DEPARTMENT OF ECONOMICS
JOHANNES KEPLER UNIVERSITY OF LINZ

A Hard Pill to Swallow? Parental Health Shocks and Children's Mental Health

by

Felix GLASER
Gerald PRUCKNER

Working Paper No. 2215

December 2022

Johannes Kepler University of Linz
Department of Economics
Altenberger Strasse 69
A-4040 Linz - Auhof, Austria
www.econ.jku.at

Corresponding author gerald.pruckner@jku.at

A Hard Pill to Swallow? Parental Health Shocks and Children's Mental Health *

Felix Glaser[a,b] and Gerald J. Pruckner[a,b]

[a] *Johannes Kepler University Linz, Austria*
[b] *Christian Doppler Laboratory for Aging, Health, and the Labor Market, Austria*

December 2022

Abstract

Based on comprehensive administrative health record data from Austria, this study examines how children's mental health responds to a severe parental health shock. To account for the endogeneity of a serious parental illness, our sample is restricted to children who experience the health shock of a parent at some point in time and we exploit the timing of shocks in a dynamic DID setting. We find a positive causal effect of parental health shocks on children's mental health care utilization. Affected children have higher medical attendance for the treatment of mental illnesses, consume more psychotropic drugs, and are more likely to be hospitalized with mental and behavioral disorders. A significant increase in the utilization of antidepressants, anxiolytics, and sedatives can be observed for older children, girls and children with a white-collar family background. Our findings have important policy implications for children's access to psychotherapies and mental health care after experiencing a traumatic household event.

JEL Classification: I10, I12, I14, I31.
Keywords: Mental health of children, parental health shock, difference-in-differences.

*Corresponding author: Gerald J Pruckner, Department of Economics, Johannes Kepler University, Linz, Altenberger Straße 69, A-4040 Linz, Austria; e-mail: gerald.pruckner@jku.at. For helpful discussions and comments, we would like to thank Analisa Packham, René Böheim, Katrin Zocher, participants at the Annual Meeting of the European Health Economics Association 2022 in Oslo, the Annual Meeting of the Austrian Health Economics Association 2021 in Vienna, and the Annual Meeting of the Austrian Economic Association 2022 in Vienna. We gratefully acknowledge financial support from the Austrian Federal Ministry for Digital and Economic Affairs and the National Foundation for Research, Technology, and Development.

1 Introduction

It has been documented that adverse childhood experiences in the family have a negative impact on mental health. Family violence and drug abuse is associated with mental health issues and behavioral difficulties in children (Srivastava and Trinh, 2021; Lund et al., 2019; Gallo et al., 2018; Norman et al., 2012; Chatterji and Markowitz, 2001). Children of psychologically distressed parents and those who experience parental divorce are also more likely to develop mental health issues or alcohol and drug abuse (Lawrence et al., 2019; Auersperg et al., 2019; Sands et al., 2017; Johnston et al., 2013).

Mental health issues during childhood are associated with adverse economic outcomes later in life. Children with mental health problems obtain fewer years of schooling (Hakulinen et al., 2019; Fletcher, 2010), perform worse academically (Cornaglia et al., 2015; Fletcher and Lehrer, 2011; Ding et al., 2009; Currie and Stabile, 2006), and have a lower probability of pursuing tertiary education (Fletcher, 2010; Fletcher, 2008). In addition to educational deficiencies, these children perform worse on the labor market throughout adulthood. They earn less (Hakulinen et al., 2019; Andersen and Gunes, 2018; Lundborg et al., 2014; Fletcher, 2014), spend more days in unemployment, and are dependent on higher social welfare payments (Mousteri et al., 2019; Fletcher, 2014; Lundborg et al., 2014).

We investigate how a parental health shock in childhood affects children's mental health. We use high-quality administrative health register data from Upper Austria that include detailed information on physician visits, prescribed medication, and hospitalization of all private-sector employees and their dependents. A health shock is defined as an initial diagnosis of cancer, stroke, or heart attack. We then measure children's mental health through the use of psychotherapy, prescribed medication related to the nervous system, and hospitalization due to mental and behavioral disorders.

To account for endogeneity of a serious parental illness, we use a quasi-experimental method by restricting the sample to children who experience a parental health shock at different points in time. Children who experience the same parental health shock several years later serve as counterfactuals for affected children. Following Fadlon and Nielsen (2019, 2021), we identify causal effects of severe parental health shocks on children's utilization of health care services using a dynamic difference-in-differences (DID) approach.

