a) shows differences in the rate of low birth weight across maternal socioeconomic variables. Panel (b) shows estimates of the correlation between mother's (2^{nd} generation) low birth weight, her own parent's (1^{st} generation) SES, and her child's (3^{rd} generation) low birth weight and income status at birth.

5.2.2 Effects of second generation low birth weight on SES at childbearing

The fact that the transmission of low birth weight is attenuated (even slightly) when we include current location fixed effects highlights the possible mediation effect of SES at childbirth. For this to be true, the mother's low birth weight should have a causal effect on her socio-economic outcomes. We examine this question in Table 3 which reports the effects of a mother's low birth weight on her individual-level measure of SES. Although our preferred specification includes family (grandmother) fixed effects and FSA fixed effects (column (3)), Table 3 also reports results for regressions that include only basic controls in column (1) and grandmother fixed effects in column (2).

Column (1) shows a strong negative link between maternal low birth weight and all of our measures of maternal SES. But once we control for grandmother fixed effects, the effect is reduced by half and the standard error triples in magnitude, leaving the results statistically insignificant at standard levels. These patterns are in line with the results presented in Table 2.

We focus on the effects of low birth weight on maternal education in panel A. We consider three different dependent variables: an indicator for having a post-secondary education, an indicator for having a university education, and an indicator for graduating from a STEM program. The effect of maternal low birth weight appears to only have a statistically significant association with the likelihood of having a university education. Relative to her normal weight sister, the low weight one is 1.8 (on a baseline of 11.8) percentage point less likely to have a university degree. The result is robust to the inclusion of FSA fixed effects (in column (3)). Although we find no significant effect on the other educational outcomes, the standard errors are quite large, and the absence of a significant effect could be due to a lack of statistical power rather than to the absence of an effect per se.

In Panel B, we turn to outcomes associated with income including average individual and family total income in the two years before childbirth[22], and a variable indicating if income falls in the bottom quartile of the income distribution by cohort and year. Looking at income in levels, column (2) indicates that of two sisters, the one born low weight faces a loss of C$764 in her personal income and her household faces a loss of C$1,367. The fact that the effect of low birth weight on family total income is almost twice the effect on individual income could suggest assor-

[22]We consider the second year before childbirth as labor market decisions may be endogenous to fertility decisions

tative matching, i.e. the initial endowment of the mother influences her future outcomes but could also influence the type of partner she associates with. This is only suggestive, but could imply that the next generation could suffer an enhanced impact of her mother's initial health endowment. When we look at the effect of low birth weight on indicators for the lowest income quartile, we find that the effect triples in size when we control for family background. Compared to her sister born weighing at least 2500 grams, a sister born below that weight is 2.3 percentage points more likely to be in the bottom 25% of the income distribution of mothers who give birth in the same year she did. We do not find any significant effect when we consider an indicator for low family income being in the lowest quartile. However, the standard errors are twice the size of the point estimates, so we cannot completely rule out the possibility of an effect which would be undetected because of precision issues. The penalty of low birth weight on income is even more pronounced (marginally though) when we add neighborhood fixed effects. This suggests that within the same neighborhood there is still a difference in SES due to initial endowment between sisters.

We also examine the likelihood of becoming a teenage mother as an additional SES outcome. Teen pregnancy is often considered both a marker of socioeconomic disadvantage and a pathway through which economic vulnerability is perpetuated. Column (3) of Table 3 shows that women born at low birth weight are 2.63 (on a baseline of 14) percentage points more likely to give birth as teenagers compared to their normal weight sisters. These results support the hypothesis that the effects of low birth weight may manifest early in the life course through fertility decisions that can influence future mobility.

Overall, our results are supportive of the causal effect of mother low birth weight on the vast majority of her socio-economic indicators at the time of childbirth. Because we rely on individual-level measures (from tax files and other administrative data) and not on average income at the neighbourhood level, our estimates are less likely to suffer from measurement error.

Table 3: Effects of low birth weight of mother on SES at her child's birth

Dependent variable	OLS	Family FE	Zip FE
Panel A: Education at child's birth:			
No post-secondary education	0.0453***	0.0211	0.0210
	(0.0038)	(0.0158)	(0.0158)
University indicator	−0.0275***	−0.0180**	−0.0179**
	(0.0019)	(0.0073)	(0.0073)
STEM major	−0.0038***	−0.0004	−0.0013
	(0.0008)	(0.0035)	(0.0036)
Panel B: Income at child's birth			
Individual income (levels)	−1,189.2***	−764.0**	−844.0***
	(94.99)	(325.4)	(324.8)
Family income (levels)	−4,163.7***	−1,367.2*	−1,436.7*
	(317.5)	(804.7)	(793.9)
Individual income is in lowest quartile	0.0087**	0.0230*	0.0291**
	(0.0029)	(0.0123)	(0.0123)
Family income is in lowest quartile	0.0399***	0.0045	0.0050
	(0.0031)	(0.0106)	(0.0105)
Panel C: Teenage pregnancy	−0.0055***	0.0214***	0.0263***
	(0.0016)	(0.0080)	(0.0087)
Observations	591,900	79,000	79,000

Notes: We report estimates of the effect of low birth weight on education outcomes (panel A) and income variables (panel B) at child's birth based on equation (1) and using the transmission sample. Column (1) reports the estimation of the OLS regression, where we include basic controls. In columns (2) to (3) we sequentially add the grand-mother and current location (FSA) fixed effects. Our controls include indicator for male child, indicator for twin birth, indicator for married mother, year of birth, mother and father's age, and quadratic terms for ages. Standard errors are in parentheses and clustered at the family (grandmother) level. See section (3.3) for the definitions of the dependent variables.

