

# Consequences of an Early Grave: Losing a Sibling During Childhood

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November 2025

*Job Market Paper*

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## Abstract

The death of a child is a devastating and life-altering event for the entire family, extending beyond the initial grief and shaping the short and long-term life trajectories of the surviving siblings and parents. Although a growing literature documents its negative impact on parental outcomes, very little is known about its causal impact on the human capital accumulation of surviving siblings. This paper examines the effect of losing a sibling during childhood on educational outcomes, using detailed register data from the entire population of Finland. I exploit the timing of an unexpected sibling loss relative to the time of 9th-grade GPA measurement. I find that losing a sibling 2 years before the 9th grade has a negative impact of 19% of a standard deviation on the 9th-grade GPA. The effect is more pronounced and prevalent across different ages at the time of sibling loss for children with a lower socioeconomic background. Further, I find a 12-14 percentage points decrease in the probability of general track choice in the upper-secondary school following a sibling loss. Exploring potential mechanisms, I find notable negative mental health effects on both surviving children and their parents, along with adverse effects on the labor market outcomes for mothers. These findings highlight the large social and economic consequences of such losses, emphasizing the need for targeted policies to support bereaved family members.

**JEL Classification:** I10, I20

**Keywords:** sibling death, spillover effects of health shocks, education.

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# 1 Introduction

The death of a child is a very large stressor for both parents and surviving siblings. While children experience their own grieving process after such a loss, they may also receive less attention from their mourning parents, who are likely to face mental health problems, marital dissolution, and worsening labor market outcomes (Adhvaryu et al., 2022; Breivik and Costa Ramon, 2021; Vaalavuo et al., 2022; Van den Berg et al., 2017). Surviving children may encounter mental disorders, attempt suicide, require hospitalization more frequently, and face an increased mortality risk after losing a sibling (Bolton et al., 2016; Gerhardt et al., 2012; Yu et al., 2017). Additionally, the loss of a child might lead to changes in how parents allocate their time and financial resources among the surviving children. The aforementioned problems that parents may face after the loss can affect the quality of time they spend with surviving children due to changes in their mental well-being, marital dissolution, or the availability of financial resources resulting from worsening labor market outcomes.

Despite these significant effects, surprisingly, little is known about the consequences in terms of educational outcomes and human capital accumulation of surviving children. Contributing to filling this gap in the economics literature, this paper presents the first evidence from the entire population of a country, as well as in a European context, on the impact of losing a sibling during childhood on educational achievement. To study this question, I use individual-level data from Finnish administrative records spanning 24 birth cohorts. It is unlikely that experiencing a sibling loss during childhood is randomly distributed across the population. For instance, variables measuring concepts such as the socio-economic background of a child could potentially predict both educational achievement and the likelihood of experiencing the loss of a sibling. To address this challenge, I employ an identification approach that exploits the variation in timing of an unexpected sibling loss relative to the 9th grade. Specifically, children who suffer a sibling loss before 9th grade form the treatment group, while those suffering sibling loss after 9th grade act as the control group. The underlying assumption for causal interpretation is that the relative timing of the loss is as good as random across affected families, for which I provide supporting evidence.

I find a negative impact of 19% of a standard deviation on the 9th-grade GPA of surviving children after experiencing a sibling loss at age 14, two years before the 9th grade. However,

there is no significant effect for those who experienced sibling loss at other ages, hiding some heterogeneity by socioeconomic status and gender. That is, the impact is stronger for children whose mothers have lower educational attainment and for girls. Yet, the gender difference is not prominent and not statistically significant for every age group. Further, I find a significant decrease of 12-14 percentage points (25-33%) in the probability of choosing a general upper-secondary school track following a sibling loss.

The impact on the 9th-grade GPA is not substantial, and not homogenous across different socio-economic groups or ages at the time of sibling loss, suggesting potential compensatory mechanisms. On the other hand, a 12-14 percentage points decrease in the probability of choosing a general upper-secondary school track is sizable. Delving into the potential mechanisms, I examine the impact of sibling loss on several other outcomes. First, considering the Finnish welfare state, surviving children and their parents are likely to receive mental health and grief support, facilitating a smoother bereavement process. To examine this potential mechanism, I employ an event study framework and estimate the effect of the loss on antidepressant prescriptions for surviving children and their parents. I find a substantial increase in the probability of antidepressant prescriptions for surviving children as well as their parents, suggesting a help-seeking behavior of the affected families and a corresponding response from healthcare professionals to mitigate the mental health challenges posed by this traumatic event.

Another potential channel could involve a reallocation of parental time and financial resources toward surviving siblings following the loss. Although specific information on parents' actual time allocation is unavailable, I use sick leave and unemployment as proxies for time use. Following the event study framework by Kleven et al. (2019), I find an increase in the probability of mothers taking sick leaves in the year of the loss and the subsequent year, accompanied by a persistent decline in their employment probability starting from the year after the loss. On the other hand, there is no evidence of a shift in fathers' probability of taking sick leave after the loss, nor in their employment probability. These findings suggest an increase in the time free from work for mothers after loss that could be potentially invested in surviving children. However, given the poor mental well-being indicated by the increase in antidepressant intake, the quality of the potentially increased parental time investment is debatable.

Lastly, another mechanism could be the teacher's compensation through increased attention

or different grading behavior towards bereaving students. The 9th-grade GPA is an average of the teacher-assessed subject grades where teachers are expected to follow certain guidelines, but it is not a standardized test result. Therefore, this channel for the 9th-grade GPA outcome remains a possibility with no chance of being examined by using the data in this study. However, track choice outcome is much less likely to be affected by teachers' behavior, for which I find substantial negative effects.

There is a broad literature on the spillover effects of health shocks providing evidence on the effects of child death in the family on surviving children. A recently growing number of studies find negative impacts of children's mild and severe health shocks such as ADHD (Kvist et al., 2013), type 1 diabetes (Eriksen et al., 2021), hospitalizations (Breivik and Costa-Ramon, 2021), disabilities (Burton et al., 2017; Gunnsteinsson and Steingrimsdottir, 2019), cancer diagnosis (Adhvaryu et al., 2022; Vaalavuo et al., 2022), and death (Van Den Berg et al., 2017) on parents' labor market outcomes and mental well-being. Similarly, children's behavioral and educational outcomes are found to be negatively affected by health shocks within the family (Kristiansen, 2021; Le and Nguyen, 2017; Alam, 2015; Bratti and Mendola, 2014; Dhanaraj 2016; Luca and Bloon, 2018; Mendolia et al., 2019; Sun and Yao, 2010; Johnson and Reynolds, 2013; Aaskoven et al., 2022; Morefield, 2010; Stans, 2020). Our knowledge, however, is more limited about how children's health shocks affect other children in the family. While having a sibling with ADHD or a disability has been found to have a negative impact on academic achievement and behavioral outcomes (Breining, 2014; Black et al., 2021; Fletcher et al., 2012), in-utero and early health shocks lead to increased parental investment to older and healthy siblings (Parman, 2013; Yi et al., 2015).

To the best of my knowledge, four studies examine how losing a sibling during childhood affects educational outcomes. While Thamarapani et al. (2020) and Gautier (2021) study this question in developing country contexts, Fletcher et al. (2013) and Fletcher et al. (2018) focus on the context of the US. Thamarapani et al. (2020) use the Indonesian Family Life Survey, which is representative of 83% of the population, to examine the impact of losing a sibling across ages at the time of death on years of schooling, secondary school enrollment, and fertility. They find a negative impact on surviving brothers' years of schooling, compared to those who were born after death. On the contrary, in the context of a conflict, Gautier (2021) finds positive effects of losing a sibling during the 1994 genocide in Rwanda on the education and later life

outcomes of surviving women. The positive impact on the years of schooling is explained by the increased parental investment and relief programs for genocide survivors. The two studies using USA data from surveys find negative effects.<sup>1</sup> While Fletcher et al. (2013) compare the educational attainment, academic performance, and later life outcomes of children with and without a sibling loss, Fletcher et al. (2018) compare the cognitive and socio-emotional outcomes of children who lost a sibling at different ages, before and after death for 121 deceased children in total.

The contribution of this paper is to the broad literature on the spillovers of health shocks within the family. Specifically, I contribute to the limited literature exploring the impact of losing a sibling during childhood on human capital development. This topic presents a significant identification challenge due to the non-random distribution of sibling loss across the population. Fletcher et al. (2018) have made strides in identifying causal effects in a peaceful setting,<sup>2</sup> by using survey data from the US and exploiting the timing of death. However, the sample Fletcher et al (2018) use is very small, and additionally, not all deaths can be considered to be exogenous or unanticipated, such as those following a prolonged illness. To overcome this challenge, I analyze the impact of an unexpected loss, a departure from previous studies that do not differentiate the cause of death.<sup>3</sup>

Using Finnish administrative records, I provide the first evidence from the whole population of a country, which not only enhances the statistical power to detect significant differences but also enables the identification of plausibly exogenous deaths with minimal anticipation effects—specifically, those caused by traffic accidents.

Utilizing administrative records from the entire population offers a unique advantage by allowing the linkage of educational records to medical outcomes for both surviving siblings and parents, as well as parental labor market outcomes. Through these links, I investigate previously unexplored mechanisms, such as the mental well-being of surviving siblings and their parents, as well as parental time use measured by sick leave spells and unemployment. This comprehensive

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<sup>1</sup>Fletcher et al (2013) use data from the National Longitudinal Study of Adolescent Health (Add Health) and the Wisconsin Longitudinal Study (WLS); and Fletcher et al. (2018) use data from the National Longitudinal Survey of Youth.

<sup>2</sup>Gautier (2021) provides evidence from the 1994 Rwanda genocide by using an IV approach, during a civil conflict.

<sup>3</sup>Fletcher et al. (2013) conduct a heterogeneity analysis by cause of death in four broad categories: infant death, accident or suicide, sudden illness, and long-term illness.

approach provides valuable insights for policy considerations.

It is crucial to comprehensively analyze the consequences of sibling loss during childhood. The impact of such an experience extends beyond the immediate grief, influencing both short and long-term life outcomes for the surviving children and other family members. As shown in this study, the educational achievement and choices of the surviving siblings, the labor market outcomes of parents - especially mothers - and the mental health of all family members are affected negatively. These effects can carry severe social and economic implications, highlighting the need for dedicated policy attention. Implementing appropriate policies can provide bereaved family members with the necessary support to navigate these challenging times, minimizing potential lasting damage and societal costs on a broader level.

## 2 Data

### 2.1 Datasets and Sample Selection

To examine how losing a sibling affects children’s educational achievement, I use register data on the entire population of Finland provided by Statistics Finland.<sup>4</sup> Information from several separate datasets is matched by the unique personal identification number. Appendix B summarizes each dataset used in this study, as well as the outcome variables and how they have been constructed.

I focus on the birth cohorts who are supposed to apply for upper-secondary schools in years available in application registers (1989, 1991-2013<sup>5</sup>) Since children apply for upper-secondary education at age 16 (end of the 9th grade), the sample is restricted to 1973, 1975-1997 birth cohorts, with known parents, at least one sibling and exactly one sibling loss before the deceased was younger than 25 years old. I exclude those who lost more than one sibling to be able to assign a certain year of shock to each child. I focus on surviving siblings of children with an unexpected death to eliminate any anticipation effect as well as the deaths more related to the health behavior or lifestyle of the family. Therefore, I restrict my attention to deaths caused by traffic accidents. These are potentially correlated with the lifestyle of the family or the risk-taking behavior. However, as long as this behavior or lifestyle does not differ depending on the

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<sup>4</sup>These datasets are not publicly available. Details of data access conditions can be found on Statistics Finland’s website. (Statistics Finland, n.d.)

