Effects of Parental Death on Youth Outcomes*

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Abstract

Losing a parent early in life profoundly alters a child's life trajectory. In this paper, we study the effects of parental death during adolescence on short- and long-term outcomes, including academic performance, mental health treatment, substance abuse, criminal behavior, teenage pregnancy, and labor market outcomes. Using administrative datasets covering the entire Danish population from 1980 to 2020, we explore how variations in the timing of parental death affect these outcomes. Our analysis employs both a matched control difference-in-differences (DiD) approach and a design that uses future-treated individuals as controls. We find that losing a parent during adolescence reduces high school graduation and college degree attainment by 4 percentage points (pp) and 0.6 pp, respectively. Affected children also exhibit increased use of antidepressant prescriptions and higher rates of criminal behavior. These short-term effects lead to a long-term reduction in annual labor earnings of approximately 15,000 DKK. Children's responses to parental death vary by gender: girls face a heightened risk of teenage pregnancy, whereas boys are more likely to engage in criminal activity. Furthermore, the observed effects of parental death are primarily driven by the loss of a father, regardless of the child's gender.

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"...losing a parent is something like driving through a plate-glass window. You didn't know it was there until it shattered, and then for years to come you're picking up the pieces—down to the last glassy splinter." Saul Bellow (1996) in a letter to Martin Amis who had recently lost his father.[1]

1 Introduction

The death of a parent represents a profound and life-altering event. As children adjust to a new reality in the absence of their deceased parent, their life trajectories are likely to shift. The potential effects of parental death on children's outcomes and the relevant underlying mechanisms vary substantially over an individual's life cycle. For example, losing a parent during early childhood is more likely to affect cognitive and non-cognitive skill formation, while losing a parent during adulthood is more likely to impact informal care arrangements within a family (Adda *et al.*, 2011; Jensen and Zhang, 2024). The teenage years are a particularly vulnerable and formative period in one's life cycle. Compared to adults, teenagers are not mature enough to cope with significant life shocks, yet compared to young children, they have some independence to make life choices related to schooling, career, and peers. Numerous studies have underscored the importance of adolescence in the development of cognitive and non-cognitive capacities that determine lifelong outcomes (Roberts *et al.*, 2006; Borghans *et al.*, 2008; Almlund, 2011; Blakemore, 2012). However, little is known about the causal effects of losing a parent during the teenage years on both short- and long-term outcomes.

In this study, we investigate the effects of parental death during a child's formative teenage years (ages 12–18) on a range of short- and long-term outcomes, including academic performance, mental health, substance use, criminal behavior, teenage pregnancy, and labor market outcomes. This age range is critical because adolescents make significant educational and life decisions during these years, which could be disrupted by the emotional and financial shock of parental loss. Moreover, mental health problems peak during adolescence, a period when mental health is more susceptible to socioeconomic and environmental changes (WHO, 2014; Paus *et al.*, 2008).

We utilize a comprehensive administrative dataset covering the entire Danish population from 1980 to 2020. This dataset provides detailed information on each parent's health records, education level, employment status, labor income, family network, and dates and causes of death. It also allows us to link parents to their children and includes detailed information on each child's academic achievement, test scores, mental health prescriptions, criminal records, teenage pregnancy, and labor market outcomes (if they reached age 30 before 2020). The longitudinal nature of the data enables us to observe variations in children's outcomes before and after parental death and to capture both short- and long-term effects of parental loss.

[1] Bellow's full letter is available here: https://bigthink.com/culture-religion/saul-bellow-writes-a-love-letter-and-considers-heaven/

The primary challenge in identifying the impacts of parental death on children's outcomes lies in the non-random nature of such events. Unobserved factors, such as socioeconomic status, may simultaneously influence both the likelihood of parental death and children's outcomes, potentially biasing the estimates.

To address these empirical challenges, we estimate the impacts of parental death using several complementary research designs. First, we employ a matched control difference-in-differences (DiD) approach to control for persistent observed differences in pre-parental death characteristics. We find that losing a parent during the teenage years reduces high school and college degree attainment by 4 percentage points (pp) and 0.6 pp, respectively. Treated children also experience a deterioration in mental well-being, reflected in an 0.8 pp increase in mental health-related prescriptions. This is driven by the extensive margin, as more children begin using mental health prescriptions after parental death. When examining specific prescriptions, the effect is driven by increased use of antidepressants and insomnia medications. Additionally, teenagers who lose a parent are more likely to commit crimes, with the rates of being charged with a crime and found guilty increasing by 0.08 pp and 0.07 pp, respectively. In the long term, parental death during adolescence significantly impacts labor market outcomes at age 30: affected children are 1.6 pp less likely to be employed, and their annual wages and income decline by 14,000 and 15,000 Danish kroner per year, corresponding to 5% and 6% of the baseline mean.

The overall effects exhibit significant variation based on the gender of the deceased parent and the affected children. The death of a father has a larger effect on both boys and girls. This could be driven by fathers' traditional role as primary breadwinners, leading to reduced family income, or by children spending less time with their mothers as mothers increase work hours to supplement income, a mechanism described by Fadlon and Nielsen (2021). Boys and girls experience similar declines in high school attainment, but boys' college attainment is more negatively affected. Girls who lose a parent face a higher risk of teenage pregnancy. Furthermore, the effect of parental death on girls' mental health and future labor market outcomes is much larger compared to boys. Only boys exhibit a significant increase in criminal behavior after paternal death.

We then leverage variation in the timing of parental death to assess the degree to which our primary results are confounded by unobserved differences between children who lose parents during their teenage years and those who do not. We compare the outcome evolution of children who lost a parent at age t to those who lost a parent at age t+4. This exercise confirms large negative economic impacts of parental death on educational attainment, mental health, and future labor market outcomes, though the magnitudes are smaller than those from the matched-control design. This discrepancy may arise because the control group in the future-treated design eventually experiences parental loss, meaning our estimates capture the intensive margin of parental death occurring between ages 12–18. Together, these findings underscore the lasting economic

consequences of parental loss during formative years.

Our paper contributes to several strands of literature. First, we add to research on parental health shocks and death during childhood and their effects on educational and academic outcomes (see e.g., Aaskoven *et al.*, 2022a; Alam, 2015; Adda *et al.*, 2011; Chen *et al.*, 2009; Corak, 2001; Kristiansen, 2021; Aaskoven *et al.*, 2022b; De Giorgi *et al.*, 2023).[2] Most existing studies focus on aggregate effects (e.g., children below age 18 or 14) and overlook age-specific or adolescent-specific impacts. Additionally, prior research often limits outcomes to academic and mental health measures, despite parental death potentially influencing behaviors such as substance abuse, criminal activity, or teenage pregnancy. Data limitations in earlier studies also restrict analysis to short-term effects, such as educational outcomes, leaving gaps in understanding long-term consequences and mechanisms specific to adolescence. Finally, our empirical strategy—using future-treated individuals as controls—addresses key methodological concerns in this literature. While parental health shocks cannot be prevented, especially fatal ones, the negative effects of parental death may be mitigated through targeted, age-specific policy interventions. Developing such policies requires understanding age-specific effects and underlying mechanisms.

Second, we also contribute to the literature on parental labor market shocks and children's outcomes (Rege *et al.*, 2011; Hilger, 2016; Huttunen and Riukula, 2019; Carneiro *et al.*, 2021; Padillah, 2023). These studies show that monetary resources, parental time inputs, and mental stress induced by parental labor market shocks affect children's short- and long-term outcomes, including mental health, academic achievement, and earnings. We extend this literature by analyzing the loss of a parent—a far more traumatic event than income shocks—and disentangling its channels: income loss, reduced time with the deceased parent, increased maternal work hours (reducing availability of the surviving parent), and the emotional impact of grief. We further expand the range of outcomes to include criminal behavior and examine socioeconomic factors that may mitigate the impact of parental death during adolescence.