Statistical significance: *p<0.1; **p<0.05; ***p<0.01.

5.3 Effects of low birth weight on moving to opportunity

The gradual inclusion of FSA fixed effects in Table 2 highlighted that mothers who reside in a different area at the time of the birth of their child compared to their own place of birth tend to have children with better health outcomes. Could the mother's initial health endowment explain her migration pattern? To address this question, we build on the literature examining the impact of migration on social mobility and investigate whether being born with low birth weight influences the likelihood of "moving to opportunities". We must first specify how we measure migration and how it is related to opportunities. Our data only document migration when a mother lives in a different census division to where she was born. A large proportion (about two thirds) of our transmission sample have migrated. This is probably because our definition of migration is broader than year-to-year migration (e.g., Chetty and Hendren 2018) and does not capture the whole migration pattern well. For example, we cannot tell for sure when mothers have migrated (in early childhood vs. late childhood vs young adulthood). However, given that our empirical strategy compares siblings — one has moved and the other has not — our definition is still very informative. Second, migration is related to a change in opportunities if our definition of moving actually corresponds to better economic conditions. We test this conjecture by estimating the effect of migration on the socio-economic status. To do so, we estimate the following model:

$$SES_{iklm} = \beta Moved_{ikl} + X_{ik}\gamma^{'} + \theta_k + \lambda_l + \eta_m + \varepsilon_{iklm}. \tag{3}$$

The coefficient of interest, β, captures the effect of moving on a socioeconomic variable SES_{iklm} of mother i (second generation) born in family k and in census division l and living in FSA m at the birth of her child. $Moved_{ikl}$ indicates if i lives in a different census division at childbirth than the one she was herself born in. We include the same controls in X as in equation (1). We also include grandmother fixed effects, θ_k, to identify β from differences in migration status between sisters. Mothers born in a particular census division l could be more likely to move as adults because of, for instance, an unobserved lack of amenities. We account for such systematic migration patterns by including census division of birth (or origin) fixed effects λ_l. Finally, we control for the possibility that unobserved characteristics of people lead them to sort to a specific neighborhood with current FSA (or destination) fixed effects η_m.[23] Standard errors are clustered at the family level to take into account serial correlation in error terms within families.

Effect of low birth weight on migration. We begin by reporting the effect of low birth weight on migration status in Table 4. A naive OLS regression (column (1)) fails to detect any correlation between migration and low birth weight, and yields a coefficient on low birth weight for which

[23] We could alternatively control for census division fixed effects (since our moving variable is defined using census divisions). However, we choose to use a finer geographic partitioning in case very local contemporaneous factors are both correlated with a mother's choice of destination and her SES at childbirth.

the sign is counter-intuitive. Although not statistically significant when controlling for family unobserved background, the direction of the potential effect becomes intuitive (column (2)). This highlights once again the ability of our family fixed effects to capture *hard-to-measure* confounding factors at the family level. Column (3) shows that the unobserved characteristics of the place where mothers live matter. Indeed, we find that of two sisters, the one born low-weight is 2.09 percentage point less likely to have migrated. This represents a 4.3% (on a baseline of 67 percentage points) decrease in the probability of migration.

Table 4: Effects of Mother low birth weight on social mobility predictor: geographic mobility.

	(1)	(2)	(3)
Dependent variable	OLS	Family FE	Zip FE
Mother moved	0.0052	−0.0145	−0.0209*
	(0.0033)	(0.0114)	(0.0110)
Observations	591,900	79,000	79,000

Notes: We report estimates of the effect of low birth weight on migration based on equation (3) and using the transmission sample. Column (1) reports the estimation of the OLS regression, where we only include basic controls X. In columns (2) to (3), we sequentially add sibling and current FSA fixed effects. Our controls include indicator for male child, indicator for twin birth, indicator for married mother, year of birth, mother and father's age, and quadratic terms for ages. Standard errors are in parentheses and clustered at the family (grandmother) level. See Section 3.3 for the definitions of the migration variable.

Statistical significance:*p<0.1; **p<0.05; ***p<0.01.

Effects of migration on SES. Table 5 estimates equation (3) using migration status as an independent variable. Panels A and B, as in Table 3, focus respectively on education and income-related outcome variables. Moving from column (1) to (3), we examine the sensitivity of the effect of migration to the sequential addition of family, origin and destination fixed effects.