<sup>5</sup>I exclude 1990 from the analysis since it does not include information for all applicants in 1990.

surviving child’s age at the time of sibling loss, it does not pose a threat to my identification strategy. I identify the deaths caused by traffic accidents by using the statistical cause of death documented in ICD-9 and ICD-10 classifications for years between 1988-1995 and 1996-2016, respectively.<sup>6</sup>

Siblings born after the death are excluded from the analysis since they were not exposed to the loss, and the fertility decision after losing a child tends to systematically differ across families with different characteristics. To observe children’s and their parents’ background characteristics before the loss and in the 9th grade, I construct a sample of children who themselves as well as their parents were alive and present in Finland one year before the death of the sibling and when the surviving children were 16 years old.

In the whole period of available years with the cause of death information (1988-2016), I observe 16530 deaths of individuals younger than 25 years old, 3260 (20%) of which died because of traffic/land transport accidents. After applying the sample restrictions mentioned above, my main analysis sample of surviving siblings consists of 1530 children, with 1105 deceased siblings in total. Descriptive statistics for this sample as well as the deceased siblings and parents are shown in Table 1. All time-variant variables are measured one year before death. 72% of the deceased children and 47% of their surviving siblings are males. Notably, surviving children live on average in relatively crowded houses with a 5.3 household size. Outcome variables except for the 9th-grade GPA (antidepressant prescription, employment, and sick leave) are measured for the subsample of individuals included in the event study analysis (those who are observed each year in the corresponding period for the relevant event study design.)

Figure 1 shows the age-at-death distribution of surviving children who lost a sibling between ages 10 and 20 and their deceased siblings. The first graph shows the surviving children’s age-at-death distribution for our main analysis sample, where those who experienced the loss at or before age 16, time of measurement of the 9th-grade GPA, are considered as treated.<sup>7</sup> In the second graph, where the age-at-death distribution of the deceased siblings of children in our sample is depicted, the minimum age at death is one since children born and died within the same year are not included in cause of death registers.<sup>8</sup> Notably, there is an increase in the

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<sup>6</sup>V01-89 for ICD-10, and E800-804 for ICD-9.

<sup>7</sup>Number of observations of surviving siblings in this graph is 1560, while number of observations in our main analysis is 1530. This difference is caused by the missing values of the 9th-grade GPA for some observations.

<sup>8</sup>Age values less than or equal to 7 are grouped in one age group category, in line with the data confidentiality

Table 1: Descriptive statistics

|                              | Mean  | SD   | N    |
|------------------------------|-------|------|------|
| <b>Deceased Siblings</b>     |       |      |      |
| Male                         | 0.72  | 0.40 | 1530 |
| First-born                   | 0.47  | 0.50 | 1530 |
| <b>Surviving Children</b>    |       |      |      |
| Male                         | 0.47  | 0.50 | 1530 |
| Native Finnish speaker       | 0.96  | 0.19 | 1530 |
| Firstborn                    | 0.18  | 0.38 | 1530 |
| Household size               | 5.29  | 2.67 | 1521 |
| Urban                        | 0.67  | 0.47 | 1530 |
| 9th-grade GPA                | 7.40  | 1.14 | 1530 |
| 9th-grade GPA (age 17)       | 7.51  | 1.17 | 163  |
| Antidepressant prescription  | 0.01  | 0.09 | 1084 |
| <b>Mothers</b>               |       |      |      |
| Age                          | 42.42 | 4.98 | 1530 |
| Primary / lower-sec          | 0.26  | 0.44 | 1530 |
| Upper-secondary non-tertiary | 0.48  | 0.50 | 1530 |
| Mother tertiary or higher    | 0.26  | 0.44 | 1530 |
| Antidepressant prescription  | 0.09  | 0.28 | 1003 |
| Employed                     | 0.79  | 0.41 | 939  |
| Sick-leave                   | 0.08  | 0.27 | 530  |
| <b>Fathers</b>               |       |      |      |
| Age                          | 44.82 | 5.66 | 1530 |
| Primary / lower-sec          | 0.34  | 0.47 | 1530 |
| Upper-secondary non-tertiary | 0.46  | 0.50 | 1530 |
| Tertiary or higher           | 0.21  | 0.40 | 1530 |
| Antidepressant prescription  | 0.05  | 0.22 | 1062 |
| Employed                     | 0.81  | 0.39 | 939  |
| Sick-leave                   | 0.32  | 0.47 | 530  |

Notes: This table shows background characteristics and some outcome variables of deceased children, surviving siblings, and their parents, for our main analysis sample. All time-variant variables are measured one year before the child's death.

incidents of death starting from age 15 which is the minimum legal age for driving a moped in Finland.

## 2.2 Education in Finland and the 9th grade GPA

Compulsory education in Finland starts at age 7 and lasts for 9 years.<sup>9</sup> The first 6 years comprise the primary education stage, whereas the last 3 years comprise the lower-secondary education stage. In the 9th grade, in February-March, children apply for the upper-secondary schools through the central Joint Application System. They have a right to apply up to 5 academic and/or vocational high schools in their preferred order. They are admitted by schools based mainly on their 9th grade GPA which is the average of their grades from individual school subjects completed in the 9th grade.<sup>10</sup>

The main outcome variable in this paper is the 9th-grade GPA, which is obtained from Joint Application Registers for the years 1989, and 1991-2013. Since this outcome relies on teacher evaluations, it is important to note that they may be subjective. The 9th grade GPA ranges from 4 (failing) to 10 (the best grade). As shown in Table 1, the mean value of the 9th-grade GPA in my analysis sample is 7.40, with a standard deviation of 1.14. For a reasonable comparison over the years, I standardize this variable within each graduation year. To eliminate the effects that might be caused by a delay in graduation, I only include the children who graduated from the 9th grade on time (by age 16) in the analysis.

A potential concern about this restriction would be that the least affected children would select themselves into graduating on time, which might cause a downward bias in the coefficient estimates. To address this concern, I present evidence that losing a sibling does not affect the probability of graduation on time in Section 4.1.

## 3 Empirical Approach

I estimate the impact of losing a sibling during childhood on educational outcomes, by exploiting the variation in the timing of sibling loss relative to one year after the 9th-grade GPA

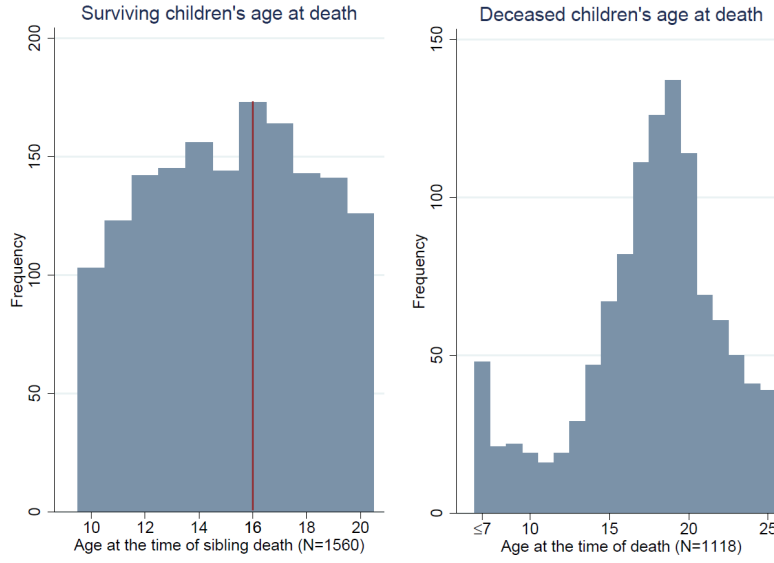
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rules of Statistics Finland.

<sup>9</sup>Compulsory education has been extended to upper-secondary school (age 18) in 2021, not including the period of interest in this study.

<sup>10</sup>The average of grades in mathematics, physics, chemistry, biology, native language and literature, other domestic language, foreign languages, geography, social studies, history, religion, and health information.

Figure 1: Age distributions of the surviving children and the deceased siblings



Notes: The figures show the number of surviving children in my analysis sample and their deceased siblings who died in a traffic accident by age at death. The sample of surviving children is restricted to those who were 10-20 years old at the time of sibling loss, with known parents, exactly one sibling loss, observed at age 16 and one year before the loss. Their deceased siblings are individuals who died in a traffic accident between the ages of 1-25. In the second figure, ages at death less than or equal to 7 are censored at 7 in line with data confidentiality rules of Statistics Finland.

measurement time, age 17. Formally, I estimate the following equation:

$$Y_i = \alpha + \sum_{t=10, t \neq 17}^{t=20} \gamma_t I_{it} + \theta_y + \delta X_i + \varepsilon_i \quad (1)$$

where  $Y_i$  is the outcome variable ((1) 9th grade GPA - standardized within each year, and (2) general upper-secondary school track) of child  $i$ ;  $I_{it}$  is an indicator of whether the age of the surviving sibling at the time of death is  $t$  for individual  $i$ ;  $\theta_y$  captures the graduation year (calendar year of the 9th grade) fixed effects; and  $X_i$  is a vector of child, household and parental characteristics, namely child's gender, being native Finnish speaker, birth order, living in an urban area, household size and highest educational attainment of both parents, as well as the deceased child's age at death. All time-variant characteristics are measured one year before death.

The coefficients of interest are  $\gamma_{10}-\gamma_{16}$  which captures the differences in the outcome of interest of children with ages of sibling loss 10-16, till six years before or at the 9th grade, in comparison to those losing their sibling when the surviving children are 17 years old, one year after the 9th grade. Coefficient estimates of  $\gamma_{18}$ ,  $\gamma_{19}$  and  $\gamma_{20}$  could be considered as a placebo test since

the performance of children who lost a sibling 2-4 years after obtaining the 9th grade GPA are expected not to be different than the performance of those who lost a sibling 1 year after obtaining the 9th grade. This hypothesis is confirmed if the point estimates for  $\gamma_{18}$ ,  $\gamma_{19}$  and  $\gamma_{20}$  are not significantly different from zero.

The underlying assumption for this identification approach to be able to identify causal effects is that the timing of sibling loss relative to age 17 (of surviving child) is as good as random. I test an implication of this assumption that is the background characteristics of children before the loss do not significantly differ depending on the timing of the loss. Specifically, I test whether the characteristics of children (measured one year before death) who lost a sibling before age 17 are different from the characteristics of children (measured at the same age as the former group) who lost a sibling at age 17.

Consider two groups of children who lost their siblings at age 16 and 17. If the timing of the loss is as good as random, it implies that the background characteristics of these two groups of children were not different from each other when they were 15 years old, the common closest age before the loss for both groups. To test this implication, I run separate regressions of several variables capturing demographic and socioeconomic characteristics of the surviving children, on an indicator that takes value 1 if the child experienced the loss at age 16, and value 0 if the loss happened when the surviving child was at age 17. Importantly, the time-variant dependent variables are measured at age 15 for both groups. Then, I do the same comparison for another two groups of children with a loss at age 15 (14, 13, 12, 11, 10) and age 17, where the time-variant variables are measured at age 14 (13, 12, 11, 10, 9) for both groups, always keeping the control group as the ones with a sibling loss at age 17, which is the control group in my main analysis.

Formally, I estimate separate regressions of these background variables for each  $t \in \{10, 11, \dots, 15\}$ , on the indicator that takes a value of 1 if the age of surviving child at the time of death is  $t$ , and 0 if the age is 17; as follows:

$$Y_i^{t-1} = \gamma I_i^t + \varepsilon_i^t \quad (2)$$

where

$$I_i^t = \begin{cases} 1, & \text{if age of } i \text{ at death} = t \\ 0, & \text{if age of } i \text{ at death} = 17 \end{cases}$$

and  $Y_i^{t-1}$  is the child's or parent's background characteristics measured at age  $t - 1$ .