Third, our paper relates to research on adolescent mental health. Depression is the leading cause of illness and disability among adolescents worldwide (WHO, 2014; Fruehwirth *et al.*, 2019). Studies document that mental health problems peak during adolescence, with causes and consequences more pronounced during this period (Paus *et al.*, 2008; Kieling *et al.*, 2011). We contribute by showing how parental death during adolescence exacerbates mental health challenges, leading to cascading effects such as increased criminality and reduced labor market earnings.

Finally, our study also advances the economic literature on human capital formation by investigating whether adolescent outcomes—such as academic performance and mental health—serve

[2]Outside economics, a wide range of literature also examines the impact of parental health shocks on children, e.g., Lytje and Dyregrov (2019); Appel *et al.* (2016); Morris *et al.* (2020), though these studies rarely emphasize causal identification.

as reliable predictors of later-life economic success. Our work addresses the "missing middle" issue raised by Almond *et al.* (2018), as structural models of human capital development often assume that transitional adolescent years critically link early-life shocks to long-term outcomes. These findings offer insights for refining such models and designing policies to strengthen youth resilience.

2 Institutional details

Pertinent to our analysis are the provision and cost of health care provided to the potentially ill parent, the physical and mental health care offered to surviving spouses and children, and the income insurance afforded to spouses and children of deceased family members. We discuss each of these below, followed by a discussion of the educational system in Denmark.

2.1 Health and mental care provision

Denmark's healthcare system is characterized by its universal access and comprehensive coverage. It operates a tax-funded healthcare system offering free access to general medical services, including those provided by general practitioners (GPs), specialists, and public hospitals. Denmark's universal health insurance covers nearly all medical expenses allowing families to receive necessary care without significant financial burden.[3]

For adult mental health, the system employs a stepped-care model, where treatment is tailored to the severity of the condition. Mild cases are primarily managed by GPs and psychologists, while more severe conditions necessitate care from psychiatrists or psychiatric hospitals (Danish Health Authority, 2022; Ly, 2024). The Danish mental health system has specific provisions for children and adolescents. Mental health services for this demographic are delivered through multidisciplinary approaches, including outpatient and inpatient services provided by psychiatric hospitals and private practitioners. In addition, free grief counseling is offered by municipalities, and support groups for bereaved children that are often organized through schools or local organizations

As discussed in Lytje (2018), in the 1990s, the Danish Cancer Society developed a standardized approach for how schools should respond when a student experiences bereavement. The system allows schools to create customized bereavement response plans (b-plans) from a template, adapting them to each school's specific needs. In 2018, nearly all Danish schools (98%)

[3]Exceptions include services like dental care, chiropractic treatments, and prescription medications. Prescribed medications also involve a co-payment that decreases proportionally with the total amount spent on medications over the course of a year. Once an annual expenditure threshold is reached (of about $750 in 2024), medications become free of charge. Medications administered in hospitals are provided to patients at no cost, see Jensen and Zhang (2024) for details.

had their own b-plan. These plans typically outline who contacts bereaved families, who needs to be informed about the loss, how to communicate with other students. Teacher feedback suggests these plans provide valuable structure and guidance for supporting bereaved students in the classroom, though no formal analysis exists to our knowledge.

In 2020, the Danish government recognized that mental health and social care services were hindered by a lack of coordination and cooperation, insufficient quality, inadequate interventions, and inadequate prevention and early intervention for those with mental health issues. In response, they allocated substantial resources to mental health care and implemented a 10-year plan aimed at reducing waiting times and enhancing service quality. Acknowledging the unique needs of adolescents, this plan emphasizes holistic and integrated care models that span education, social services, and health sectors (Danish Health Authority, 2022).

2.2 Income Insurance

Fadlon and Nielsen (2021) offer a detailed overview of Denmark's income insurance systems, which we summarize here. Income insurance mechanisms relevant to spousal death in Denmark include Social Disability Insurance (Social DI), employer-based insurance policies, and private life insurance. Social DI provides permanent, non-earnings-based benefits to surviving spouses who cannot maintain their standard of living independently after their partner's death, available until they transition to old-age pensions. Employer-based insurance policies, frequently integrated into collective labor agreements, may include life insurance components that offer benefits to surviving spouses. However, these policies are often limited in scope and are more prevalent among workers in unionized sectors. Private life insurance also plays a role but is constrained by health screenings. A notable gap in Denmark's system is the absence of a universal survivor's insurance program, which leaves many surviving spouses vulnerable to financial shocks. As discussed in Fadlon and Nielsen (2021), in the absence of comprehensive coverage, survivors often rely on informal mechanisms such as increasing their labor supply or drawing on savings to mitigate the financial impact of spousal death. Finally, financial assistance is available through the state's children's pension for children who have lost a parent before the age of 18. In 2024, The child allowance is DKK 4,644. per quarter per deceased parent, or about $2600 per year.[4]

2.3 Education

In Denmark, children are required to attend nine years of compulsory schooling, typically from ages 7 to 16. As they approach the end of primary education, Danish students participate in a national exam that assists them in determining their next educational step. Students showing an

[4]See https://www.borger.dk/familie-og-boern/familieydelser-oversigt/boernetilskud

academic aptitude can choose to attend a gymnasium for their secondary schooling which will allow them to specialize in subjects like languages, science, or mathematics, effectively preparing them for university studies. Universities are publicly funded and free of charge. The government also offers generous student grants and optional student loans with favorable terms. Most university students proceed directly to a two-year master's degree immediately after earning their bachelor's degree.

On the other hand, students may choose to attend a trade school instead of a gymnasium, where they can learn skills such as metalworking or mechanics. Alternatively, they might attend a business school to study fields like accounting or software development. Students may also decide to postpone the choice between gymnasium and trade school for a year by enrolling in an efterskole (after school). In this environment, students live away from home and have the opportunity to study subjects of personal interest, such as theater or sports, alongside their standard academic courses.

As pointed out by Aaskoven *et al.* (2022a), the effects of parental death in Denmark are likely to be a lower bound compared to countries in which education and healthcare are predominantly private and/or where the social safety net is less comprehensive.

3 Data and descriptive analysis

3.1 Data

We leverage Denmark's comprehensive population-level administrative data to examine the impact of parental death during adolescence on a broad array of economic and behavioral outcomes. The unique strengths of this dataset—extensive child-parent linkages and longitudinal coverage of the entire population since 1980—provide an ideal foundation for investigating how adolescent exposure to parental death shapes individual trajectories across multiple domains.

Crucially, Denmark's administrative registers allow for precise identification of the timing of parental death. From 1970 onwards, we observe individual death records, including the exact date of each parent's death, which enables us to isolate the effects of unexpected parental loss during specific adolescent years.

Uniquely, all the relevant datasets can be linked using unique personal identifiers. As such, information on parental death can be linked to a large set of child outcomes, including: education attainment, mental health, criminal behavior, employment and earnings. We use these data to follow the trajectories of children around parental death. In addition, we extract several parental characteristics to identify appropriate matched controls who do not experience parental death; see Section 4 for more details on this matching procedure. We describe each of the relevant data sources in more detail in the following.

Demographics, death, and birth weight: Starting in 1980, we can observe several demographic data on the entire Danish population (in the FAIN- and BEF-register). These include birthdays, parent-child links, home address IDs, home regions, and civil status. The demographic registers also allow us to determine if a person is actually legally residing in Denmark. Starting already in 1970, we can observe all deaths in Denmark as well as the reason of death (in the DODSAARS/DODSAARG-registers). Using parent-child links from the demographic data, we can then identify each parental death. To identify appropriate matched controls of children who do not experience parental death, we also match on individuals' birth weights (available in the FTBARN-register for children born in 1973 onwards).