Panel A, unsurprisingly, documents that migration is associated with better education outcomes. The results for our preferred specifications in column (3) show that of two sisters, the one who has migrated is 1.71 (on a baseline of 4.23) percentage point more likely to have a post-secondary education. When we look at the type of post-secondary and fields of education, we find some particularly interesting patterns. First, migration is associated with 0.63 percentage point increase in the probability of having a university education. This is consistent with the story that the search for opportunities is probably the goal of migration. The strong effect on health-related studies reinforces this interpretation. We find that migration is associated with 1.59 percentage point increase in the probability of majoring in health-related fields. In fact, tertiary institutions offering health programs are, in most cases, located in large urban areas (such as Montreal, Toronto, Vancouver, Quebec city). The fact that migration is associated with the pursuit of health-related studies is therefore not surprising if medical schools are not evenly distributed across the country.

In panel B, we are interested in the effects of migration on income variables. Migration has a statistically significant effect on all income variables we consider unless we control for destination fixed effects. Once we add destination fixed effects migration has a statistically significant effect at the 5% level on total family income and on the probability of living in a neighborhood within the bottom quartile of the distribution in terms of average income. For total family income, column (3) shows that migration is associated with a C$892 increase. This point estimate represents 62% of the estimated effect of low birth weight on family income in Table 3. This simple calculation suggests that initial health endowments have a stronger effect on social mobility than opportunity seeking. We also find that migration is associated with a 1.27 (on a baseline of 28) percentage point lower probability of living in poor neighborhoods. Since geographic mobility is a component of social mobility (e.g., Chetty and Hendren 2018; Boujija, Connolly and St-Denis 2023), our results here suggest that one's initial endowment could play a role in social mobility.

Table 5: Effects of migration on SES at childbirth.

Dependent variable	Family FE	Origin FE	Destination FE
Panel A: Education at child's birth:			
No post-secondary education	-0.0111^{**}	-0.0098^{*}	-0.0171^{***}
	(0.0053)	(0.0053)	(0.0065)
College education	0.0157^{***}	0.0149^{***}	0.0074
	(0.0040)	(0.0041)	(0.0048)
University indicator	0.0031	0.0030^{**}	0.0063^{*}
	(0.0030)	(0.0030)	(0.0037)
STEM major	0.0040^{***}	0.0041	0.0026
	(0.0014)	(0.0014)	(0.0018)
Health related studies	0.0126^{***}	0.0129^{***}	0.0159^{***}
	(0.0028)	(0.0028)	(0.0034)
Panel B: Income at child's birth			
Individual income (levels)	703.5^{***}	420.2^{***}	175.2
	(130.5)	(128.3)	(156.9)
Family income (levels)	$1,837.7^{***}$	$1,484.9^{***}$	892.0^{**}
	(366.2)	(375.2)	(433.9)
Individual income is in lowest quartile	-0.0200^{***}	-0.01030^{*}	-0.0014
	(0.0054)	(0.0053)	(0.0062)
Family income is in lowest quartile	-0.0123^{**}	-0.0094^{**}	-0.0047
	(0.0046)	(0.0047)	(0.0055)
Poor neighborhoods	-0.0160^{***}	-0.0152^{***}	-0.0127^{**}
	(0.0031)	(0.0106)	(0.0105)
Observations	591,900	79,000	79,000

Notes: We report estimates of the effect of migration on education outcomes (panel A) and income variables (panel B) at child's birth based on equation (1) and using the transmission sample. In columns (1)-(3) we sequentially add the grand-mother, Census division of birth, and current FSA fixed effects. All of our estimates control for indicator for male child, indicator for twin birth, indicator for married mother, year of birth, mother and father's age, and quadratic terms for ages. Standard errors are in parentheses and clustered at the family (grandmother) level.

Statistical significance: *p<0.1; **p<0.05; ***p<0.01.

6 Additional results

6.1 Effects of low birth weight on upward social mobility

Because health inequalities at birth are transmitted from one generation to the next and because health inequalities at birth are involved in the process of opportunity seeking, our results suggest that the transmission of low birth weight may play a role in perpetuating the cycle of poverty. In this section, we provide additional evidence to support this claim. This part of the analysis is based on our *mobility sample*.[24] We seek to determine how being born weighing less than 2,500 grams is related to low social mobility in one's early twenties. In this regard, we introduce a more direct measure of social mobility in our analysis. We construct a social mobility indicator that shows whether the child's income rank in his early twenties is higher than his parents' income rank when he was aged 0-5. We continue to use mother fixed effects θ_k (See Equation 1) to compare siblings who differ in their birth weight status, thus controlling for all time-invariant family characteristics. This approach helps isolate the role of early health endowment in shaping socioeconomic trajectories, net of family background.

Table 6 shows the results of this analysis. All our regressions include family and FSA fixed effects. Each column of the table corresponds to a different outcome. We first find (columns 2 and 3) an association between low birth weight and the likelihood of university education and of majoring in a STEM field, supporting the idea that the lack of an effect in Table 3 could be due to the lack of statistical power. The association with a university education falls in the same range as the results in Table 3. We find that low birth weight is associated with a 2.02 percentage point decrease in the probability of having a tertiary education. In addition, we find that low birth weight is associated with a 1 (on a baseline of 18.9) percentage point lower probability of being enrolled in (or graduated from) STEM programs.