Estimates indicate a positive causal effect of severe parental health shocks on children's health care utilization related to mental health. Affected children have higher medical attendance for the treatment of mental illnesses, consume more psychotropic drugs, and are more likely to be hospitalized with mental and behavioral disorders. Moreover, two years after the shock, affected children are 70 % more likely to have a psychotherapy visit and 21 % more likely to receive a psychotropic prescription. The effects on medication further increase in the subsequent years. We find similar results for the group of antidepressants, anxiolytics, and sedatives, and also for pain drugs. Compared to their non-affected counterparts, affected children are 34 % more likely to be prescribed a pain drug one year after the shock. The effect persists over the subsequent years. Finally, affected children are more likely to be hospitalized with mental and behavioral disorders, with effect sizes up to almost 90 % in post period two. The effects are stronger for children who experience fatal parental health shocks and vary between younger and older children, and also between girls and boys. A significant increase in the utilization of antidepressants, anxiolytics, and sedatives can be observed for older children, girls and children with a white-collar family background.

Studies have demonstrated a negative association between parental death and children's mental health. This association was derived from interviews (Cerel et al., 2006; Marks et al., 2007; Brent et al., 2009) and from comprehensive administrative data sources (Appel et al., 2013, 2016; Berg et al., 2016; Rostila et al., 2016). Parental death is associated with higher hospitalization for mental health reasons (Rostila et al., 2016; Berg et al., 2016; Appel et al., 2013) and higher antidepressant use (Appel et al., 2016).[1]

Severe health impairments of parents can effect children even if the parents do not die from the disease. There is evidence that non-fatal parental health shocks negatively affect children's education (Kristiansen, 2021; Luca and Bloom, 2018; Alam, 2015; Bratti and Mendola, 2014) and adult children's labor market performance (Frimmel et al., 2020).[2] In the context of health behavior, Fadlon and Nielsen (2019) find that adult children in Denmark increase their use of preventive health measures following parental health shocks. Based on U.S. health care claims data for Massachusetts, Bergquist and de Vaan (2022) determine that the hospitalization of a family member reduces the spending on outpatient services of other members on the same family insurance plan.

Several studies observe adverse effects of parental health shocks on children's cognitive and non-cognitive development (Mühlenweg et al., 2016; Le and Nguyen, 2017), while others do not find an effect (García-Miralles and Gensowski, 2020). Rellstab et al. (2020) use survey data to provide suggestive evidence of a negative but economically insignificant effect of parental health shocks on adult children's mental health.[3]

Only a few studies identify a causal effect of parental health shocks on children's mental

[1] For a comprehensive literature review, see Lytje and Dyregrov (2019). Previous literature has demonstrated the negative consequences of parental death on children's education, criminal activity, and mortality. Children who experience parental death in childhood have lower school enrollment (Bockerman et al., 2021; Cas et al., 2014; Gertler et al., 2004), perform worse academically (Kristiansen, 2021; Kailaheimo-Lönnqvist and Kotimäki, 2020), and are less likely to attend university (Kailaheimo-Lönnqvist and Erola, 2020; Kailaheimo-Lönnqvist and Kotimäki, 2020; Gimenez et al., 2013; Chen et al., 2009). It is further associated with a higher probability of committing violent crime (Berg et al., 2019; Wilcox et al., 2010) and higher mortality (Hiyoshi et al., 2021; Rostila and Saarela, 2011).

[2] In contrast, Rellstab et al. (2020) reveal that parental health shocks do not impact children's employment and wages. The authors suggest that formal long-term care in the Netherlands reduces children's negative labor market responses. Norén (2020) present similar results for Sweden.

[3] The related literature on informal care provision confirms the negative effects of the aforementioned. See Bom et al. (2019); Heger (2017); Bauer and Sousa-Poza (2015); Bobinac et al. (2010), for example.

health (Kristiansen, 2021; Frimmel et al., 2020; Bockerman et al., 2021). In an event study design, Kristiansen uses administrative data that cover all Danish children between 14 to 18 years old. The author establishes that a negative health shock of parents increases the children's probability of psychotherapy visits and antidepressant prescriptions. The effects on antidepressant use are more pronounced for children of divorced families and families with low income, while the increase in utilization of psychotherapy is higher for children in high-income families. Overall, the effects are stronger for girls and for diseases ending with parental death.