Education: Our primary educational outcomes include high school completion and college attendance/enrollment. Starting in 1980, we observe completed education in the UDDA-register. Data on completed education allow us to determine whether individuals have finished high school by age 19 – the modal age for high school completion. Starting in 1995, we can also observe spells of enrollment at all relevant educational institutions in Denmark in the KOTRE-register. We focus on enrollment in tertiary education, specifically whether individuals are enrolled in a college/university program at age 19. Although the age of college enrollment varies substantially in Denmark, enrollment in tertiary education soon after high school will represent an educational trajectory without substantial interruptions.

Mental health: Mental health represents a primary area of concern following the death of a parent. Danish administrative data are particularly useful for assessing mental health effects as the LMDB-register contains records of all full-filled medical prescriptions starting in 1995. These data include detailed ATC-codes for each prescription, allowing us to separately consider medical prescriptions related to the treatment of psychoses (ATC-codes N05A*), anxiety (ATC-codes N05B*), insomnia (ATC-codes N05C*), depression (ATC-codes N06A*), and psychostimulants (ATC-codes N06B*).[5] The fact that we observe the type of mental health treatment enables us to evaluate the potential psychological pathways through which parental loss affects long-term outcomes. For each type of mental health condition, we consider both the extensive and intensive margins of mental health treatment; that is, whether a person has received *any* prescription related to these conditions within a given year, as well as the *number* of prescriptions related to these conditions within each year.

[5]Note that prescriptions related to depression (ATC-codes N06A*) include the widely used selective serotonin reuptake inhibitors – in addition to the treatment of depression, these are also used to treat e.g. generalized anxiety disorder.

Crime: Danish administrative data also provide rich information on criminal behavior through individual-level police records, allowing for analyses of the effects of parental death on adolescent participation in crime. Although partial data on criminal charges are available from 1980, complete data on criminal charges are only available starting in the early 1990s (in the KRSI-register).[6] To have a consistent time series on criminal behavior we therefore focus on outcomes from 1995 onward, and exclude traffic offenses as they typically rely on people having access to a car and having a driver's license. We consider two sets of crime outcomes: 1) all criminal charges, and 2) those charges for which an individual have been found guilty (information on sentences/verdicts/fines are available in the KRAF- and KRKO-registers).

Employment and income: Employment and income records extend our analysis into adulthood, offering insights into the long-term economic consequences of adolescent parental loss on labor market outcomes. Information on income and employment is available starting in 1980 in the IND- and IDAP-registers, respectively. The IDAP-register also includes a proxy for hours worked, making it possible to consider the intenstive margin of labor supply and wages.[7] The income and employment data are used both as an outcome when considering long-term effects of parental death, but also as a relevant parental characteristic to match on when finding an appropriate control group who do not experience parental death.

3.2 Summary statistics and descriptives

Before outlining our empirical strategy, we first present dynamics around parental death, considering both the causes of death and the timing of death. Next, we further describe our child outcomes of interest, including mean outcomes for our treatment and control groups.

Dynamics of death: In Figure 1, we consider the timing of first parental deaths. Panel A shows the full age distribution of children at the time they experience first parental death. We see that the probability of experiencing parental death peaks in the late 30s/early 40s, but also that the probability start increasing already in the late teenage years. To further understand the dynamics of parental death in childhood, adolescence, and early adulthood, we plot the cumulative probability of having experienced parental death in Panel B, Figure 1. We see that by age 18, around 5% of children have experienced their first parental death. Again, it is evident that after age 18,

[6] From 1991 to 1992 the structure of the data on criminal charges changes from having one observation for each combined case in KRSI to having an observation for each relevant sub-case. In addition, the the decision/verdict codes change in KRAF in the early 1990s.

[7] Hours worked are proxied by ATP-pension payments which are paid by employers proportional to hours worked. This appropriateness of this proxy is discussed in **?**.

the probability of having experienced parental death increases relatively faster, with about 10 % of children having experienced parental death already by age 25.

Next, in Figure 2, Panel A, we consider the causes of parental death from child age 0 to 60. Accidents are the leading cause of parental death in the first 3 years of children's lives, but cancers dominate as the most common single cause of parental death already by child age 4. In early teenage years, cancers account for more than a third of parental deaths, whereas accidents account for less than 15%. By age 60, cancers remain the leading cause of parental death. In Figure 2, Panel B, we zoom in on cause of parental death in adolescence. While the fraction of parental deaths due to heart attach and cancers are steadily increasing from age 12 to 18, the fraction of deaths to due accidents reduces by more than a third.

Child outcomes: In Table 1, we provide an overview of the means of our outcomes of interest. We include mean outcomes for three groups: a) our treatment group which are children experiencing their first parental death in adolescence, i.e. age 12-18, in Column 1; b) children experiencing first parental death age 19-30 in Column 2; c) children experiencing first parental death when relatively older, age 35 and above, in Column 4. We also provide p-values from simple t-tests of differences in means between our treatment group, providing initial, suggestive evidence of potential effects of parental death in adolescence. Panel A considers educational attainment (measured at age 19). We see that around 19% of children have finished high school by age 19, and the fraction is similar across those who experience parental death in adolescence and early adulthood (age 19-30). However, the fraction is significantly large for those in experiencing parental death later in life. In contrast, we see that those experiencing parental death in adolescence are significantly less likely to have enrolled in college by the end of year in which they turn 19 – and this is both true when comparing to those experiencing parental death in early adulthood and later in life.

In Table 1, Panel B, we consider labor market performance (measured at age 30). In line with the results on college attendance, we observe the lowest participation rates, the lowest level of labor supply at the intensive margin, and lowest income and wage levels among those who experience their first parental death in adolescence.

In Table 1, Panel C, we find a similar picture when considering mental health outcomes (measured at age 19). We first consider mental health across all relevant ATC-codes, and next, we separately consider prescriptions related to psychosis, anxiety, insomnia, depression, and psychostimulants. The first six rows of Panel C refers to the *number* of prescriptions related to these conditions within each year, the following six rows are indicators for any relevant prescriptions. Again, the children experiencing parental death in adolescence appear as those with the least favorable outcomes with consistently higher uptake of all types of mental health prescriptions.

4 Empirical strategy

We use two empirical designs to estimate the causal effects of parental death on a broad spectrum of adolescent outcomes. First, we estimate impacts of parental death using a matched control Difference-in-difference (DiD) approach to control for persistent observed differences in pre-parental death characteristics of the children and their families. Second, we leverage variation in the timing of parental death to check whether our results is confounded by unobserved differences between children lose their parents and children do not lose their parents. We compare the evolution of children's outcomes for those experience parental death at an early age to another group of children born in the same cohort but who experience parental death at a later age.

4.1 Matching Design

In our matched control DiD design, we match each treated child to an observationally equivalent child who does not lose a parent during adolescent period based on family and child characteristics measured prior to parental death. We first conduct exact match on the child's birth year, gender and parental age group (above or below 40 years old). Within these groups, we match on a wider set of covariates based on an estimated propensity score. To do so, we estimate a logit regression, where the dependent variable is a dummy capturing whether a child loses a parent during adolescent period, and with controls including: (1) *Children's characteristics*: birth order, number of siblings, birth weight, region of residence (5 regions), and a dummy of whether taking anti-depressants one year before parental death. (2) *Parental characteristics*: health status of both parents measured by number of hospital visits one year before parental death, marital status, highest education level, age, income, and employment status.[8] Based on the estimated propensity scores, we perform nearest-neighbor matching, selecting three control children for each treated child. Therefore, our treatment group consists of adolescents who lost a parent between the ages of 12 and 18, while the control group comprises individuals with similar observed characteristics who did not experience the loss of either parent during the same period.