Turning to our social mobility indicators, we find that the sibling born low-weight is less likely to climb the social ladder in her early twenties. More specifically, low birth weight is associated with a 1.47 percentage point decline (on a baseline of 35 percentage points) in the probability of upward social mobility. Although we argue that low birth weight may hinder social mobility, our

[24] All individuals born in Canada between 1993 and 1996. Here, the focus is not on the transmission of health inequalities, but rather on the intergenerational income mobility. Ahmed et al. (2024) use the same data to explore the role of premature births on upward social mobility.

analysis acknowledges a significant limitation: income in the early twenties may not accurately reflect permanent income or serve as a comprehensive measure of lifetime socioeconomic status (Solon 1999). However, supported by our findings on lower education attainment (in university education and STEM fields), we cautiously interpret the impact of low birth weight as influencing *potential* social mobility.[25] In other words, our results indicate that among siblings, the one born at less than 2500 grams is less likely to be on a trajectory surpassing their parents in terms of life achievements and socioeconomic standing.

Table 6: Effects of Low Birth Weight on Outcomes in Early Twenties

Dependent variable	Missing education	University	STEM	Social mobility
Birth weight < 1,500 grams	0.0052	-0.0202^{***}	-0.0100^{**}	-0.0147^{***}
	(0.0054)	(0.0051)	(0.0047)	(0.0054)
mean dependant variable	0.308	0.402	0.189	0.350
Controls	✓	✓	✓	✓
Family FE	✓	✓	✓	✓
Location FE	✓	✓	✓	✓
Observations	325,150	325,150	325,150	325,150

Notes: We report estimates of the effects of low birth weight on young adult outcomes based on equation (1) and using the mobility sample. Each column corresponds to a different outcome. We include grand-mother and FSA fixed effects in all our regressions. All of our estimates control for indicator for male child, indicator for twin birth, indicator for married mother, year of birth, mother and father's age and quadratic terms for ages. We also control for the length of gestation. Standard errors are in parentheses and are clustered at the family level.
Statistical significance: *p<0.1; **p<0.05; ***p<0.01.

6.2 Low birth weight or later health shocks?

Although our analysis has focused on examining the impact of low birth weight on new outcomes directly related to social mobility, it overlooks the potential long-term effects of childhood health shocks on adult outcomes. In fact, there is growing interest in understanding how postnatal (versus perinatal, which we explore here) health shocks influence future outcomes (e.g., Almond, Currie and Duque 2018).

To address this question, we modify the equation (1), by including the number of days spent in

[25] However, Corak (2020) shows that income ranks are established early in life, so there is a strong correlation between income ranks in the twenties and late thirties, when permanent income is typically defined.

acute care facilities (hospitalizations), separately, for early, mid, and late childhood. Specifically, we consider hospitalizations between ages 0 and 5 ($Health_{0-5}$), 7 and 12 ($Health_{7-12}$) and 13 and 17 ($Health_{13-17}$).[26] The model is rewritten as follows:

$$y_{ik} = \beta_0 LBW_{ik} + \beta_1 Health_{0-5} + \beta_2 Health_{7-12} + \beta_3 Health_{13-17} + X_{ik}\gamma' + \theta_k + \varepsilon_{ik}. \tag{4}$$

The other variables are as described in equation (1).

Table 7 shows the coefficient estimates for low birth weight and hospitalizations at ages 0-5, 7-12, and 13-17 separately. The table suggests that low birth weight is still a strong predictor of all our young adult outcomes when we add later childhood health shocks. However, we note that compared to Table 6, the point estimates of the impact of low birth weight on university education and upward mobility decrease by 3% (-2.02 pp vs -1.95 pp) and 13% (-1.47 pp vs -1.28 pp), respectively. In addition, a 10-day increase in hospitalizations at ages 0-5, ages 7-12, and ages 13-17 decreases the probability of being university educated, respectively, by 1.2, 2 and 2.6 percentage points. For the social mobility indicator, the same increase in hospitalizations yields a decrease in the likelihood of upward mobility by 0.8, 2.4, and 1.2 percentage points, respectively.

Overall, when we look at the magnitude of the point estimates for all three variables of health shock, we can draw two possible and non-mutually exclusive conclusions. First, prenatal health shocks are persistent (at least in early adulthood), and part of their effect is mediated through their influence on later childhood health shocks. Second, compared to early-life hospitalizations, later childhood hospitalizations seem to be more important when it comes to influencing outcomes in adulthood. This could be because in a model in which health at birth, health in early life and health in late childhood are integrated, the stronger predictive power of health at birth on health in early life encompasses the effect of the latter.[27] We explore this possibility by regressing low birth weight in hospitalizations in early life or late childhood hospitalizations. The results are shown in Appendix Table F.5, which confirms the predictive power of low birth weight on health shocks in childhood. Compared to his sibling, the low birth weight sibling spent nearly 2 additional days in

[26] We mainly draw on Currie et al. (2010).