Figure A.1 and Figure A.2 present the results of this test for the outcomes of parents and children, respectively. Both figures suggest that the children with sibling loss at different ages are not different from each other, especially in terms of socioeconomic background. Specifically, differences in parental educational attainment, employment and earnings (adjusted for 2019 prices) fluctuate around zero and most of them are not statistically significant.<sup>11</sup> It is important to note that in Figure A.2 one significant difference across ages at the sibling loss is the age difference between the surviving child and the deceased sibling, for ages at sibling loss 10-14. This difference is reasonable given the higher probability of death after age 15 of the deceased child, as depicted in Figure 1. Nonetheless, by including age at death fixed effects in Equation 1, I control for these age differences.

As a second control for the identification assumption, Figure A.3 shows the employment and earnings outcomes of parents of children who lost their siblings at different ages, measured one year before death and relative to the corresponding outcome of the parents of children who lost their siblings at age 17. As depicted in the graphs, there is no significant difference in these time-variant characteristics measured one year before death, either.

**Event Study Design for Mental Health Outcomes:** To estimate the impact of child death on mental health outcomes, proxied by the probability of being prescribed antidepressants, I exploit the variation in the timing of child death within an event study framework. Specifically, I construct a balanced panel of children, along with their mothers and fathers, who experienced a loss between the ages of 10 and 20, corresponding to 71% of my main analysis sample.<sup>12</sup> The observations cover 3 years before and 7 years after the loss. Then, I estimate the coefficients of indicator variables for years relative to the death year (“event time”) using the following equation separately for siblings, mothers, and fathers:

<sup>11</sup>Since several characteristics for several years are measured for this exercise, it is plausible to expect a few coefficients to be statistically significant.

<sup>12</sup>Information on antidepressant prescriptions is only available starting from 1993. This constraint, together with the balanced sample requirement between 3 years before and 7 years after the loss, causes the sample used for the event study design to be smaller than the main analysis sample.

$$Y_{it}^g = \alpha_i^g + \sum_{t=-3, t \neq -1}^{t=7} \gamma_t^g I_t + \varepsilon_{it}^g \quad (3)$$

where  $Y_{it}^g$  is the outcome of interest for individual  $i$  of group  $g$  (sibling, mother, father) at event time  $t$ ,  $\alpha_i^g$  represents individual fixed effects, and  $I_t$  denotes event time fixed effects. Omitting the event time dummy at  $t = -1$ , the coefficients of interest are  $\gamma_t^g$  which measure the impact of the loss relative to one year before the loss.

**Event Study Design for Parents' Labor Market Outcomes:** To estimate the impact of child death on parents' labor market outcomes, I employ an event study framework following Kleven et al. (2019). The specification I use is analogous to theirs, with the event being child death instead of childbirth. I construct balanced panels of mothers and fathers of the surviving children in my main analysis sample, observed each year between 4 years before and 6 years after the loss.<sup>13</sup> Subsequently, I estimate the following equation separately for mothers and fathers:

$$Y_{iyt}^g = \sum_{t=-4, t \neq -1}^{t=6} \gamma_t^g I_{it} + \omega_{iy}^g + \delta_y^g + \varepsilon_{iyt}^g \quad (4)$$

Here,  $Y_{iyt}^g$  represents the outcome of interest (sick leave, employment, or earnings) for individual  $i$  of group  $g$  (mother or father) in year  $y$  and at event time  $t$ , and  $I_t$  are event time dummies. Following Kleven et al. (2019), I control for underlying life-cycle trends by including age at year  $y$  fixed effects denoted by  $\omega_{iy}^g$  and for time trends of macroeconomic conditions by including year fixed effects denoted by  $\delta_y^g$ . The coefficients of interest are  $\gamma_t^g$ , which measure the impact of the loss on parents' labor market outcomes relative to one year before the loss.

## 4 Results

### 4.1 Educational Outcomes

This section investigates the impact of sibling loss during childhood on educational outcomes. Before delving into the main findings concerning 9th-grade GPA, I analyze the impact on the

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<sup>13</sup>Since the balanced sample requires each individual to be observed each of these 11 years, the sample for this event study exercise is 61% of the main analysis sample for employment and income outcomes. For the sick leave outcome, it is 35% of the main analysis sample since this information is available starting from 1995.

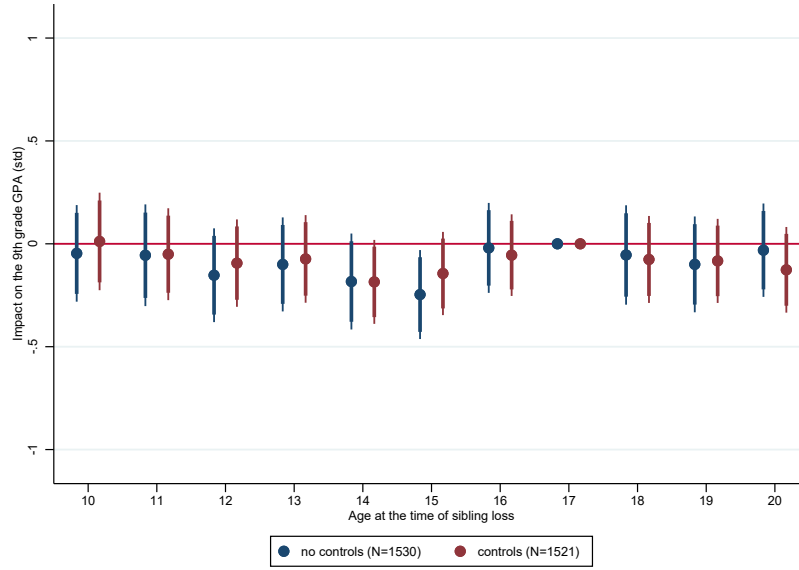
probability of timely graduation (by age 16). As depicted in Figure A.4, this probability is not affected significantly by the loss of a sibling.

Figure 2 presents the impact of losing a sibling on the standardized 9th grade GPA for each age at sibling loss, by estimating Equation 1 with and without control variables. Results suggest no significant effect for children losing their siblings at the ages between 10 and 13. However, the 9th grade GPA of those who lost their sibling at age 14 is 19% of a standard deviation (0.22 points, 2.9%) below compared to those who lost their sibling at age 17, just after the 9th grade. As for the age 15, I find an effect of a similar magnitude (14% of a standard deviation), however, the coefficient is not precisely estimated. The 9th-grade GPA of those losing their siblings at age 16 is not affected by the loss. For ages between 18 and 20, coefficient estimates are small in magnitude and not statistically significant. This observation works as a placebo check, confirming the expectation that the 9th-grade GPA of those who lost their siblings after the 9th grade at different ages are not systematically different from each other, providing support for my identification approach.

Next, I analyze the impact on the upper-secondary school enrollment on time (by age 16) and the track choice of the surviving siblings. First, on the extensive margin, Figure A.5 shows that there is no impact on enrollment in upper-secondary school education. Then, Figure 3 presents results from estimating Equation 1 with and without control variables, where the outcome of interest is the indicator of whether the child is enrolled in a general or vocational track upper-secondary education. Results indicate a significant decrease of 12-14 percentage points (28-33%) in the probability of choosing a general track over a vocational track, for ages of sibling loss 10, 11, 13, and 14.

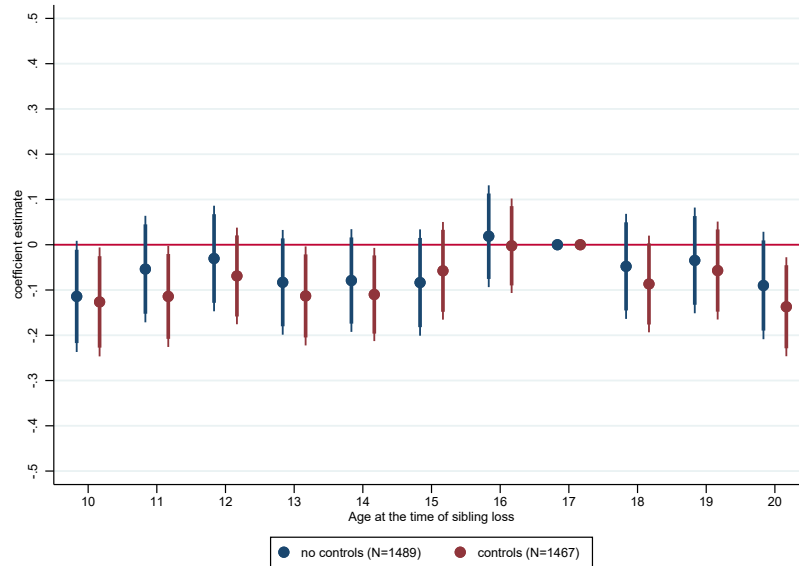
Figure 4 presents the results for the 9th grade GPA estimated for the subsample of females and males, separately. For females who lost their siblings, the coefficient estimates consistently exhibit a negative trend, proving statistically significant at a 90% confidence level for ages 12 and 15. However, no analogous trend is observed for males. The coefficient estimates for males fluctuate around zero, lacking statistical significance. These findings suggest that the 9th-grade GPA of females tends to be more adversely affected compared to males, except for ages of sibling loss 11, 13, and 14 where the confidence intervals overlap considerably. A similar pattern is observed for the probability of choosing the general track for the upper-secondary school. As

Figure 2: Impact of losing a sibling on the 9th grade GPA



Notes: This figure shows coefficient estimates from the regression of standardized 9th grade GPA on the categorical variable of the age at sibling loss and corresponding confidence intervals of 95% and 90% in thin and thick lines, respectively. Control variables include the child's gender, being a native Finnish speaker, being firstborn, living in an urban area, HH size, both parents' highest educational attainment, deceased child's age at death, and graduation year fixed effects.

Figure 3: Impact of losing a sibling on general track choice



Notes: This figure shows coefficient estimates from the regression of the indicator that takes a value of 1 if the child is enrolled in a general track in upper-secondary school, and 0 if enrolled in a vocational track at age 16 on the categorical variable of the age at sibling loss and corresponding confidence intervals of 95% and 90% in thin and thick lines, respectively. Control variables include the child's gender, being a native Finnish speaker, being firstborn, living in an urban area, HH size, both parents' highest educational attainment, age at death, and graduation year fixed effects.

depicted in Figure 5, for ages 10 and 13, females' general track choice probability decreases by 24 and 22 percentage points, respectively, while the effect is almost zero and not statistically significant for males. However, there is not a clear pattern for this difference, nor any evidence of such differential effect for those who lost their siblings at other ages.

Moving forward, I investigate the heterogeneity in results based on the socioeconomic status of children, proxied by parents' educational attainment. In Figure 6, I present results from separate regressions for subsamples of children with mothers having different educational attainment levels. The findings suggest that the negative effect is more pronounced for surviving children with lower-educated mothers. Specifically, for ages of sibling loss 13 to 16, the effect ranges between 33-47% of a standard deviation, proving significant for ages of sibling loss 14 to 16. Results based on the educational attainment of the father, as presented in Figure A.6, mirror those of the mother.