To identify the effect of parental death during adolescence on individual short- and long-run outcomes, we estimate the following equation:

$$Y_{it} = \beta_0 + \beta_1 \mathrm{D_i} + m_{(i)} + \mu_t + \mu_a + \varepsilon_{it} \tag{1}$$

Where Y_{it} is the outcomes of interest, D_i is treated status of individual i, and $m_{(i)}$ is the matched pair fixed effect, such that are we are comparing a treated child to their matched controls. The

[8]Categorical varaibles are included in the logit regression as fixed effects and continuous variables like income are included in the logit regression as continuous variables.

terms μ_t and μ_a are the calendar year and birth year fixed effects, respectively. The term β is the parameter of interest.

4.2 Future Death Design

Children who lost their parents at adolescent period may share unobservable factors that make their parents more likely to experience early death and cause differences in the evolution of the children's outcomes. To address this concern, we follow the methodological framework proposed by Fadlon and Nielsen (2021) to construct counterfactuals for affected children by identifying adolescents from the same birth cohort who experienced parental death under comparable circumstances but at different points in time.

Formally, the treatment group is defined as individuals who experienced parental death between the ages of 12 and 18. To create a suitable counterfactual for the treated individuals, we construct a control group consisting of individuals matched on birth year and gender who experienced parental death four years later. For instance, consider two children born in 1990: one lost a parent in 2015 (at age 15), and the other lost a parent in 2019 (at age 19). The outcomes observed for the individual who lost a parent at age 19 between ages 15 and 18 serve as counterfactuals for the individual who lost a parent at age 15. This approach compares individuals with similar expectations regarding the distribution of future outcomes but differing in the timing of parental death. By comparing staggered exposure to parental loss, we isolate the causal effect of this event while controlling for cohort-invariant unobservable characteristics. The final sample includes 62,981 individuals in the treatment group and 85,783 individuals in the control group, providing a robust foundation for empirical analysis.

The research design constructs matched pairs of adolescents based on their birth cohort, the year of parental death and the gender of the adolescent. The inclusion of gender in the matching process is crucial, as many outcomes of interest, such as educational attainment, labor market performance, and criminal behavior, exhibit strong gender-specific patterns. Accounting for gender ensures that comparisons are made between individuals with similar underlying trajectories in these dimensions.

To recover the treatment effect, we employ a difference-in-differences (DiD) framework to estimate the impact of parental death on a wide range of outcomes, including educational attainment, labor market performance, and criminal behavior. This methodology allows us to approximate the counterfactual outcomes for affected individuals and quantify the causal effect through regression analysis, as specified below:

$$Y_{it} = \beta_0 + \beta_1 D_i + \mu_t + \mu_a + \varepsilon_{it} \tag{2}$$

In this regression, Y_{it} denotes an outcome for individual i at time t; D_i denotes an indicator for whether an individual belongs to the treatment group; μ_a and μ_t represent the birth year and calendar year fixed effects, respectively. The parameter β_1 represents the causal effect of parental death events on adolescents.

By design, the same adolescent can appear in both the treatment and control groups, which enhances the statistical power of our analysis. Importantly, however, an adolescent is never used as a control for themselves. For instance, treated adolescents who experienced an event in 1996 are matched with adolescents who experienced a similar event in 2000 as controls. These same controls may also appear in the treatment group if, for example, adolescents who experienced the event in 1992 are included in the analysis. Additionally, we account for households where multiple adolescents experienced parental death, ensuring that such cases are appropriately handled. To address potential concerns about within-household correlation, we report robust standard errors clustered at the household level, providing reliable inference in the presence of such clustering.

5 Results

In this section, we conduct our primary analysis of the impact of parental death on a comprehensive range of adolescent outcomes. We begin by examining the central focus of our study: the influence of this extreme event on adolescents' educational choices. Next, we explore the mental health conditions of affected adolescents. Subsequently, we investigate the long-term effects on labor market performance and engagement in criminal behavior over the life course. Finally, we provide a complementary analysis, highlighting the heterogeneity in these responses.

5.1 Short-run effects

Educational Responses: We begin by analyzing the educational outcomes of individuals at the age of 19, focusing on two key indicators: (a) a binary variable denoting whether the individual attended college, and (b) a binary variable indicating whether the individual completed academic high school. The results of these analyses are reported in Table 2 and Table 3, which correspond to the matching design and the future death design, respectively.

Under the matching design, we find that adolescents who experience parental death are 4 percentage points more likely not to complete academic high school by the age of 19, and 0.6 percentage points less likely to attend any college. Furthermore, when the parental death occurs at an earlier stage of adolescence, the negative effects on educational attainment are slightly more pronounced. These findings highlight the significant and enduring impact of early parental loss on educational trajectories. Similarly, under the future death design, we observe negative effects of parental death on educational attainment, though the magnitude of these effects is smaller.

Specifically, adolescents who experience parental death are 1 percentage point more likely not to complete academic high school by the age of 19 and 0.2 percentage points less likely to attend any college.

One possible explanation for the smaller magnitudes observed under the future death design is that, in this framework, both the treatment and control groups experience parental death during the observation period. This overlap may mitigate the anticipatory or expectation effects of parental death, leading to attenuated estimates compared to the matching design. These results underscore the sensitivity of educational outcomes to the timing and measurement frameworks employed in the analysis.

Mental Health Issues: In addition to examining educational outcomes, this study investigates the immediate mental health effects of parental death, focusing on the year following the event. Using prescription data, we analyze both the extensive and intensive margins of mental health treatment. The extensive margin refers to whether an individual has received any prescription related to mental health conditions within a given year, while the intensive margin examines the total number of prescriptions issued for these conditions annually. The results, derived from both matching and future-death designs, are presented in Table 4 and Table 5, respectively.

We begin by evaluating the aggregate impact of parental death on mental health problems (column (1)) and further disaggregate these effects into five specific conditions: psychosis, anxiety, insomnia, depression, and psychostimulant-related issue (columns (2)–(6)). Panel A of each table reports the estimated effects on the extensive margin, while Panel B presents the corresponding results for the intensive margin.

Under both the matching and future-death designs, parental death significantly increases the likelihood of experiencing any mental health problems. Specifically, the probability rises by 0.8 percentage points under the matching design and by 0.7 percentage points under the future-death design. A closer examination reveals that adolescents who experience parental death exhibit higher probabilities of developing specific mental health conditions, particularly insomnia and depression, with increases of 0.3 and 0.4 percentage points, respectively, across both designs. Additionally, a 0.1 percentage point increase in the likelihood of experiencing psychosis is observed. These findings underscore the immediate and significant mental health challenges faced by adolescents following the loss of a parent.

5.2 Long-run effects

Labor Market Performance: We examine the long-term labor market outcomes of adolescents who experience parental death, focusing on their employment and income when they enter the labor market at age 30. Specifically, we analyze unemployment and labor force participation,

distinguishing between extensive and intensive margins. Unemployment is measured as the proportion of available working hours lost to unemployment, calculated annually as the ratio of unemployed hours to potential working hours. Labor force participation is assessed in terms of whether individuals participate in work (extensive margin) and their annual working hours (intensive margin).

Table 6 presents the results derived from a matching design. The findings suggest that experiencing parental death during adolescence increases the share of unemployment by 0.4 percentage points, reduces the labor force participation rate by 1.6 percentage points, and decreases annual working hours by approximately 20 hours on average. Additionally, labor income and total income are found to decline by 14,060 DKK and 15,622 DKK per year, respectively.

By contrast, when using a future death design, the effects on unemployment share, labor force participation, and hours worked per year are not statistically significant. However, we observe a reduction in labor income and total income of 2,254 DKK and 2,143 DKK per year, respectively, although the magnitudes of these effects are smaller compared to the matching design.