[27] Another possible interpretation is that health at birth influences health in subsequent life stages at a diminishing rate.

acute care facilities in his first five years of life, while the effect on late childhood hospitalizations was 95% lower.[28]

Table 7: Effects of Low Birth Weight and Hospitalizations on Outcomes in Early Twenties.

Dependent variable	Missing education	University education	STEM	Social mobility
Birth weight < 1,500 grams	0.0095	-0.0195^{***}	-0.0144^{***}	-0.0128^{**}
	(0.0062)	(0.0059)	(0.0054)	(0.0063)
Hospitalizations at ages 0-5	0.009^{*}	-0.0012^{***}	-0.0005	-0.0008^{*}
	(0.0004)	(0.0004)	(0.0003)	(0.0005)
Hospitalizations at ages 7-12	0.0031^{***}	-0.0020^{**}	-0.0010^{*}	-0.0024^{***}
	(0.0009)	(0.0006)	(0.0008)	(0.0005)
Hospitalizations at ages 13-17	0.0024^{***}	-0.0026^{***}	-0.0017^{***}	-0.0012^{**}
	(0.0004)	(0.0004)	(0.0003)	(0.0005)
Controls	✓	✓	✓	✓
Family FE	✓	✓	✓	✓
Location FE	✓	✓	✓	✓
Observations	244,000	244,000	244,000	244,000

Notes: We report estimates of the effects of low birth weight and acute hospital stays in childhood on young adult outcomes based on equation (4) and using the mobility sample. Each column corresponds to a different outcome. We include mother and FSA fixed effects in all our regressions. All of our estimates control for indicators for male child, twin births, married mother, year of birth, mother and father's age and quadratic terms for ages. Standard errors are in parentheses and are clustered at the mother level.

Statistical significance: *p<0.1; **p<0.05; ***p<0.01.

6.3 Heterogeneity by SES

How parents respond to their child's poor health at birth could be influenced by their socioeconomic status. Wealthier parents might be better equipped to compensate for the adverse effects of low birth weight. Therefore, examining the heterogeneity by SES can help understand whether

[28] Behavioral problems in adolescence, such as substance use, could influence children's academic success (e.g., Wang and Fredricks 2014). Using ICD-10 codes for hospitalizations related to the use of substances such as opioids, alcohol, and others, we also explore the link between low birth weight and the likelihood of being hospitalized for these problems between the ages of 12 and 17. We find no effect of low birth weight on hospitalizations due to substance use (see Table G.6) The lack of effect of low birth weight (LBW) on hospitalizations due to substance use could be partly due to limitations in the measurement of substance abuse. Data only capture severe cases that result in hospitalization, potentially missing less severe or unreported cases managed in outpatient settings or private clinics. Furthermore, the analyzed age range (12 to 17 years) may not align with the maximum risk period for substance use behaviors related to LBW; such effects could manifest earlier in childhood or later in early adulthood. These factors could result in an underestimation of the relationship between LBW and substance use if it occurs primarily in less severe or timed instances.

parental resources can mitigate the poor health of their child. We explore this by estimating the effects of low birth weight on future outcomes separately for individuals in the mobility sample born in families above (rich) and below the median income (poor).[29]

Table 8 reports both OLS and sibling fixed-effects estimates of the effects of LBW on the same outcomes as in Table 6. For the heterogeneity analysis by parental income (above vs. below the median), we instead focus on the second generation's absolute income rank. Since these subgroups are defined based on parental SES, intergenerational mobility measures offer limited additional variation. Income rank provides a clearer measure of how low birth weight affects economic outcomes within relatively homogeneous SES backgrounds.

Generally speaking, the table does not show a clear differential effect between individuals born to rich and poor parents since both OLS estimates and sibling fixed-effects estimates are similar across the two samples. This may underscore the role of universal health coverage in Canada. However, we observe that the effects of LBW on university education and hospitalization at young ages are greater for the sample of rich parents. A closer look at the point estimates and standard errors prevents us from interpreting this as the failure of parental input to compensate for their child's poor health. First, it is only when we consider the sibling fixed effects that the point estimates for university education diverge (1.49 pp vs. 2.56 pp).[30] Furthermore, the effect is less precisely estimated for the sample of poor parents. Children from low-SES families may be less academically inclined, which could contribute to lower estimated coefficients and inflated standard errors.[31] A similar argument applies to hospitalizations in childhood. If children in low-SES families are more likely to face health challenges at a young age, there may be little difference between the low birth weight sibling and the normal weight sibling in terms of hospitalizations during early childhood.

We observe a notable differential effect of low birth weight on income rank in early adulthood between children from rich and poor families. Once we control for family background (using

[29] Parents' income is the family's total income averaged over the first five years of the child's life. While a measure of pre-birth earnings would have been less likely to be endogenous to the child's (second generation) low birth weight status, we only have access to parents' (first generation) tax record from the year of the child's (second generation) birth onward.

[30] The OLS estimates were in the same range (3.39 pp vs. 3.46 pp).