As depicted in Figure A.7, Figure A.8, and Figure A.9, no discernible heterogeneity is observed based on the presence of other siblings, the age difference between the surviving and deceased children, and birth order.<sup>14</sup>

## 4.2 Mechanisms

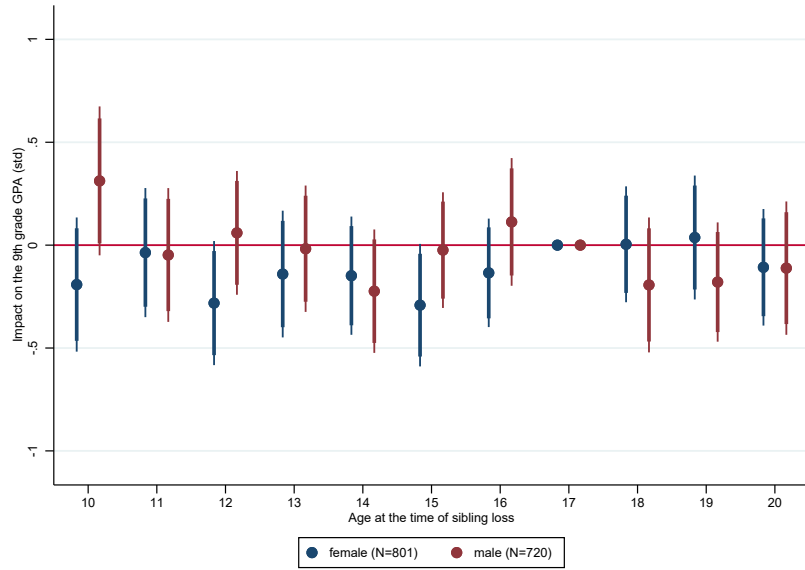
The findings so far indicate a negative impact for ages of sibling loss 12 to 15 within certain demographic groups. However, this impact is neither substantial nor uniform across all ages and socio-economic groups. On the other hand, I find a decrease of 12-14 percentage points in the probability of choosing a general upper-secondary school track, which is notable in size. These findings suggest the presence of potential compensatory mechanisms for the 9th-grade GPA, but not for the general track choice.

While there could be many changes following a child's death in the family which could potentially explain the effects on the educational outcomes, I focus on two main channels that can be proxied by using the administrative records. Specifically, in the subsequent sections delving into potential mechanisms, I examine the effect of child loss on the mental health of both

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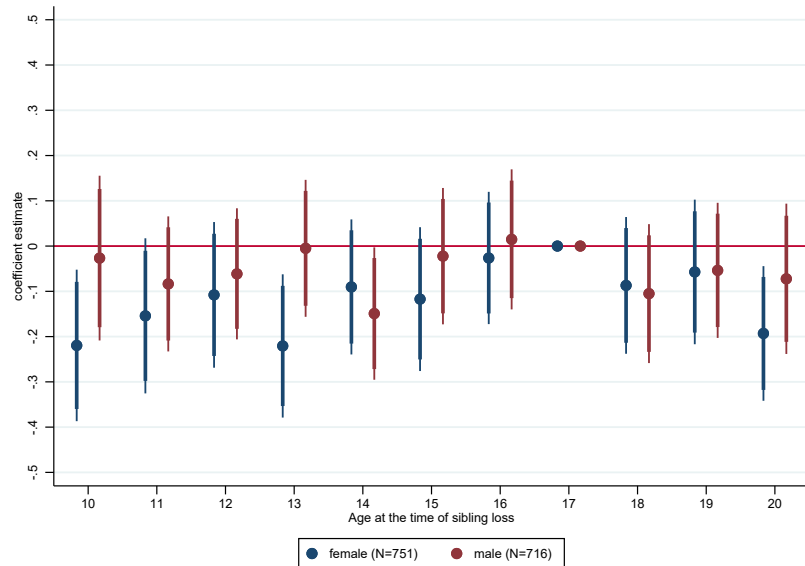
<sup>14</sup>Figure A.9 suggests a significant negative impact for ages 12, 13, and 15 for the subsample of children where the deceased sibling is not the first-born. However, it is important to note that the observed effect is not solely driven by this particular subsample, as its confidence intervals overlap with those of other subsamples. (Please note that a subsample in this graph is not necessarily exclusive of others, as surviving children might have additional siblings besides the deceased one.)

Figure 4: Heterogeneity by gender (GPA)



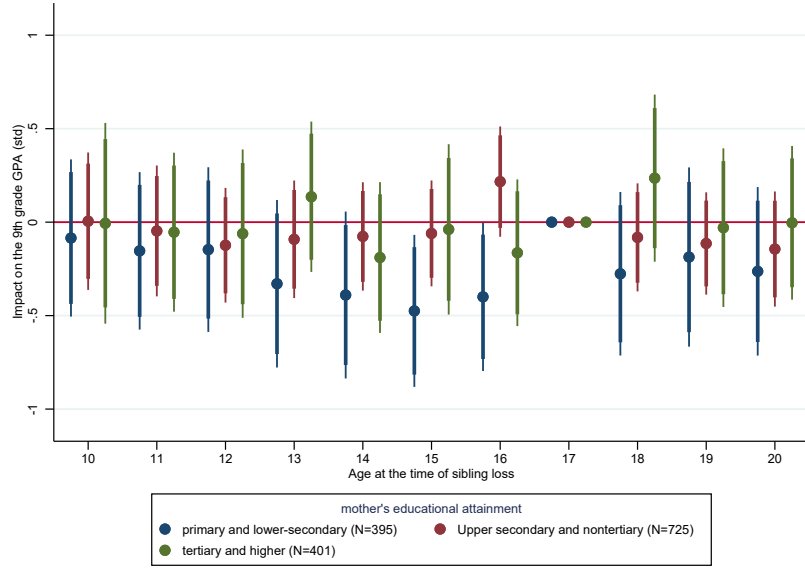
Notes: This figure shows coefficient estimates from the regression of standardized 9th grade GPA on the categorical variable of the age at sibling loss and corresponding confidence intervals of 95% and 90% in thin and thick lines, respectively, separately for females and males. Control variables include being a native Finnish speaker, being firstborn, living in an urban area, HH size, both parents' highest educational attainment, age at death, and graduation year fixed effects.

Figure 5: Heterogeneity by gender (track choice)



Notes: This figure shows coefficient estimates from the regression of the indicator that takes a value of 1 if the child is enrolled in a general track in upper-secondary school, and 0 if enrolled in a vocational track at age 16 on the categorical variable of the age at sibling loss and corresponding confidence intervals of 95% and 90% in thin and thick lines, respectively, separately for females and males. Control variables include the child's gender, being a native Finnish speaker, being firstborn, living in an urban area, HH size, both parents' highest educational attainment, age at death, and graduation year fixed effects.

Figure 6: Heterogeneity by mother's educational attainment (GPA)



Notes: This figure shows coefficient estimates from the regression of standardized 9th grade GPA on the categorical variable of the age at sibling loss and corresponding confidence intervals of 95% and 90% in thin and thick lines, respectively, separately for surviving siblings with mothers having (i) primary and lower-secondary, (ii) upper-secondary and non-tertiary, and (iii) tertiary and higher educational attainment. Control variables include the child's gender, being a native Finnish speaker, being firstborn, living in an urban area, HH size, father's highest educational attainment, deceased child's age at death, and graduation year fixed effects.

surviving siblings and their parents, as well as its impact on parental labor market outcomes.

#### 4.2.1 Mental Health

In this section, I present the estimated impact of sibling loss on mental health, using antidepressant prescriptions as a proxy. It is important to note that being prescribed antidepressants indicates an individual's initiative to seek mental health support. However, not all individuals seeking mental health support are necessarily prescribed antidepressants. Therefore, this variable serves as a conservative proxy, representing a lower bound of help-seeking behavior for mental well-being. Additionally, those prescribed antidepressants may represent cases with more severe consequences of the loss or individuals experiencing a relatively smoother bereavement period due to the mental health support they receive. It's essential to consider these nuances when interpreting the results.

As detailed in Appendix B, prescription data is available only starting from 1993, and to construct a balanced sample from 3 years before to 7 years after, I restrict my attention to losses between 1996 and 2013. Figure 7 displays results from estimating Equation 3 for surviving children, their mothers, and fathers separately. Across all groups, there is no evidence of a pre-

trend.<sup>15</sup> For surviving children, there is an increase of 1 percentage point in the probability of being prescribed antidepressants in the same year as the sibling loss. Considering the age range of the surviving siblings at the time of the event (10-20), this effect is notable. Furthermore, there is an upward trend until 7 years after the loss, where the magnitude of the impact reaches 5 percentage points at the end of the observable period.

For parents, there is a notable increase in the probability of being prescribed antidepressants in the year of the child's death. Mothers experience a substantial increase of 11 percentage points, followed by 13 percentage points in the subsequent year. Then, there is a decreasing trend, resulting in a 4 percentage point impact at the end of the observable period. Fathers experience a smaller effect at the year of loss compared to mothers, with a 6 percentage point increase at event times 0 and 1. The impact shows a slight downward trend, converging to 3 percentage points at the end of the observable period. Considering the mean of the antidepressant prescriptions of mothers and fathers one year before death (9% and 5%, respectively, as shown in Table 1), the percentage increase of mothers is slightly higher than that of fathers. All in all, for all family members, there is a persistent impact that does not disappear even 7 years after loss.

Figure 8 shows the change in the antidepressant prescriptions for the surviving siblings, estimated by females and males, separately. For girls, the magnitude of the coefficient estimate is larger than that of boys, with significant differences in the 3rd and the 4th years following the sibling loss.

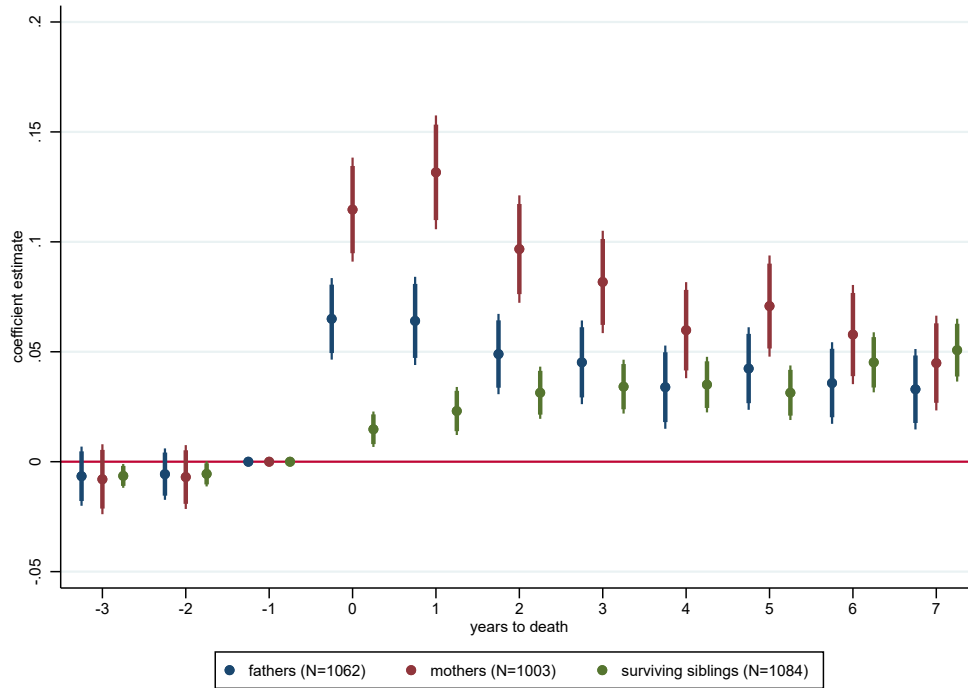
#### **4.2.2 Labor Market Outcomes of Parents**

This section examines the impact of child loss on the labor market outcomes of parents with surviving siblings in the main analysis sample. Figure 10 presents coefficient estimates from estimating Equation 4, separately for mothers and fathers, where the outcome of interest is the probability of receiving sickness allowances in a given year. For fathers, there is no discernible effect of child loss on the probability of taking sick leave. However, for mothers, there is a significant increase of 16 percentage points in the probability of taking sick leave in the year of loss, followed by an 11 percentage point increase in the subsequent year. Starting from the second year after the loss, the coefficient estimate becomes smaller and statistically insignificant,

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<sup>15</sup>While the coefficient estimate for event time -3 is statistically significant for surviving siblings, its magnitude is very small.

Figure 7: Antidepressant prescription probability



Notes: This figure shows coefficient estimates from the regression of the probability of being prescribed antidepressants on the “event time”, and corresponding confidence intervals of 95% and 90% in thin and thick lines, respectively. Control variables include individual fixed effects.