Criminal Behaviors: An intriguing dimension of our analysis explores the potential impact of parental death during adolescence on criminal behavior. The findings reveal a statistically significant increase in the likelihood of criminal involvement among individuals who experienced parental loss during their teenage years. Specifically, the probability of being charged with a criminal offense rises by 0.8 percentage points, while the likelihood of being convicted following a charge increases by 0.7 percentage points in the sample period we observed after parental death. These results underscore the broader social and behavioral implications of adolescent parental loss, extending beyond economic and educational outcomes.

Table 8 provides the detailed estimates supporting these findings. The observed increase in criminal activity suggests that the trauma and instability caused by the loss of a parent during a formative period may contribute to a heightened risk of deviant behavior.

Moreover, these findings emphasize the importance of considering the multifaceted consequences of parental loss during adolescence. While previous sections have primarily focused on labor market, educational, and health outcomes, this analysis highlights that the effects of such a traumatic event may extend into domains critical for societal stability and individual well-being. These results suggest the need for targeted interventions, such as counseling and social support programs, to mitigate the long-term social and behavioral repercussions of parental death during adolescence.

5.3 Heterogeneous effects

We now turn to an analysis of the potential heterogeneous effects of parental death on both the short- and long-term outcomes discussed above. As illustrated in Figure 3, there are notable disparities in family income following the death of a parent, depending on whether the deceased parent is the mother or the father. These differences likely reflect varying economic and emotional impacts within the household, which may influence the adolescent's response to the parental death event.

Furthermore, it is plausible that boys and girls exhibit differing responses to the shock of parental loss, given gender-specific roles, emotional processing, and societal expectations. These variations may manifest in distinct patterns of short-term behavioral adjustments and long-term socioeconomic trajectories. By examining these dimensions, we aim to provide a nuanced understanding of how parental death affects adolescents differently based on the gender of both the deceased parent and the affected child.

We divide our sample into two groups based on the gender of the adolescents and present the corresponding results in Table 9 for boys and girls, respectively. Starting with educational outcomes (Column (1) and (2)), we find that parental death negatively affects high school completion by the age of 19 for both boys and girls. The magnitude of these effects is particularly pronounced and similar when the deceased parent is the father. In contrast, while the death of a mother also appears to reduce the probability of completing academic high school, these effects are not statistically significant. Turning to college attendance at the age of 19, we observe that only the death of a father has a significant negative impact on boys' likelihood of attending college, whereas no statistically significant effects are found for other groups. This pattern suggests potential gender-specific vulnerabilities and the critical role of fathers in shaping boys' educational trajectories, particularly in terms of post-secondary education attainment.

In Columns (3) and (4), we examine the heterogeneous responses of boys and girls to the death of a parent, focusing on both the extensive and intensive margins of mental health outcomes. Our findings indicate that the death of a father significantly increases the likelihood of experiencing mental health issues for both boys and girls, with the negative effects being more pronounced among girls. In the case of a mother's death, girls are similarly affected, exhibiting a comparable magnitude of adverse mental health outcomes. For boys, while an increased likelihood of mental health problems is also observed, the effects are not statistically significant. One potential explanation for these patterns could be the differing emotional and functional roles mothers and fathers play within the household. Fathers may provide critical financial support and a sense of security, whose loss might disproportionately impact girls. Conversely, mothers often serve as primary caregivers, and their absence may uniquely disrupt household dynamics and emotional well-being, particularly for girls, given their closer reliance on maternal support. These

gender-specific roles may shape the ways in which adolescents cope with and adapt to parental loss.

Next, we examine the heterogeneous long-term effects of parental death (mother or father) on adolescents' labor market outcomes at age 30, focusing on labor force participation and income. For boys, we do not find statistically significant effects of parental death on labor market performance, whether in terms of labor force participation or income. In contrast, the results for girls present a different pattern. Specifically, while the death of a mother does not appear to have significant effects on girls' labor force participation or income, the death of a father is associated with significant negative effects on both outcomes. These findings again suggest a gendered response to parental death in terms of long-term economic performance, with the loss of a father having a particularly detrimental impact on girls. This could reflect the critical role fathers may play as primary financial providers, whose absence disproportionately affects daughters' economic opportunities and trajectories in adulthood.

Finally, we turn our attention to criminal behavior as an outcome of interest. Our analysis reveals notable gender differences in the long-term effects of parental death during adolescence on the likelihood of being charged with or found guilty of a crime. For boys, the death of a father during adolescence significantly increases the probability of engaging in criminal behavior over their lifetime. In contrast, the death of a mother does not yield statistically significant effects on boys' criminal outcomes. For girls, however, the results differ. Regardless of whether they experience the death of a mother or a father during adolescence, we do not find any statistically significant effects on their likelihood of engaging in criminal behavior later in life. These findings suggest a gendered divergence in how adolescents respond to the loss of a parent in terms of behavioral outcomes, with boys appearing more vulnerable to negative influences, particularly when the father is lost. This could reflect the unique roles fathers may play in shaping boys' behavioral and social development, whose absence may increase susceptibility to riskier paths.

In summary, our analysis reveals significant gender-specific heterogeneity in the short- and long-term effects of parental death during adolescence across a range of outcomes. Boys demonstrate heightened vulnerability to adverse effects on educational attainment, mental health, and criminal behavior, particularly when the deceased parent is a father, while the loss of a mother tends to have less pronounced impacts. For girls, the death of a father is a critical determinant of both short- and long-term outcomes, influencing educational attainment, mental health, labor force participation, and income, whereas the loss of a mother shows relatively limited effects. These findings highlight the distinct economic, emotional, and social roles fulfilled by mothers and fathers and underscore the differing ways boys and girls process and respond to the loss of a parent, offering valuable insights into the broader implications of such events during formative years.

6 Conclusion and policy implications

Parental death is something that the vast majority of us will have to endure. Even though death and the resulting grief are ultimately unavoidable, some of the sustained negative effects of parental death on children could potentially still be mitigated if probably addressed policymakers and caregivers. In order to address these negative effects of parental death, however, it is necessary to first understand the dynamics and mechanisms at play.

In this paper, we focus on providing casual evidence on the effects of parental death during adolescence. We focus on adolescence as this period of life is particularly formative for long-term outcomes. We consider some of the most consequential outcomes in adolescence: mental health, criminal behavior, and education. We relate our findings on these dimensions to long-term effects of adolescent parental death by considering earnings at age 30.

We find negative effects of adolescent parental death across all dimensions. Children experiencing parental death from age 12 to 18 have significantly worse mental health and educational outcomes compared to our controls of both nearest neighbors and to children who are treated four years later, respectively. Similarly, adolescent parental death results in higher crime rates among the affected children. We see interesting heterogeneity by child gender: female children experience the highest increase in mental health treatment as a result of adolescent maternal death; male children are more likely to be charged and found guilty of crimes as a result of adolescent paternal death.

Our results suggest that policies aimed at helping grieving adolescents following parental should be two-fold. One set of policies should be aimed at monitoring, preventing, and treating internalizing mental conditions. Another should focus more on externalizing behaviors such as criminal behaviors. Preventing long-term mental health conditions and criminal behavior among the 5% of the population who experience parental death early in life has the potential to yield substantial societal gains.