[31] Another way to interpret this is that children from poor family backgrounds may attend post-secondary education in their late twenties, making our identification noisy for this group (see Doray et al. (2024) for recent evidence of inequality in access to post-secondary education between children from rich and poor parents).

mother fixed effects), we find that low birth weight is associated with a lower income rank in early adulthood only for children born into low-SES families. This suggests that low birth weight marks a clear economic disadvantage later in life between siblings in poor families, but not as much in rich families. It may be that family resources in wealthier families help compensate for the economic drawbacks caused by a poor initial endowment, thus mitigating the long-term impact of low birth weight. This finding sheds further light on how health inequalities at birth can serve as a channel through which socioeconomic inequalities persist across generations.

Table 8: Heterogeneity by SES

	Poor (N=159,919)		Rich (N=165,238)	
	OLS	Siblings FE	OLS	Sibling FE
Missing education	0.0270***	−0.0057	0.0228***	0.0100
	(0.0062)	(0.0081)	(0.0054)	(0.0072)
University education	−0.0339***	−0.0149***	−0.0346***	-0.0256***
	(0.0053)	(0.0069)	(0.0064)	(0.0082)
STEM	−0.0174***	−0.0075	−0.0244***	−0.0157*
	(0.0037)	(0.0051)	(0.0061)	(0.0089)
Income rank in young adulthood	−0.0130***	−0.0139***	−0.0114***	−0.0073
	(0.0036)	(0.0047)	(0.0040)	(0.0050)
Hospitalizations at ages 0-5	0.6795	0.6846**	0.8204	0.7983*
	(0.0451)	(0.0665)	(0.04849)	(0.0672)
Hospitalizations at ages 7-12	0.0480**	0.0145	0.0437***	0.0480**
	(0.0232)	(0.0426)	(0.0169)	(0.0211)
Hospitalizations at ages 13-17	0.0391	0.1134**	0.0369	0.0867**
	(0.03101)	(0.0498)	(0.0242)	(0.0387)

Notes: We define rich families as the upper income rank families (i.e., above the median). Each row represents an outcome. All of our estimates control for indicator for male child, indicator for twin birth, indicator for married mother, year of birth, mother and father's age and quadratic terms for ages, and the length of gestation. Standard errors are in parentheses and clustered at the family level.
*p< 0.1; **p<0.05; ***p<0.01.

7 Discussion and Policy Implications

The intergenerational transmission of inequalities is certainly a multifaceted problem. Our results suggest that the interplay between the transmission of health and income vulnerabilities is not to be overlooked. Indeed, we find that lower SES individuals are more likely to give birth to low birth weight babies, who are themselves more likely to end up economically disadvantaged, partly because of their condition at birth. A direct policy implication of these findings is that trying to reduce the likelihood of negative health shocks in utero and at birth could help break the cycle of socioeconomic disadvantages. The stronger the effect on LBW, the stronger it should be on social mobility. To provide some insights, we put in Table 9 the expected effect of different programs fostering positive shocks on health at birth, as documented in the literature. Assuming that everything else is equal to the settings in those papers, our exploratory analysis finds that maternal education (Currie and Moretti 2003) and the nutrition program (OLO) offered to pregnant women in Québec (Haeck and Lefebvre 2016) would have stronger effects on social mobility (4% and 14%, respectively).[32]

What could make these programs powerful tools in the fight against poverty? Both interventions promote a healthy environment in utero for the child. First, Currie and Moretti (2003) show that additional maternal education is associated with increased prenatal care and smoking cessation during pregnancy. Similarly, by supplementing specific foods and counseling pregnant women, the OLO program in Québec fosters healthy in utero conditions. Hence, helping low-SES mothers develop healthy practices during pregnancy could be an effective means to reduce the risk of poor pregnancy outcomes, low birth weight, and break the transmission of disadvantages.

8 Conclusion

How are inequalities transmitted from one generation to the next? This paper strongly suggests that part of the answer lies in differences in health capital very early in life. Using a new linkage between different sources of administrative data on births in Canada, we first find evidence of the transmission of birth weight from a mother to her child. While less economically advantaged mothers are more likely to give birth to low-weight babies, this mechanism alone does not fully explain the intergeneration persistence of low birth weight status. Our results are consistent with the fetal origin hypothesis, and strongly suggest that low birth weight is a marker of low educational attainment and low income in adulthood. Furthermore, we improve the existing literature by establishing a direct link between low birth weight and social mobility. Specifically, we show that

[32] Note that this exercise is purely descriptive.

Table 9: Example of positive shocks to BW and Social Mobility

Papers	**Shocks/Program**	**Reduction in LBW**	**Expected Effect Mobility**
Currie and Moretti (2003)	Maternal education in US	0.96pp-0.99pp	+ 3.89%-4.03%
Hoynes, Miller and Simon (2015)	Earned Income Tax Credit	0.17pp-0.31pp	+ 0.69%-0.89%
Hoynes, Page and Stevens (2011)	Supplemental Nutrition Program (WIC)	0.0756pp	+ 0.31%
Currie and Gruber (1996)	Medicaid Expansion	0.42pp	+ 1.7%
Haeck and Lefebvre (2016)	OLO program in Québec	3.6pp	+ 14.61%

Notes:

pp refers to percentage points.