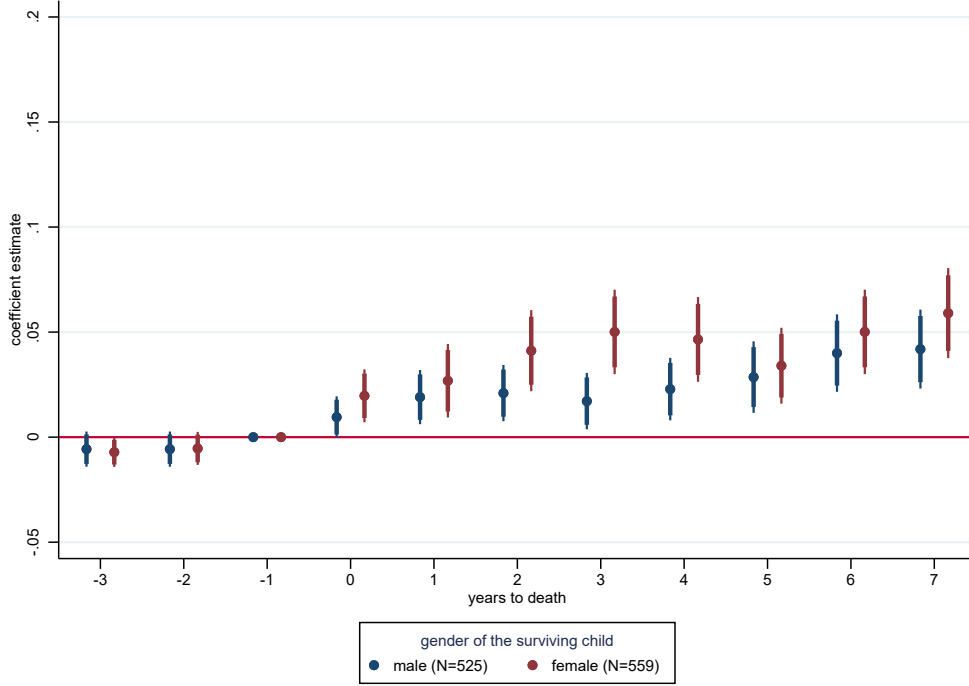
except for year 5.

Next, Figure 9 illustrates coefficient estimates for the impact on the probability of employment. Similar to the sick leave outcome, there is no significant effect for fathers until the last observable year (6 years after death), though a downward trend emerges from year 4. In contrast, mothers experience a persistent decrease of 4-5 percentage points in the probability of employment from the year following the loss.

Finally, the impact of the loss on the earned income of parents is presented in Figure A.11. For mothers, there is a persistent decline in income by approximately 2000 Euros per year, starting from one year after the loss. Fathers also exhibit a decreasing trend, but the estimates are less precise compared to those of mothers. Starting from year 3, coefficient estimates are statistically significant, with magnitudes ranging from around 2000 to 3500 Euros.

These findings suggest worsening labor market outcomes for mothers following the death of a child, while fathers’ labor market outcomes are not affected significantly, except for the wage drop that emerges starting 3 years after the child’s death. The increase in the probability of

Figure 8: Antidepressant prescription probability by gender of the surviving child



Notes: This figure shows coefficient estimates from the regression - separately estimated for females and males - of the probability of being prescribed antidepressants on the “event time”, and corresponding confidence intervals of 95% and 90% in thin and thick lines, respectively. Control variables include individual fixed effects.

mothers’ sick leave-taking and the decrease in their employment could suggest increased parental time investment for the surviving children. However, given the increased antidepressant intake shown in Section 4.2.1, the quality of this time investment is not clear.

## 5 Robustness Checks

To analyze the robustness of the findings, I perform several checks in this section.<sup>16</sup> First, I standardize the 9th-grade GPA outcome within each school-year pair - while I standardize it within each year for the main specification - to account for potential variations between schools, such as differences in grading behavior or the geographical setting. This involves standardization based on the anonymous lower-secondary school ID for each child. As shown in Figure A.10, the results closely align with the baseline findings showed in Figure 2.

The main specification (Equation 1) incorporates controls for the educational attainment of both parents, capturing the socio-economic background of the children. As an alternative measure for

<sup>16</sup>I present the results for the 9th-grade GPA outcome in this section. However, results for the track choice outcome are also robust to all of these changes and are available upon request.

socio-economic status, Figure A.12 includes controls for the income of both parents measured one year before the child's death. The findings are very close to the baseline.

To investigate potential distinctions in the impact for full siblings who share the same biological father in addition to the same biological mother as the deceased child, I estimate Equation 1 for this specific subsample. As demonstrated in Figure A.13, the results remain unchanged for this group of siblings.

Given that the cause of death in this study is traffic accidents, there is a possibility that surviving children might have been involved in the same accident that resulted in the loss of their sibling. To address this concern, I repeat the analysis for a subsample of surviving siblings who were not hospitalized within the same month as the loss or the following month. The aim of including the following month is to take into account the potential physical effects of the accident that might be realized later. The causes of hospitalization include various reasons, including psychiatric causes or injuries. Results, as presented in Figure A.14, closely align with the baseline, suggesting that the effect on 9th-grade GPA is not driven by the worsening health status of the surviving child resulting from the accident.<sup>17</sup>

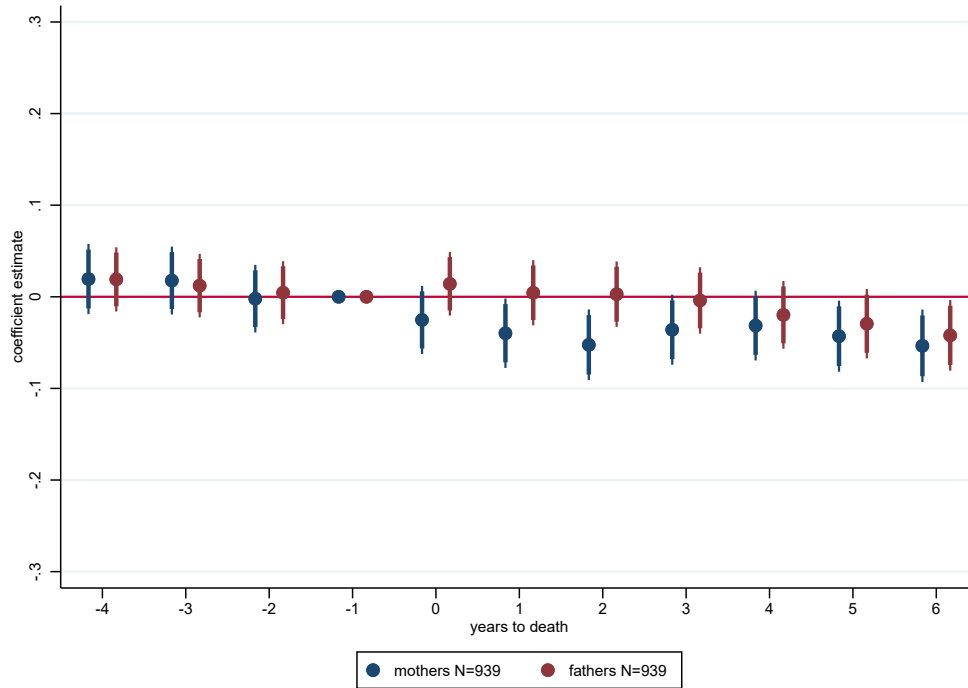
## 6 Discussion and Conclusion

This paper analyzes the impact of losing a sibling during childhood on educational outcomes in Finland, exploiting the time variation of sibling death relative to the 9th grade. Results suggest that losing a sibling has a negative impact of 19% of a standard deviation (0.22 points) on the 9th-grade GPA of surviving children with a loss at age 14, 2 years before the 9th grade. Considering that a sibling loss is a major adverse event, the effect is rather small. Examining potential compensation mechanisms, I find substantial increases in the probability of antidepressant prescriptions. One interpretation of these results could be that mental health support to children and their parents helps with their grieving process, resulting in small effects on grades. On the other hand, the negative effect on the general track choice (12-14pp, 28-33%) is not small, suggesting that not all educational outcomes remain unaffected by the loss.

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<sup>17</sup>Given the availability of hospital discharge registers from 1994 onwards, this analysis is restricted to sibling deaths occurring between 1994 and 2016, excluding the period spanning 1986 to 1993. Consequently, there is a substantial reduction in the number of observations. For comparability, Figure A.15 presents the main results derived from this restricted sample, focusing exclusively on losses between 1994 and 2016.

Figure 9: Parental employment



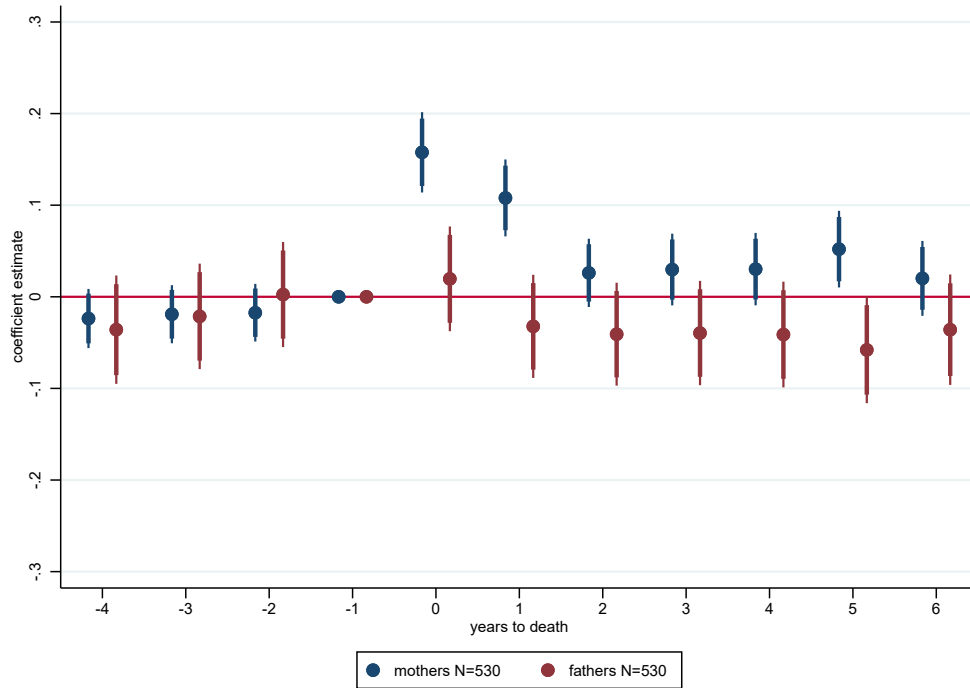
Notes: This figure shows coefficient estimates from the regression - separately estimated for mothers and fathers of the surviving children - of the probability of employment on the “event time”, and corresponding confidence intervals of 95% and 90% in thin and thick lines, respectively. Control variables include age and year fixed effects.

Another compensation mechanism might be an increased time investment from the mothers, given that I find an increase in their probability of receiving sick leave and a decrease in their employment probability. Yet, this finding should be interpreted cautiously since it might instead suggest that mothers have more difficulty coping with the loss compared to fathers and they are more likely to take sick leaves and get unemployed. Although these questions might be out of the scope of this paper, they should be carefully examined in future research for potential policy implications.

Another channel that I cannot explore with the available data is potential compensation from the teachers. Although in Finland teachers are very thoroughly selected and educated and are expected to follow certain rules in grading, this remains a possibility given that the 9th-grade GPA is not a standardized test result. However, it is important to note that the track choice is expected to be less affected by potential compensation from teachers.

The negative impact on the general track choice suggests a medium-run effect of the loss on the human capital accumulation of surviving siblings. Concerning this, such a devastating life

Figure 10: Parental sick leave



Notes: This figure shows coefficient estimates from the regression - separately estimated for mothers and fathers of the surviving children - of the probability of receiving sickness allowance on the “event time”, and corresponding confidence intervals of 95% and 90% in thin and thick lines, respectively. Control variables include age and year fixed effects.

experience during childhood might potentially have impacts on other outcomes, including long-term mental health, marriage and fertility decisions, and labor market trajectories that could affect the next generations. It is crucial to causally analyze the long-term effects of sibling loss during childhood to derive accurate policy implications. Therefore, the long-term impacts of sibling loss will be the subject of future research.