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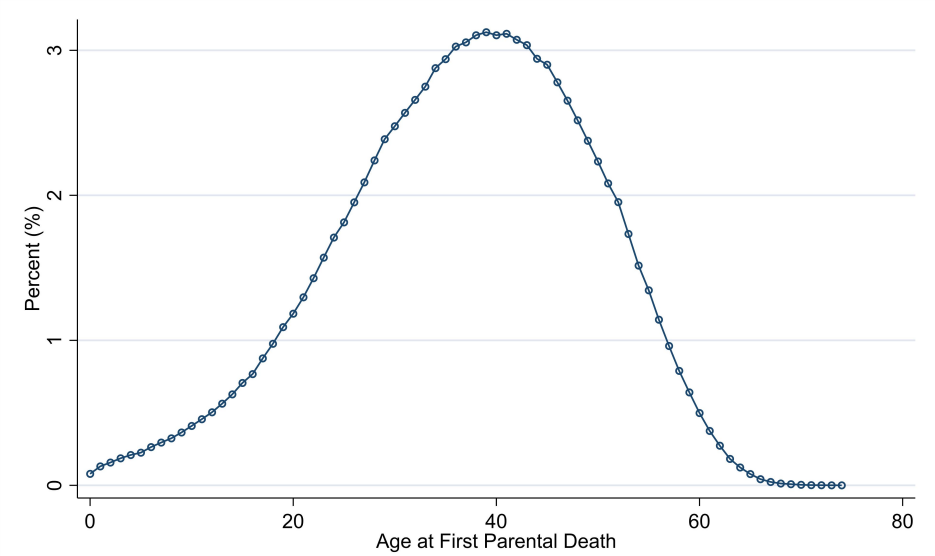
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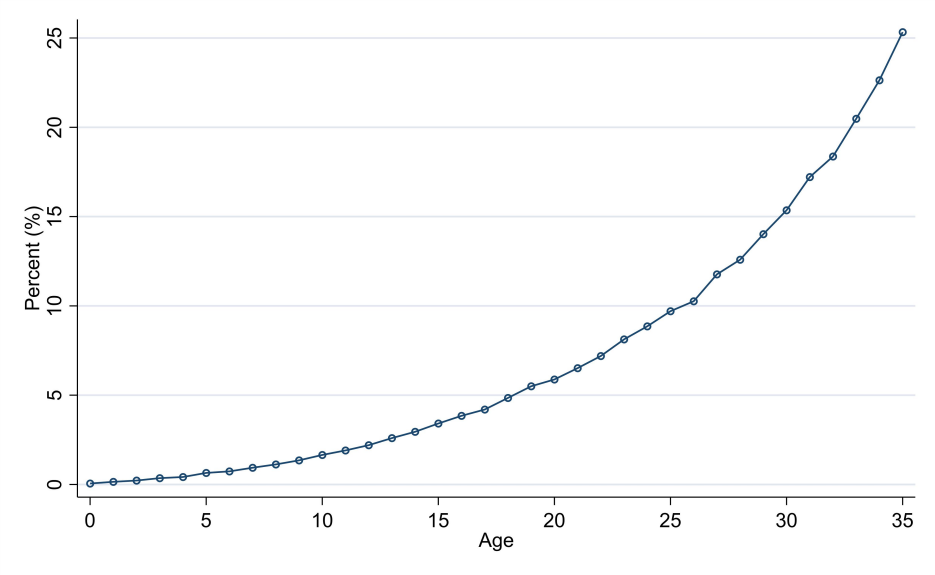
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Figure 1: Age Distribution of Parental Deaths and Prevalence of Parental Loss by Age Group

(a) Panel A: Probability of Parental Death by Child Age



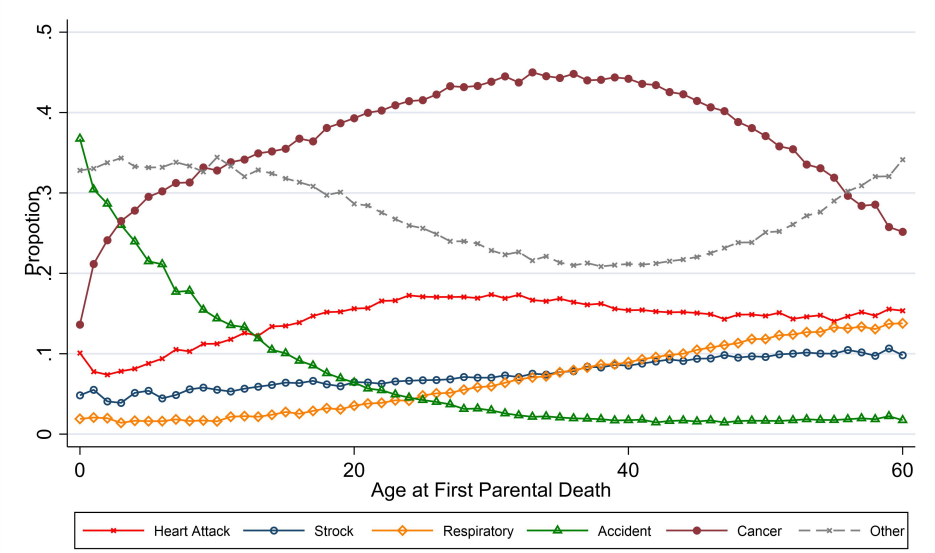
(b) Panel B: Cumulative Probability of Parental Death by Child Age



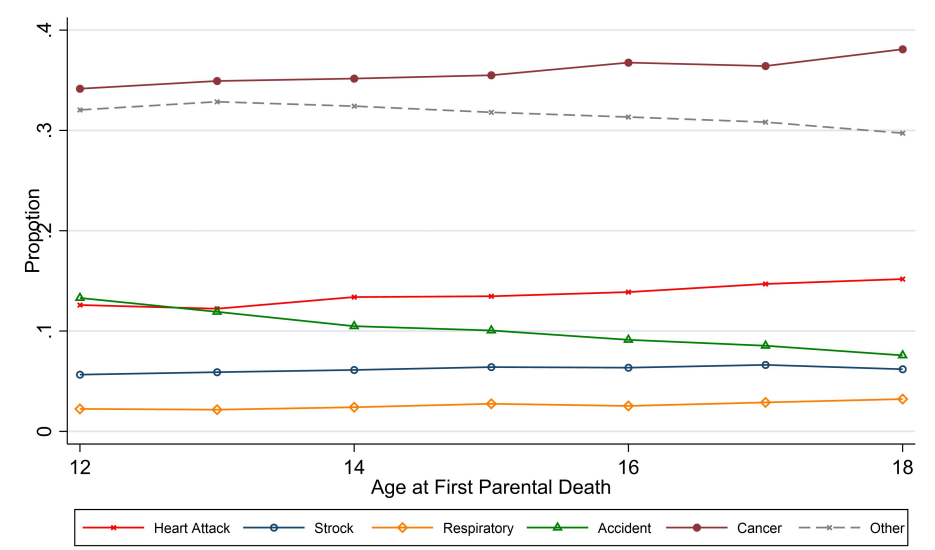
Notes: In this figure, panel A shows the age distribution of individuals at the time of experiencing the death of a parent, based on administrative data from Statistics Denmark. Panel B provides the proportion of individuals within each age group (ages 0–30) who have experienced parental loss, using data from the year 2000 as an example. Both panels are constructed to illustrate the demographic patterns and prevalence of parental loss across different stages of childhood and young adulthood.