Bockerman et al. (2021) apply an event study methodology and identify the causal effect of parental death on children's mental health. Based on administrative data of all Finnish children who suffer from parental death between the ages of 10 and 20, the authors reveal positive causal effects on hospitalization related to child mental health. The effects are driven by deaths of parents of the same sex as the child. The authors further provide descriptive evidence for a positive correlation between parental death and medication related to child mental health.

The research closest to our work is Frimmel et al. (2020). Their study focuses on the effects of elderly parent's health on their children's labor supply. In their analyses, the authors also estimate effects on adult children's (mental) health. Based on administrative data from Austria, the identification strategy makes use of the randomness in the exact timing of the parental health shock. They find no effect of parental stroke on adult children's (mental) health. After the shock, adult children do not increase their total health care expenditures or their medication expenditures related to the nervous system.

Our findings add two main contributions to the literature. First, our comprehensive individual-level database allows not only the analysis of fatal and non-fatal health shocks (all types of neoplasms and relevant cardiovascular diseases) but also the differentiation of detailed health care utilization components for treatment of mental illness such as psychotherapy or antidepressants. The detailed analysis of medical subcomponents allows indications of whether and how children, who suffer from mental health problems, are treated with different therapies. Second, based on a credible identification strategy and using high-quality administrative health register data from Austria, we analyze young children aged 2 to 18 years (in the shock year). In doing so, we abstract from the caregiving effect (Bom et al., 2019; Heger, 2017) and at the same time distinguish ourselves from Frimmel et al. (2020), who analyze adult children.

The remainder of this paper is organized as follows. Section 2 discusses the data and institutional background in Austria. Section 3 explains the estimation strategy, and section 4 presents the results and provides robustness checks. Section 5 discusses policy implications and presents concluding remarks.

2 Institutional background and data

2.1 The Austrian health care system

The Austrian Bismarck-type health care system guarantees almost universal access to high-quality services for the entire population. Mandatory health insurance covers expenditures for hospitalization, doctor visits in the outpatient sector, and medication. A total of nine provincial health insurance funds (in German, *Gebietskrankenkassen*) offer health insurance for all private-sector employees and their dependents, representing approximately 75% of the whole population. Children are co-insured with their parents.[4]

Health insurance funds cannot be chosen freely, the affiliation with an insurance institution is determined by the individual's place of residence and occupation. Health care expenditures in the outpatient sector including costs for medication are funded by wage-based social security contributions from employers and employees. Hospitalization expenses are co-funded by social security contributions and tax revenues at different federal levels. Patients pay a prescription charge for medical drugs (6 € in 2018) and a small deductible per day of hospitalization.[5]

General practitioners (GPs) and medical specialists provide ambulatory care. Although patients can freely choose among the available GPs, they usually consult the so-called family doctor located in the neighborhood of their place of residence (Hackl et al., 2015). GPs have a gatekeeping function. They provide primary care for adults and children and, if necessary, refer the patients to a resident specialist or a hospital. Pediatricians, who provide primary care for children and adolescents, can be consulted without a referral.

GPs, pediatricians, psychiatrists, psychologists, and psychotherapists provide outpatient services for treatment of mental health problems. In contrast to almost all outpatient medical services, psychotherapies are only partially funded by the regional health insurance funds. In Upper Austria, patients have two basic options. They can apply to the regional health insurance fund for co-financing of their therapy hours. In most cases, these applications are approved. However, the insurance provider only covers approximately 25 % of the actual costs incurred and the rest must be borne by the patients themselves. Alternatively, patients can contact a clearing center to obtain psychotherapy free of charge. After a personal interview, the person is placed on a waiting list depending on the time of registration and the urgency of the treatment. The waiting time for a cost-free therapy place, which is fully financed by social security, is up to six months. Children

[4]In 2020, the nine provincial health insurance funds were merged into one single Austrian Health Insurance Fund. Special social security institutions provide mandatory health insurance for certain occupational groups, such as farmers, civil servants, or self-employed workers.

[5]Supplementary private health insurance can be used to complement statutory health insurance. It may reduce waiting times for surgeries and guarantees free choice of hospital doctors and access to more comfortable hospital rooms.

and adolescents as well as urgent cases are given priority. In the international context, the availability of psychotherapy services is low. Psychotropic drugs are prescribed by medical specialists in psychiatry as well as GPs and pediatricians. After deducting the prescription fee, the cost of these drugs is covered by the regional health insurance funds.