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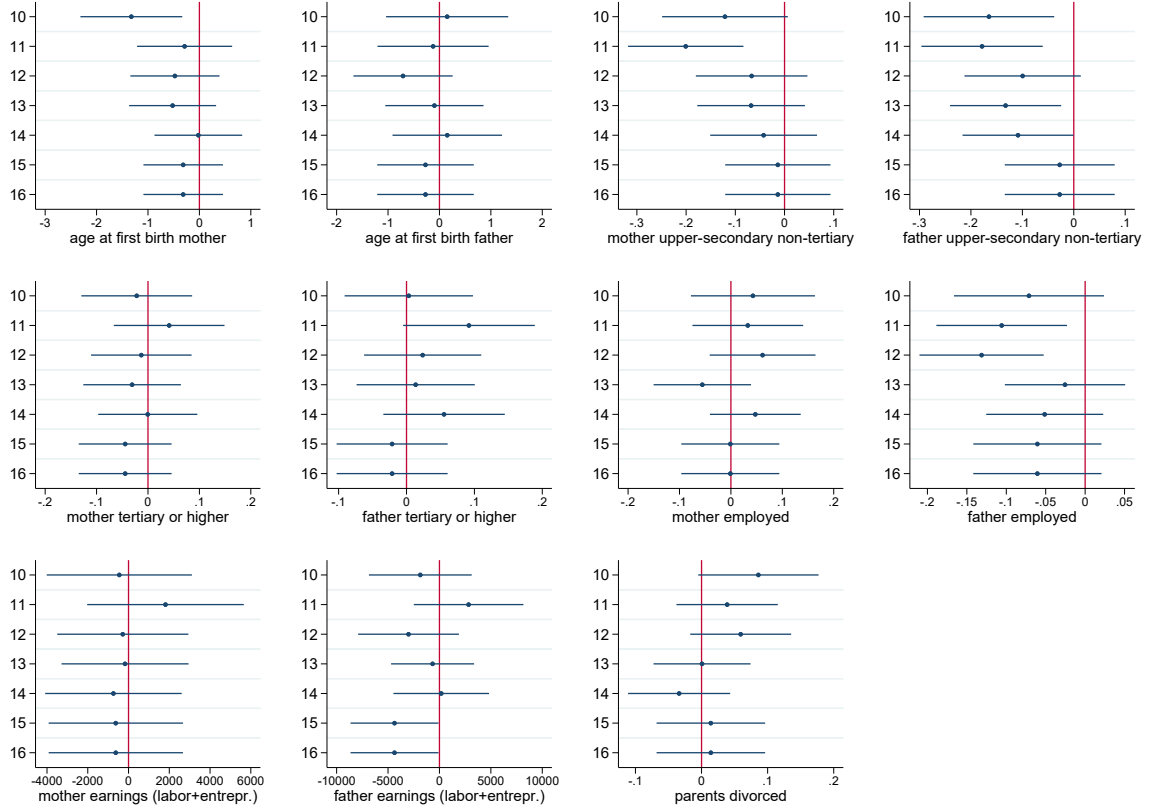
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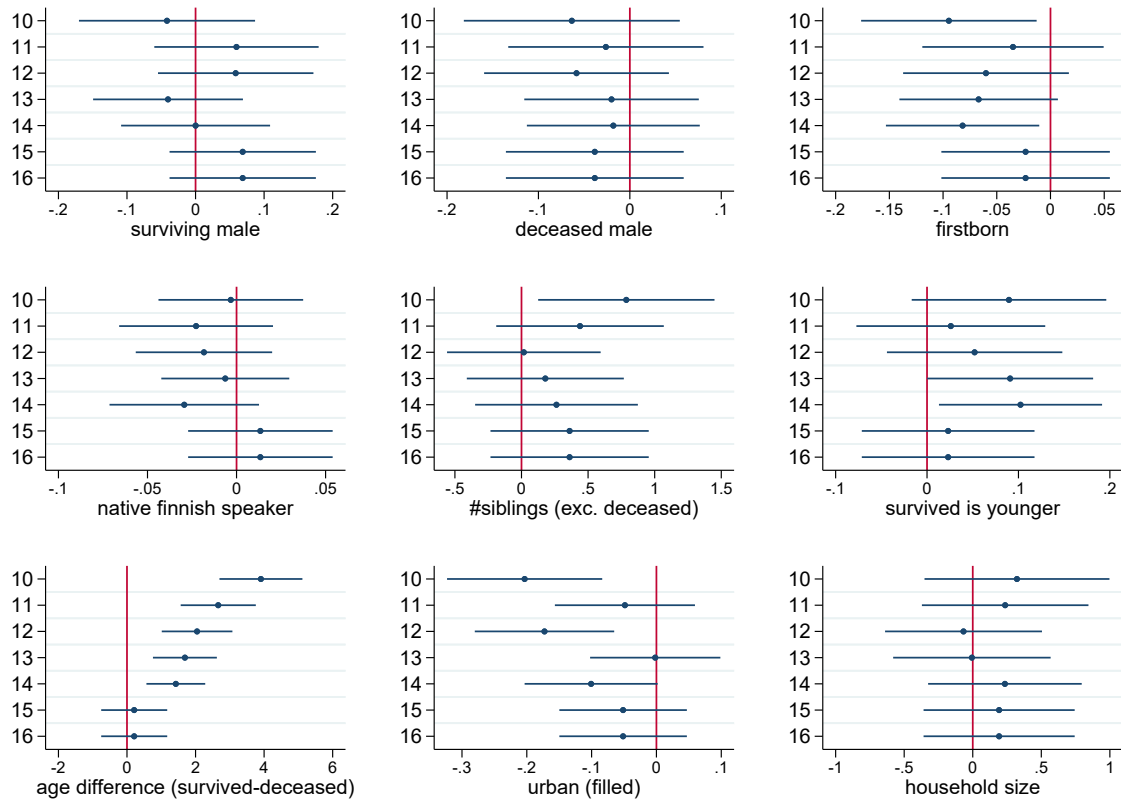
## A Appendix A: Additional Figures and Tables

Figure A.1: Parents' background characteristics



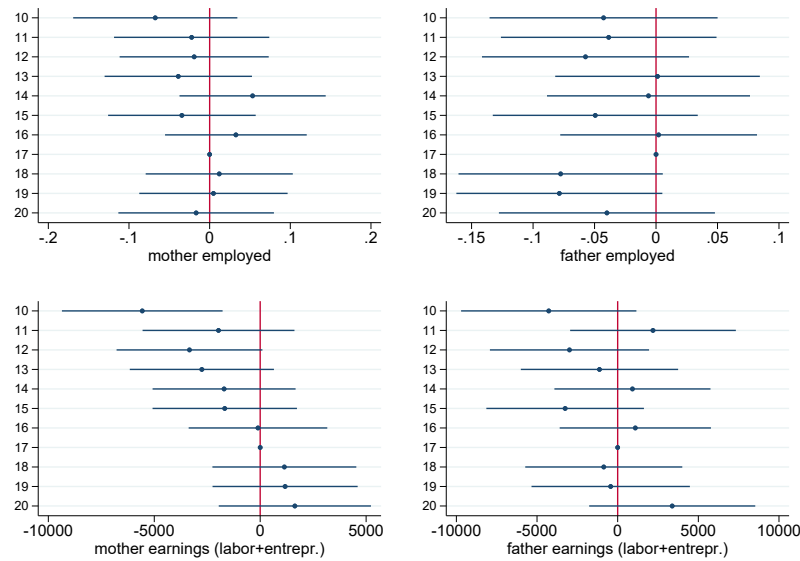
Notes: Figures show the coefficient estimates and 95% confidence intervals from the separate regressions of the several variables for each  $t \in \{10, 11, \dots, 16\}$ , on the indicator that takes a value of 1 if the age of surviving child at the time of death is  $t$ , and 0 if the age is 17. Earnings are adjusted for 2019 prices, and all time-variant variables are measured in the closest common age of the surviving children before the sibling loss.

Figure A.2: Surviving children's background characteristics



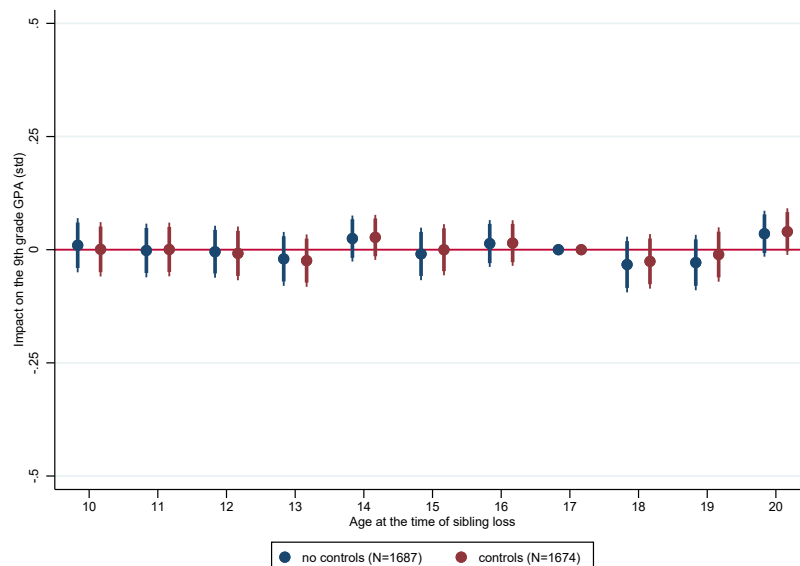
Notes: Figures show the coefficient estimates and 95% confidence intervals from the separate regressions of the several variables for each  $t \in \{10, 11, \dots, 16\}$ , on the indicator that takes a value of 1 if the age of surviving child at the time of death is  $t$ , and 0 if the age is 17. Earnings are adjusted for 2019 prices, and all time-variant variables are measured in the closest common age of the surviving children before the sibling loss.

Figure A.3: Parents' background characteristics - one year before child's death



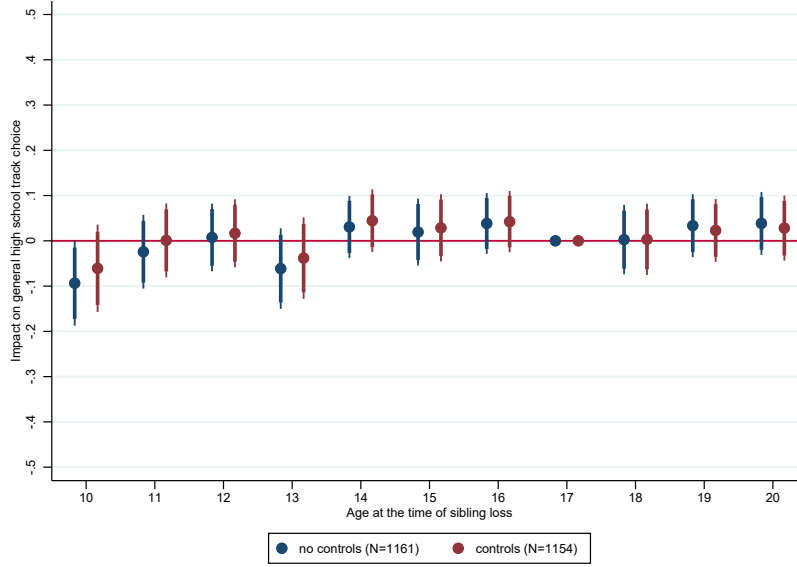
Notes: This figure shows the employment and earnings outcomes of parents of children who lost their siblings at different ages measured one year before the child's death and relative to the corresponding outcome of the parents of children who lost their siblings at age 17.