The effect on social mobility is obtained by multiplying the reduction in LBW in percentage points (pp) by our estimates of the impact of LBW on social mobility from column (4) in Table 6.

low birth weight reduces the probability of moving to opportunity. However, as we measure mobility in young adults, we cautiously interpret our results as effects of low birth weight on potential mobility.

Policy interventions could break this cycle. For example, the environmental justice movement (see Mohai, Pellow and Roberts 2009), which promotes reducing the exposure of the less privileged to environmental risks such as air pollution and lead poisoning, which are all factors leading to poor neonatal health, could have a lasting effect on social mobility through a reduction in the incidence of low birth weight within these communities. More directly, programs intended to improve prenatal condition could have positive intergenerational effects that are not often taken into account in traditional cost-benefit analyses.

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Appendix

A Selection in the population of infant born between 2006 and 2015

Table A.1: Selection in the population of infant born between 2006 and 2015.

	All births 2006-2015		Transmission sample		
	Mean	SD	Mean	SD	p-value
Child at birth:					
Gender (Male)	0.513	0.5	0.513	0.5	1
Birth weight (in grams)	3364	570.6	3405	570.8	< 0.001
Low birth weight	0.06	0.237	0.054	0.226	
Gestation length (in weeks)	38.8	1.9	38.9	1.9	< 0.001
Prematurity	0.076	0.265	0.074	0.261	< 0.001
Birth year	2010.6	2.9	2011.8	2.6	< 0.001
Mothers and family at birth					
Age	29.8	11	23.9	8.6	< 0.001
Teen moms	0.033	0.18	0.14	0.34	< 0.001
Married	0.706	0.455	0.534	0.499	< 0.001
Parity	0.9	1.4	0.7	2	< 0.001
less than post-secondary education	0.683	0.465	0.577	0.494	< 0.001
College education	0.096	0.295	0.173	0.378	< 0.001
University educated	0.092	0.29	0.118	0.323	< 0.001
Low family income	0.250	0.433	0.426	0.494	< 0.001
Poor neighborhood	0.217	0.412	0.279	0.449	< 0.001
Moved	0.946	0.225	0.674	0.469	< 0.001
Observations	3,500,000		591,500		

Notes: The table provides summary statistics for the population of children born between 2006 and 2015, as well as for the subsample of those whose mothers were born between 1983 and 1996. The last column reports the p-value for the difference in means between the two groups for each variable.

B Inverse Probability Weighting Procedure

To account for potential selection bias in our analytic sample, we implement inverse probability weighting (IPW). Inclusion in the analytic sample requires successfully linking the birth record of a child born between 2006 and 2015 to the birth record of their mother, born between 1983 and 1996. Given that this linkage may depend on observable characteristics, we construct two sets of weights to assess the robustness of our estimates.

Main Specification. Our main specification uses weights defined as the inverse of the predicted probability of being matched across generations, estimated from a logistic regression of sample inclusion on low birth weight status only:

$$\mathrm{IPW}_i = \frac{1}{\Pr(\mathrm{Matched}_i \mid \mathrm{LBW}_i)}.$$

This approach ensures that our matched and unmatched samples are balanced on the treatment dimension central to our analysis.

Extended Specification. As a robustness check, we also estimate a richer model that includes a broader set of baseline covariates at birth:

$$\mathrm{IPW}_i^{\mathrm{rich}} = \frac{1}{\Pr(\mathrm{Matched}_i \mid \mathrm{LBW}_i, \mathrm{Preterm}_i, \mathrm{Male}_i, \mathrm{TeenMother}_i, \mathrm{LowIncome}_i, \mathrm{NoPostSec}_i, \mathrm{FatherAge}_i)}.$$

This allows us to account for additional channels through which selection into the analytic sample may occur.

C Variable Availability by Sample

This appendix table summarizes which outcome and control variables are available for each analytic sample, along with the level of family fixed effects. The transmission sample includes rich intergenerational and neighborhood characteristics from birth certificates, while the mobility sample focuses on long-run socioeconomic outcomes and health mechanisms.

Table C.2: Variable Availability and Family Fixed Effects by Sample

Panel A: Outcomes		
Outcome Variable	**Transmission Sample**	**Mobility Sample**
Child born low birth weight	✓	×
Adult income rank	×	✓
Upward mobility indicator	×	✓
Adult educational attainment (university, STEM)	×	✓
Mother's education at childbirth	✓	×
Parental income at childbirth	✓	×
Migration / geographic mobility	✓	×
FSA / neighborhood poverty	✓	×
Teen motherhood (13–17)	✓	×
Hospitalizations (childhood health shocks)	×	✓
Panel B: Controls and Fixed Effects		
Control Variable	**Transmission Sample**	**Mobility Sample**
Individual low birth weight status	✓	✓
Gestational age	✓	✓
Mother preterm birth	✓	×
Birth order	✓	✓
Parental age and marital status	✓	✓
Grandparents' age at mother's birth	✓	×
Grandmother's marital status at mother's birth	✓	×
Parental income at birth	✓	✓
Parental education	✓	×
Neighborhood poverty	✓	✓
Grandparents' SES	✓	×
Family fixed effects	Grandmother FE (cousins)	Mother FE (siblings)

Notes: This table summarizes which outcomes, control variables, and family fixed effects are available in each analytic sample. Grandmother fixed effects in the transmission sample compare cousins born to sisters, holding constant all characteristics shared by siblings of the same grandmother. Mother fixed effects in the mobility sample compare siblings within the same nuclear family.