Figure 2: Cause of Parental Death by Child Age Group

(a) Panel A: Children Aged between 0 and 60



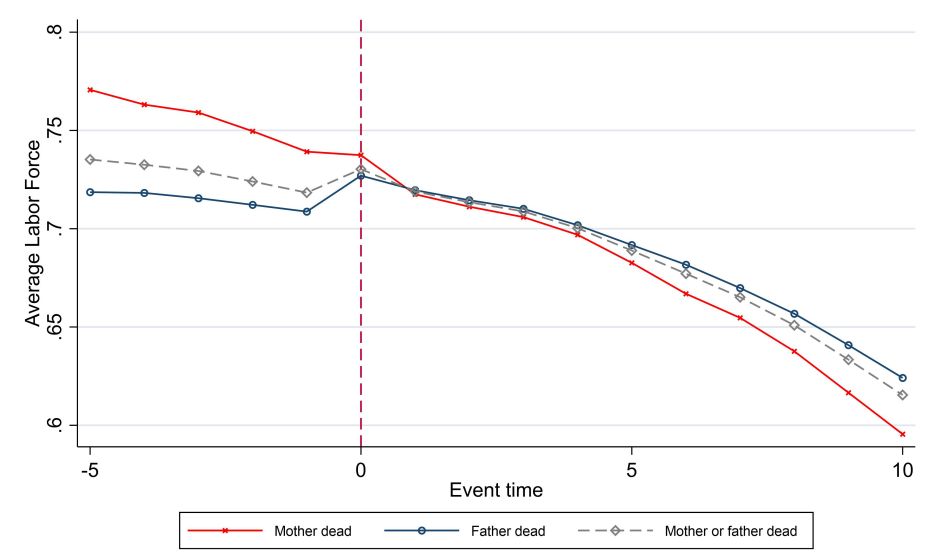
(b) Panel B: Adolescent Only



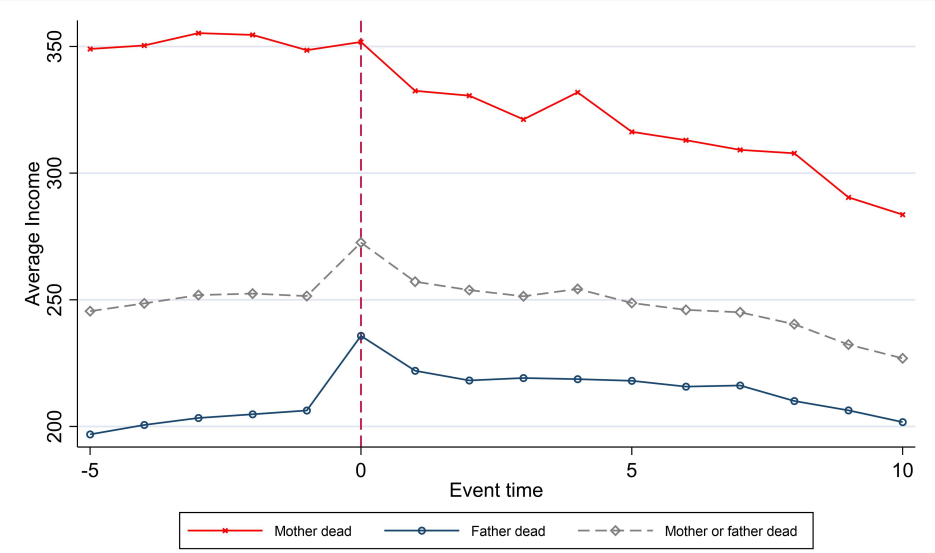
Notes: This figure shows the causes of age distribution across different ages. Panel A presents the distribution of causes of parental death for individuals aged 0–60 who have experienced parental loss, based on administrative data from Statistics Denmark. Panel B focuses specifically on adolescents aged 12–18, providing a detailed breakdown of the causes of parental death within this critical age group.

Figure 3: Parental Labor Market Outcomes Following Spousal Death

(a) Panel A: Labor Force Participation



(b) Panel B: Income



Notes: This figure shows the shows the labor market performance of the surviving parent. Panel A illustrates the labor force participation rate of the surviving parent after the death of the other parent, differentiated by whether the deceased was the father or mother. Panel B depicts the income levels of the surviving parent in the aftermath of parental death, highlighting the economic adjustments following the loss.

Table 1: Summary Statistics by Age at Parental Death

	(1) Adolescence	(2) Age 19-30	(3) P-value (1)-(2)	(4) Age 35+	(5) P-value (1)-(4)
Panel A: Educational Outcomes					
Finish Academic High School	0.19	0.19	0.45	0.26	0.00
Attend College	0.01	0.02	0.00	0.02	0.00
Number of Observations	39,702	98,877	138,579	1,473,871	1,513,573
Panel B: Labor Market Outcomes					
Labor Force Participation	0.81	0.83	0.00	0.86	0.00
Hours Worked	781.89	795.12	0.00	834.41	0.00
Wage Income	239.69	240.49	0.36	263.62	0.00
Labor Income	246.99	247.72	0.43	271.73	0.00
Number of Observations	47,722	261,705	309,427	1,836,715	1,884,437
Panel C: Health Outcomes					
Mental Health	0.34	0.24	0.00	0.26	0.00
Psychosis	0.08	0.06	0.00	0.05	0.00
Anxiety	0.02	0.02	0.23	0.01	0.00
Insomnia	0.03	0.02	0.00	0.02	0.00
Depression	0.14	0.10	0.00	0.10	0.00
Psychostimulant	0.08	0.04	0.00	0.07	0.05
Any Mental Health	0.07	0.05	0.00	0.00	0.00
Any Psychosis	0.02	0.01	0.00	0.05	0.00
Any Anxiety	0.01	0.01	0.00	0.01	0.00
Any Insomnia	0.01	0.01	0.00	0.01	0.00
Any Depression	0.04	0.03	0.00	0.03	0.00
Any Psychostimulant	0.01	0.01	0.02	0.01	0.13
Number of Observations	40,608	98,877	139,485	1,539,870	1,580,478

Notes: This table compares means and differences in key outcomes across treatment and control groups. The outcomes include educational attainment (measured at age 19), health status (measured at age 19), and labor market performance (measured at age 30). Column (1) represents individuals who experienced parental death during adolescence, serving as the treatment group in our analysis. Column (2) includes individuals who experienced parental death between the ages of 19 and 30, defined as the first control group. Column (3) presents the results of t-tests comparing the outcomes of the treatment group (Column 1) and the first control group (Column 2). Column (4) consists of individuals who either experienced parental death at age 35 or older or have not experienced any parental death, serving as the second control group. Finally, Column (5) displays the results of t-tests comparing the treatment group (Column 1) and the second control group (Column 4).

Table 2: Effects of Parental Death on Children's Educational Attainment (Matching Design)

	(1)	(2)	(3)	(4)	(5)	(6)
	Whole Sample		Death between 12-15		Death between 16-18	
VARIABLES	High School	College	High School	College	High School	College
Treat	-0.040***	-0.006***	-0.043***	-0.006***	-0.036***	-0.006***
	(0.003)	(0.001)	(0.004)	(0.001)	(0.004)	(0.001)
Pair FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Birth Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	135,384	135,384	66,716	66,716	68,668	68,668
R-squared	0.279	0.253	0.284	0.254	0.274	0.252

Notes: This table presents estimates of the effect of parental death on children's likelihood of completing academic high school and pursuing college education, using a matching design. The first two columns analyze the full sample, while subsequent analyses divide the treated group into two subgroups based on the child's age at the time of the first parental death. Standard errors are clustered at the family level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 3: Effects of Parental Death on Children's Educational Attainment (Future Death Design)

	(1)	(2)	(3)	(4)	(5)	(6)
	Whole Sample		Death between 12-15		Death between 16-18	
VARIABLES	High School	College	High School	College	High School	College
Treat	-0.010***	-0.002**	-0.012***	-0.001	-0.009**	-0.002
	(0.002)	(0.001)	(0.004)	(0.001)	(0.004)	(0.001)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Birth Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	11,398,366	11,398,366	5,352,654	5,352,654	6,045,712	6,045,712
R-squared	0.004	0.002	0.005	0.003	0.003	0.002

Notes: This table presents estimates of the impact of parental death on the likelihood of children completing academic high school and pursuing college education, analyzed within the future death design framework. The first two columns report results based on the full sample. In subsequent columns, the treated group is divided into two subgroups according to the age at which the first parental death occurred. Standard errors are clustered at the family level throughout the analysis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 4: Effects of Parental Death on Children's Health Condition (Matching Design)