Figure A.4: Probability of graduating on time



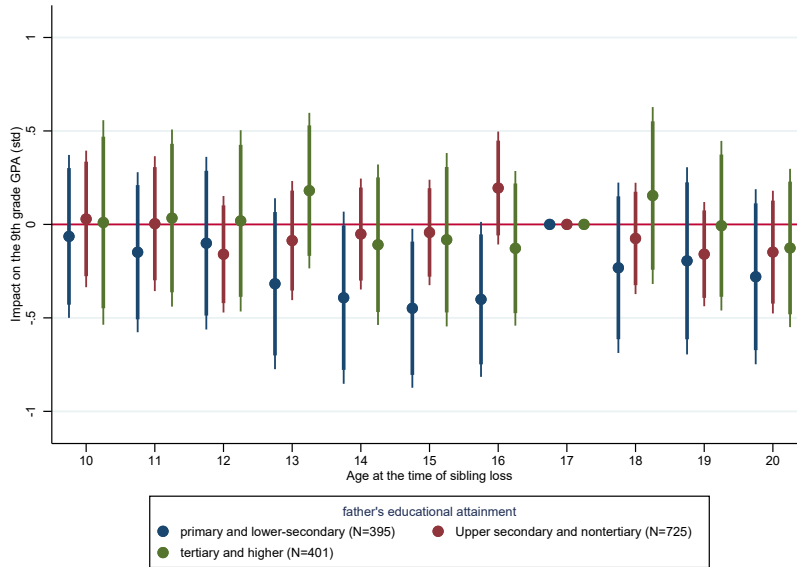
Notes: This figure shows coefficient estimates from the regression of the probability of graduating on time on the categorical variable of the age at sibling loss and corresponding confidence intervals of 95% and 90% in thin and thick lines, respectively. Control variables include the child's gender, being a native Finnish speaker, being firstborn, living in an urban area, HH size, and age at death.

Figure A.5: Probability of upper-secondary school enrollment on time



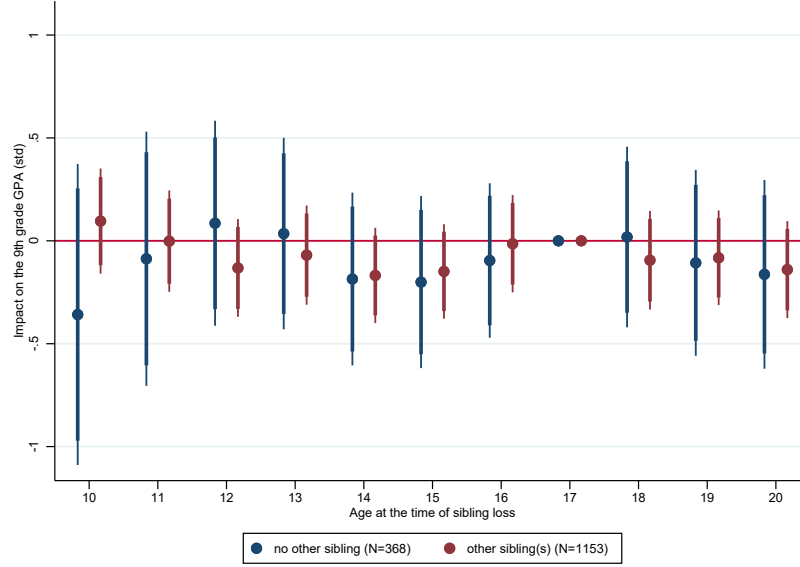
Notes: This figure shows coefficient estimates from the regression of the probability of upper-secondary school enrollment on time on the categorical variable of the age at sibling loss and corresponding confidence intervals of 95% and 90% in thin and thick lines, respectively. Control variables include the child's gender, being a native Finnish speaker, being firstborn, living in an urban area, HH size, age at death, and graduation year fixed effects.

Figure A.6: Heterogeneity by father's educational attainment (GPA)



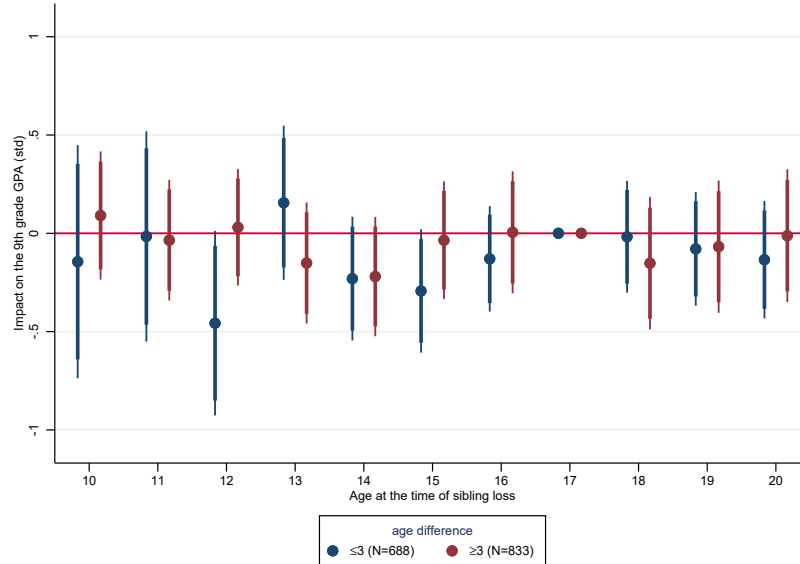
Notes: This figure shows coefficient estimates from the regression of standardized 9th grade GPA on the categorical variable of the age at sibling loss and corresponding confidence intervals of 95% and 90% in thin and thick lines, respectively, separately for surviving siblings with fathers having (i) primary and lower-secondary, (ii) upper-secondary and non-tertiary, and (iii) tertiary and higher educational attainment. Control variables include the child's gender, being a native Finnish speaker, being firstborn, living in an urban area, HH size, mother's highest educational attainment, deceased child's age at death, and graduation year fixed effects.

Figure A.7: Heterogeneity by presence of other siblings (GPA)



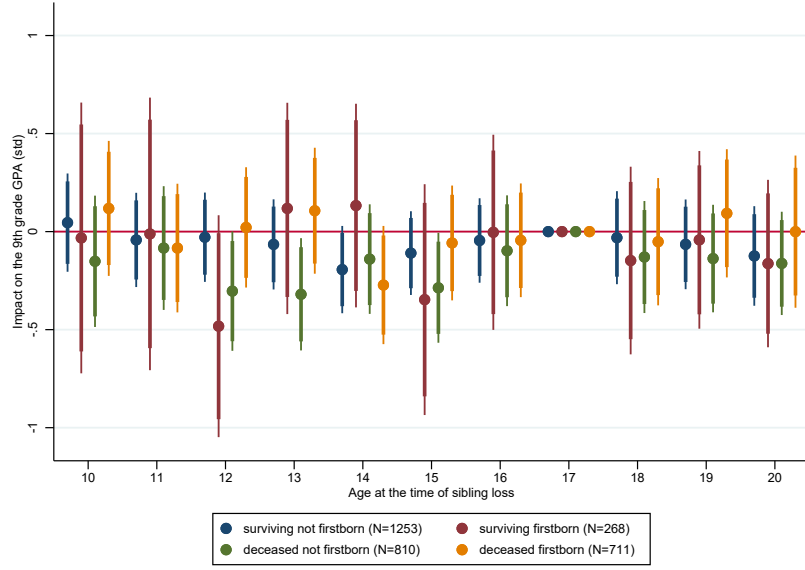
Notes: This figure shows coefficient estimates from the regression of standardized 9th grade GPA on the categorical variable of the age at sibling loss and corresponding confidence intervals of 95% and 90% in thin and thick lines, respectively, separately for those with no other siblings and those with other siblings. Control variables include the child's gender, being a native Finnish speaker, being firstborn, living in an urban area, HH size, both parents' highest educational attainment, deceased child's age at death, and graduation year fixed effects.

Figure A.8: Heterogeneity by age difference (GPA)



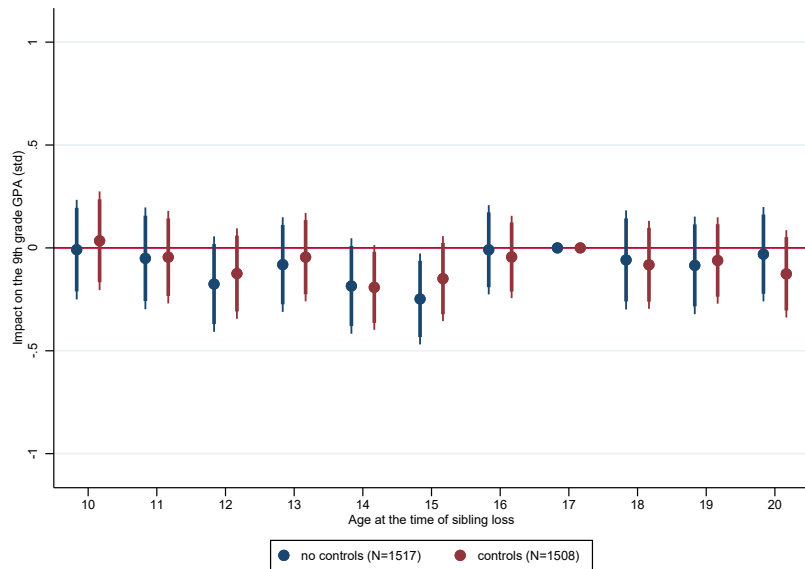
Notes: This figure shows coefficient estimates from the regression of standardized 9th grade GPA on the categorical variable of the age at sibling loss and corresponding confidence intervals of 95% and 90% in thin and thick lines, respectively, separately for those with an absolute age difference  $\leq 3$ , and the rest. Control variables include the child's gender, being a native Finnish speaker, being firstborn, living in an urban area, HH size, both parents' highest educational attainment, deceased child's age at death, and graduation year fixed effects.

Figure A.9: Heterogeneity by birth order (GPA)



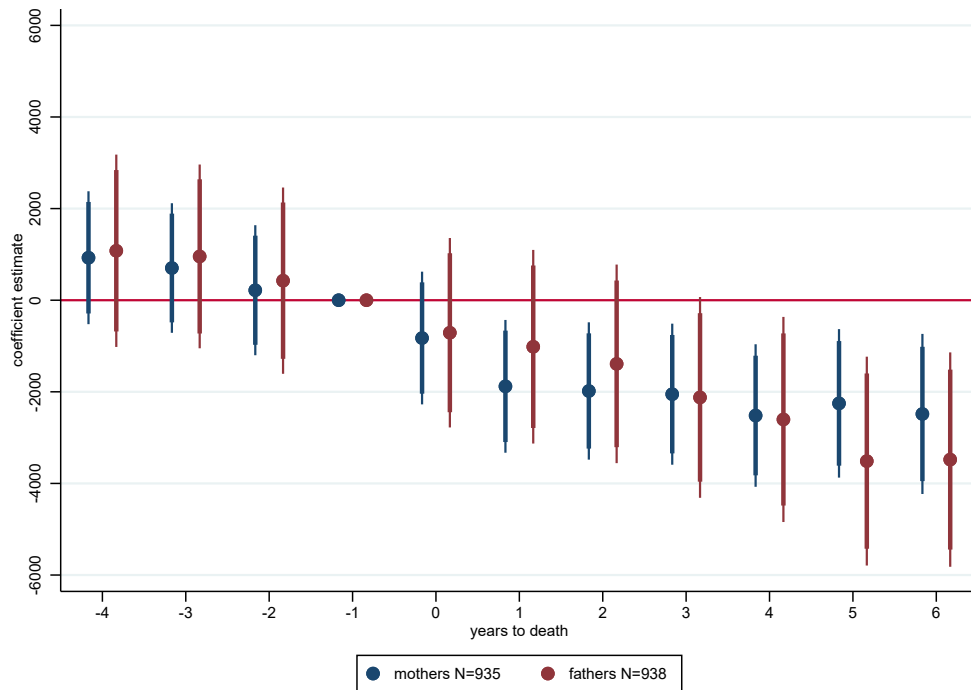
Notes: This figure shows coefficient estimates from the regression of standardized 9th grade GPA on the categorical variable of the age at sibling loss and corresponding confidence intervals of 95% and 90% in thin and thick lines, respectively, separately for (i) later-born surviving siblings, (ii) firstborn surviving siblings, (iii) surviving children losing a later-born deceased sibling, and (iv) surviving children losing a firstborn deceased sibling. Control variables include the child's gender, being a native Finnish speaker, being firstborn (only for (iii) and (iv)), living in an urban area, HH size, both parents' highest educational attainment, deceased child's age at death, and graduation year fixed effects.