D Alternatives models of transmission of Birth weight

Table D.3: Transmission of Birth Weight.

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Birth Weight (BW)	BW on BW					
Mother's birth weight	0.2211***	0.2216***	0.1203***	0.1204**	0.1188**	0.1182***
	(0.0018)	(0.0017)	(0.0075)	(0.0075)	(0.0076)	(0.0077)
Panel B: Log BW	log on log					
Mother's birth weight (log)	0.1897***	0.1905***	0.1035***	0.1036***	0.1016***	0.1012***
	(0.0021)	(0.0020)	(0.0081)	(0.0081)	(0.0081)	(0.0081)
Socio-demographic controls		✓	✓	✓	✓	✓
Grandmother FE			✓	✓	✓	✓
Mother SES controls				✓	✓	✓
Mother current location FE					✓	✓
Mother birth location FE						✓
Observations	591,000	79,000	79,000	79,000	79,000	79,000

Notes: This table reports estimates of the effect of maternal low birth weight on her child's low birth weight in panel A and on her child's birth weight in grams in panel B. Column (1) presents a raw correlation between mother's low birth weight and her child's low birth weight. In column (2), we add basic demographic controls that include indicator for male child, indicator for twin birth, indicator for married mother, year of birth, mother and father's age and quadratic terms for ages. We add grandmother fixed effects in column (3). We add SES variables at the child's birth such as lowest income indicator, university-educated indicator, and no post-secondary education indicator in column (4). Columns (5)-(6) report estimates when mother's current and past zip codes fixed effects are, respectively, added. We proxy past zip code by the census division of residence of the grandmother at the mother's birth. All standard errors are in parentheses and clustered at the grandmother level.

*p< 0.1; **p<0.05; ***p<0.01.

E Summary Statistics for Mobility data

Table E.4: Summary Statistics

	Observations	Mean	SD
A. Child variables			
% Male	1,042,000	51.9	50
Birth weight (in grams)	1,042,000	3423	562.9
% Low birth weight	1,042,000	5.1	22
Gestation age (in weeks)	1,042,000	39.2	1.8
% Premature	1,042,000	6.4	24.6
First born	1,042,000	43.1	49.5
% No post-secondary education	1,042,000	30.9	46.2
% College	1,042,000	39	50
% University	591,900	57.7	49.4
Income	1,042,000	23,200	19,800
Upward mobility	1,042,000	0.512	0.500
Substances use	768,000	0.009	0.096
Hospitalizations 0-5 years	768,000	1.42	2.9
Hospitalizations 7-12 years	768,000	0.213	1.6
Hospitalizations 13-17	768,000	0.448	2.9
B. Family variables			
Mother's age	1,042,000	28.5	21.7
Father's age	972,390	30.8	5.7
Married	1,042,000	0.69	0.463
Family income	1,042,000	24,500	27,000
Family income rank	1,042,000	0.5	0.29

Notes: The table presents summary statistics for the sample used in the social mobility analysis. We use the population of all children born during the period 1993-1996. Hospitalization variables are not available for children born in the province of Quebec. Family income is the average total income of the parents when the child was aged 0 to 5. Child income is the child's total income between the ages of 20 and 25. Upward mobility indicates that the rank of the child's income is higher than that of the parents' income.

F Effects of low birth weight on childhood hospitalization

Table F.5: Effects of low birth weight on childhood hospitalization.

Dependent variable	(1)	(2)	(3)
Hospitalizations at ages 0-5	2.797***	1.745***	1.746***
	(0.0484)	(0.0818)	(0.0821)
Hospitalizations at ages 13-17	0.0772***	0.0821**	0.0883**
	(0.0149)	(0.0341)	(0.0344)
Controls	✓	✓	✓
Family FE		✓	✓
Location FE			✓
Observations	244,000	244,000	244,000

Notes: The regressions are based on the sample of children born during the period 1993-1996 (Mobility sample). *p<0.1; **p<0.05; ***p<0.01.

G Effects of low birth weight on childhood substance use.

Table G.6: Effects of low birth weight on hospitalization due to substances use.

Dependent variable	(1)	(2)	(3)
Have been hospitalized for substances use	0.0018	0.0021	0.0023
	(0.0015)	(0.0015)	(0.0016)
Controls	✓	✓	✓
Family FE		✓	✓
Location FE			✓
Observations	244,000	244,000	244,000

Notes: The regressions are based on the sample of children born during the period 1993-1996 (Mobility sample). *p<0.1; **p<0.05; ***p<0.01.