VARIABLES	(1) Mental health	(2) Psychosis	(3) Anxiety	(4) Insomnia	(5) Depression	(6) Pyhchostimulant
Panel A: Extensive Margin						
Treat	0.008***	0.001**	0.000	0.003***	0.004***	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Pair FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Birth Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	126,480	126,480	126,480	126,480	126,480	126,480
R-squared	0.273	0.253	0.249	0.260	0.264	0.280
Panel B: Intensive Margin						
Treat	0.019	0.006	-0.003	0.002	0.011**	0.001
	(0.011)	(0.006)	(0.002)	(0.002)	(0.004)	(0.006)
Pair FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Birth Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	126,480	126,480	126,480	126,480	126,480	126,480
R-squared	0.267	0.253	0.255	0.255	0.256	0.270

Notes: This table presents the estimated impact of parental death on children's mental health outcomes. In column (1), we examine the overall prevalence of mental health issues, while column (2) through (6) disaggregate mental health problems into five specific categories: psychosis, anxiety, insomnia, depression and psychostimulant-related conditions, respectively. Panel A reports results at the extensive margin, indicating whether the individual has experienced any mental health problems. Panel B provides the corresponding results at the intensive margin, capturing the severity of these mental health issues. All the standard errors are clustered at family level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 5: Effects of Parental Death on Children's Health Condition (Future Death Design)

VARIABLES	(1) Mental health	(2) Psychosis	(3) Anxiety	(4) Insomnia	(5) Depression	(6) Pyhchostimulant
Panel A: Extensive Margin						
Treat	0.007***	0.001	0.000	0.003***	0.004***	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Birth Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	9,785,942	9,785,942	9,785,942	9,785,942	9,785,942	9,785,942
R-squared	0.019	0.004	0.002	0.007	0.016	0.015
Panel B: Intensive Margin						
Treat	0.022*	0.008	0.000	0.003*	0.012**	-0.002
	(0.011)	(0.005)	(0.002)	(0.002)	(0.005)	(0.006)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Birth Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	9,785,942	9,785,942	9,785,942	9,785,942	9,785,942	9,785,942
R-squared	0.011	0.002	0.001	0.004	0.010	0.011

Notes: This table presents the estimated impact of parental death on children's mental health outcomes. In column (1), we examine the overall prevalence of mental health issues, while column (2) through (6) disaggregate mental health problems into five specific categories: psychosis, anxiety, insomnia, depression and psychostimulant-related conditions, respectively. Panel A reports results at the extensive margin, indicating whether the individual has experienced any mental health problems. Panel B provides the corresponding results at the intensive margin, capturing the severity of these mental health issues. All the standard errors are clustered at family level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 6: Effects of Parental Death on Children's labor market outcomes (Matching Design)

	(1)	(2)	(3)	(4)
VARIABLES	Labor force participation	Hours worked	Wage	Total income
Treat	-0.016***	-20.283***	-14.060***	-15.622***
	(0.003)	(3.739)	(1.396)	(1.607)
Pair FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Birth Year FE	Yes	Yes	Yes	Yes
Observations	154,173	154,173	154,171	154,173
R-squared	0.277	0.288	0.309	0.287

Notes: This table presents estimates of the impact of parental death on children's labor market performance, measured through various labor market outcomes, using the matching design. Standard errors are clustered at the family level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 7: Effects of Parental Death on Children's labor market outcomes (Future Death Design)

	(1)	(2)	(3)	(4)
VARIABLES	Labor force participation	Hours worked	Wage	Total income
Treat	-0.002	-3.465	-2.254**	-2.143**
	(0.002)	(2.717)	(0.985)	(1.017)
Year FE	Yes	Yes	Yes	Yes
Birth Year FE	Yes	Yes	Yes	Yes
Observations	19,004,920	19,004,920	19,004,920	19,004,920
R-squared	0.004	0.005	0.004	0.004

Notes: This table presents estimates of the impact of parental death on children's labor market performance, measured through various labor market outcomes, using the future death design. Standard errors are clustered at the family level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 8: Effects of Parental Death on Children's Criminal Behaviors

	(1)	(2)	(3)	(4)
	Extensive Margin		Intensive Margin	
	Charge	Guilty	Charge	Guilty
Treat	0.008***	0.007***	0.101	0.110
	(0.003)	(0.003)	(0.109)	(0.080)
First Death Year FE	Yes	Yes	Yes	Yes
Birth Year FE	Yes	Yes	Yes	Yes
Observations	8,864,137	8,864,137	8,864,137	8,864,137
R-squared	0.012	0.012	0.003	0.004

Notes: This table reports the effects of parental death on children's criminal behavioral under the future death design. Here we calculate the all the charge cases after the first parental death. Since we only access the data of crime after 1995, in our analysis, we only include these have their first parental death after 1995. In the first two columns, we use dummy variables to be the outcome variables and in the last two columns, we use the number of cases as the outcome variables. All the standard errors are clustered at family level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 9: Heterogeneous Effects of Parental Death

	(1) High School	(2) College	(3) Mental health (E)	(4) Mental health (I)	(5) Participation	(6) Income	(7) Charge	(8) Guilty
Panel A: Boy								
Treat ×Mother Dead	-0.002	0.001	0.003	0.002	0.000	-1.119	0.005	-0.000
	(0.005)	(0.002)	(0.003)	(0.026)	(0.005)	(2.435)	(0.007)	(0.007)
Treat ×Father Dead	-0.012***	-0.004***	0.005**	0.031*	0.001	-2.211	0.010**	0.011**
	(0.003)	(0.001)	(0.002)	(0.019)	(0.003)	(1.775)	(0.005)	(0.005)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes		
Birth Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First Death Year FE							Yes	Yes
Observations	6,037,392	6,037,392	5,172,116	5,172,116	9,863,466	9,863,466	4,656,072	4,656,072
R-squared	0.003	0.001	0.018	0.011	0.005	0.005	0.018	0.018
Panel B: Girl								
Treat ×Mother Dead	-0.007	0.000	0.010***	-0.002	-0.001	-0.026	-0.002	-0.004
	(0.006)	(0.002)	(0.003)	(0.021)	(0.005)	(2.039)	(0.005)	(0.004)
Treat ×Father Dead	-0.014***	-0.001	0.009***	0.033*	-0.007*	-3.540**	0.001	0.002
	(0.004)	(0.001)	(0.003)	(0.018)	(0.004)	(1.592)	(0.003)	(0.003)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes		
Birth Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First Death Year FE							Yes	Yes
Observations	5,360,974	5,360,974	4,613,826	4,613,826	9,141,454	9,141,454	4,208,065	4,208,065
R-squared	0.005	0.005	0.026	0.014	0.004	0.006	0.008	0.008

Notes: This table reports the heterogeneous effects of parental death among child gender and the gender of the first dead parent by the following equation:

$$Y_{it} = \beta_0 + \beta_1 \text{ Treat }_i \times \text{ Mother Dead First }_i + \beta_2 \text{ Treat }_i \times \text{ Father Dead First }_i + \mu_a + \mu_t + \varepsilon_{it} \quad (3)$$

where Treat $_i$ is an indicator whether individual i belongs to the treatment group or not; Mother Dead First $_i$ takes value of one if the first dead parent for individual i is mother; Father Dead First $_i$ takes value of one if the first dead parent for individual i is father. Column (1) and (2) present results for educational outcomes, specifically the completion rate of academic high school and college attendance rate at the age of 19. Column (3) and (4) focus on mental health outcomes, measured at both the extensive margin (whether the individual has experienced mental health problems) and the intensive margin (the severity of mental health problems) one year after the parental death. Column (5) and (6) examine labor market outcomes, as measured by the labor force participation rate and the income at the age of 30. The last two columns report the effects of parental death on adolescents' criminal behaviors, measured by whether they have been charged with a crime or confirmed as guilty, respectively. Standard errors are clustered at family level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.