Figure A.10: GPA standardized within schools



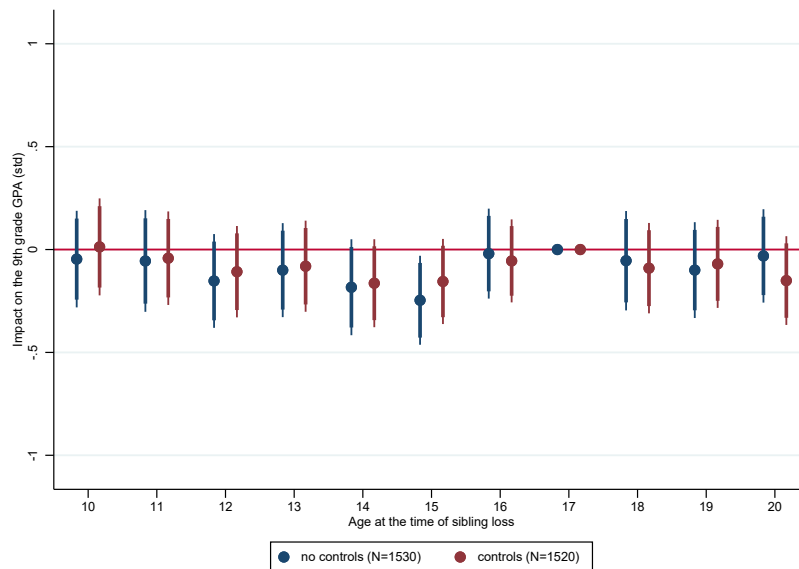
Notes: This figure shows coefficient estimates from the regression of standardized 9th grade GPA (within year-school) on the categorical variable of the age at sibling loss and corresponding confidence intervals of 95% and 90% in thin and thick lines, respectively. Control variables include the child's gender, being a native Finnish speaker, being firstborn, living in an urban area, HH size, both parents' highest educational attainment, deceased child's age at death, and graduation year fixed effects.

Figure A.11: Parental income



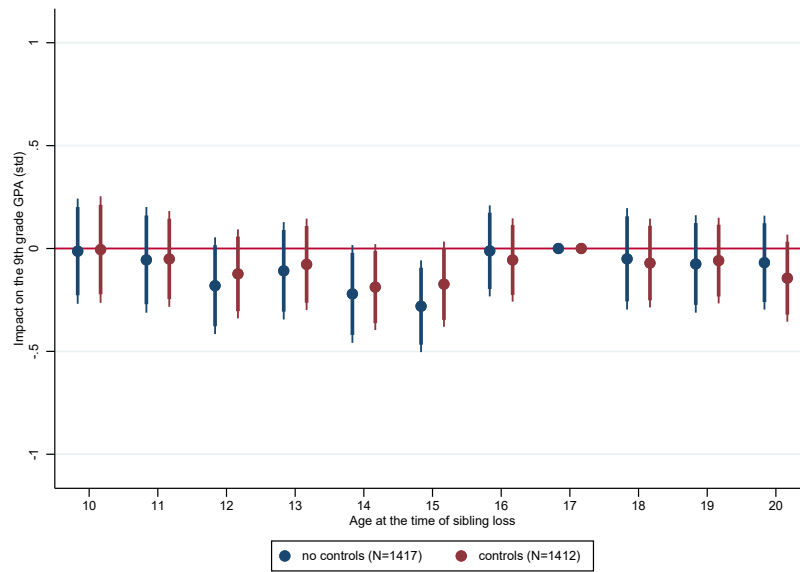
Notes: This figure shows coefficient estimates from the regression - separately estimated for mothers and fathers of the surviving children - of income on the “event time”, and corresponding confidence intervals of 95% and 90% in thin and thick lines, respectively. Control variables include age and year fixed effects.

Figure A.12: Impact of losing a sibling on the 9th grade GPA - Parents' income



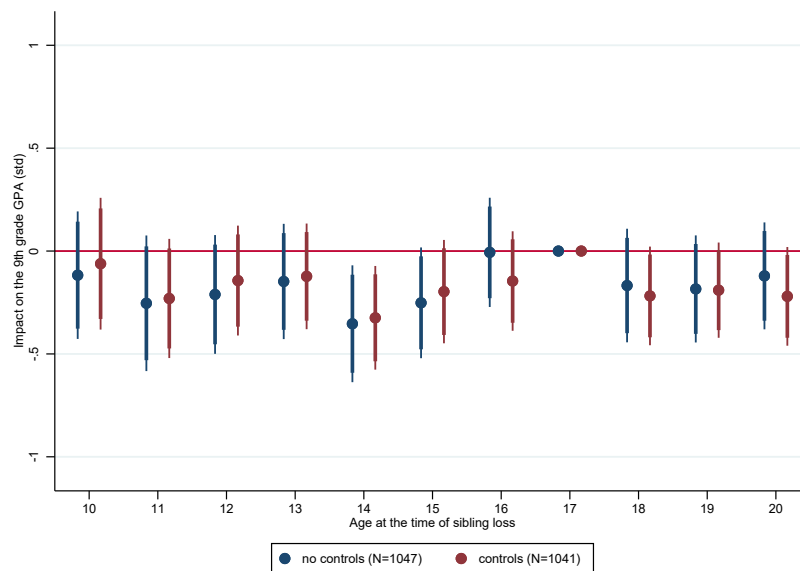
Notes: This figure shows coefficient estimates from the regression of standardized 9th grade GPA on the categorical variable of the age at sibling loss and corresponding confidence intervals of 95% and 90% in thin and thick lines, respectively. Control variables include the child's gender, being a native Finnish speaker, being firstborn, living in an urban area, HH size, both parents' income measured one year before the child's death, deceased child's age at death, and graduation year fixed effects.

Figure A.13: Impact of losing a sibling on the 9th grade GPA - Full siblings



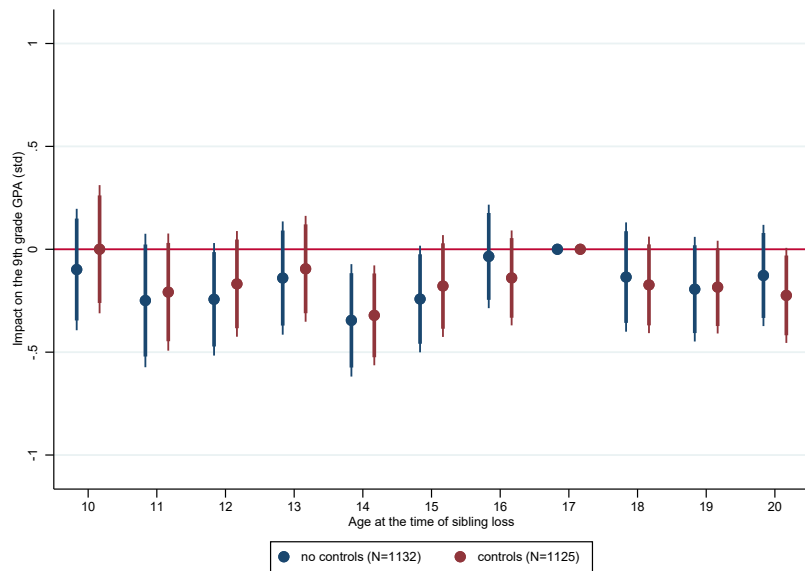
Notes: This figure shows coefficient estimates from the regression of standardized 9th grade GPA on the categorical variable of the age at sibling loss and corresponding confidence intervals of 95% and 90% in thin and thick lines, respectively, for the subsample of the full siblings who has the same biological father in addition to the same biological mother as the deceased child. Control variables include the child's gender, being a native Finnish speaker, being firstborn, living in an urban area, HH size, both parents' educational attainment, deceased child's age at death, and graduation year fixed effects.

Figure A.14: Surviving children not hospitalized (GPA)



Notes: This figure shows coefficient estimates from the regression of standardized 9th grade GPA on the categorical variable of the age at sibling loss and corresponding confidence intervals of 95% and 90% in thin and thick lines, respectively, for the subsample of children who were not hospitalized within the same month as the loss or the following month. Control variables include the child's gender, being a native Finnish speaker, being firstborn, living in an urban area, HH size, both parents' educational attainment, deceased child's age at death, and graduation year fixed effects.

Figure A.15: Impact of losing a sibling on the 9th grade GPA - 1994 onwards



Notes: This figure shows coefficient estimates from the regression of standardized 9th grade GPA on the categorical variable of the age at sibling loss and corresponding confidence intervals of 95% and 90% in thin and thick lines, respectively, for the subsample of children who lost a sibling between 1994 and 2016. Control variables include the child's gender, being a native Finnish speaker, being firstborn, living in an urban area, HH size, both parents' educational attainment, deceased child's age at death, and graduation year fixed effects.

## B Appendix B: Details of the Data

### B.1 Main Datasets

This section summarizes the datasets used in this study and the outcome variables.

Background characteristics of the deceased and surviving children as well as their parents and relevant information on the household level are obtained from the FOLK basic, FOLK household-dwelling, and FOLK income modules. To identify siblings, I use the biological mother links from the FOLK child-parents dataset.

Year and cause of death information comes from Cause of Death Registers which cover the deaths of all individuals (excluding those born and died within the same year) with a Finnish personal identification number and with a known cause of death, for years between 1988 and 2016.

Joint application registers provide information on the 9th grade GPA as well as the application and admission to upper secondary schools of all students who apply for an upper-secondary educational institution. Students Data Module includes individual-level data on students who have been enrolled in upper secondary school and higher levels of education, starting from 1995.

I use hospitalization information for the robustness checks from the Register of Healthcare collected by the Finnish Institute for Health and Welfare (THL) which has been available starting from 1994. Antidepressant Prescriptions are reported in Prescriptions Registers.

### B.2 Outcome Variable Descriptions

The **9th-grade GPA** is reported in the Joint Application Registers for Upper-secondary Schools. For the analysis, I standardize it within each graduation year. The indicator for **graduating on time** is a dummy variable that I construct using the year of graduation certificate reported in the same dataset.

**Enrollment in upper-secondary school on time** is constructed from the Students Data Module, by using the age of the individual and the year. Similarly, the indicator for being enrolled in a **general track** in the upper-secondary school is reported in this dataset. Both variables are only available from 1995.

**Antidepressant prescriptions** of surviving siblings and their parents are obtained from Prescription Records which are collected by Kela, the Social Insurance Institution of Finland. The dummy variable takes the value of 1 if the person is prescribed antidepressants at least once during the year, and 0 otherwise. This variable is only available from 1993.

**Earned income** for parents is the sum of labor and entrepreneurial income reported in the FOLK Income Module.

**Sick Leave** for parents is a dummy variable that I construct by using the sickness allowance reported in the FOLK Income Module. It takes the value of 1 if the person received a positive sickness allowance during the year, and 0 otherwise. This variable is only available from 1995 onwards.

The **employment** variable for parents considers entrepreneurs or wage-earners during the last week of the year, and it is reported in the FOLK Basic Module.