2.2 Data

We use individual-level administrative data on health care use between 2005 and 2019 provided by the *Upper Austrian Regional Health Insurance Fund (OOEGKK)*. This fund covers more than one million people in Upper Austria.[6] The registry data includes detailed information on doctor visits and expenditures in the outpatient sector (GPs and medical specialists in various medical fields) and for medication (number of prescriptions and expenses) according to Anatomical, Therapeutic, Chemical (ATC) classification system codes. Inpatient information covers hospitalizations (hospital days and expenditures), including admission diagnoses for each individual, according to the International Classification of Diseases (ICD-10) scheme. The final dataset is structured as a panel of children with various health outcomes aggregated per individual at the annual level.

The health register data are linked with the Austrian Social Security Database (ASSD) by a pseudonymized social security number. The ASSD is a matched employer-employee data set providing individual-level information on parental labor market history between 2005 and 2019. It includes daily spells of labor market status, annual wages, and socio-economic characteristics (Zweimüller et al., 2009). Wages are top-coded, as they are limited to the maximum social security contribution base.

2.3 Sample and outcome variables

Based on all insured persons of the *Upper Austrian Health Insurance Fund*, we restrict the sample to children of parents who experience a severe health shock for the first time between 2007 and 2019. At the time of the shock, the children are between two and 23 years old. Circulatory diseases and cancer – the most frequent causes of death – are the two main groups of diseases. More specifically, we identify severe parental health shocks by the following diagnoses: (i) severe heart conditions including acute myocardial infarction (ICD-10 code *I21*) and heart failure *(I50)*, (ii) various types of severe strokes *(I60-I64)*, and (iii) all types of malignant neoplasms *(C00-C97)*. The diagnoses to identify shocks are made during an inpatient hospital stay.[7] Our outcome variables relate to different components of health care services for the medical treatment of mental and behavioral disorders. In the baseline specification, we refer exclusively to the extensive margin. That

[6]Upper Austria is one of nine Austrian provinces. It has 1.505 million inhabitants representing 16.8 % of the population. Per capita health care expenditures in 2017 were 4,012 €, which was 6.5 % below the Austrian average of 4,291 € (Hofmarcher and Singhuber, 2019).

[7]The available outpatient health care data do not include medical diagnoses.

is, we estimate the influence of a parental health shock on the probability of utilizing medical services. All outcome variables are measured as dummy variables (0/1).[8]

Outpatient health care services: In addition to the GP and pediatrician visits in the outpatient sector, we examine the use of psychotherapies and psychotropic drugs. Specifically, we monitor those psychotherapies that are either covered in full by social insurance or for which the regional health insurance fund provides a co-payment. Exclusively privately financed psychotherapies are not included in the data. Consequently, the monetary expenses for psychotherapy include those portions that are covered by the *Upper Austrian Regional Health Insurance Fund*.

Medication: We first analyze the effects on medical drug use including the entire ATC-N group. This group (medication for the nervous system) includes anesthetics (*N01*), analgesics (*N02*), antiepileptics (*N03*), anti-Parkinson drugs (*N04*), psycholeptics (*N05*), psychoanaleptics (*N06*), and other nervous system drugs (*N07*). Obviously, some (e.g., anti-Parkinson drugs, antiepileptics, anesthetics, ...) are not relevant for treatment of mental and behavioral disorders in children. Therefore, in a second step, we follow (Høeg et al., 2021) and analyze a subgroup of medications including antidepressants (*N06A*), anxiolytics (*N05B*), and sedatives (*N05C*). Finally, we focus on anilides (*N02BE*), which include medication such as Paracetamol and Propacetamol and represent a chemical component used in painkillers commonly prescribed for headache and cold symptoms (Ogemdi, 2019). Mental health issues such as anxiety or depression are associated with headaches among children (Bellini et al., 2013). Children who experience a parental health shock may worry about their parent's well-being and develop stress-induced mental health problems accompanied by headaches and migraines. Prescriptions for these drugs appear to be another appropriate measure of children's mental health deterioration. In the remainder of this paper, we use the term "pain drugs" to refer to anilides.

Inpatient health care services: Inpatient treatment of mental health-related diseases relate to ICD-10 Chapter V (Mental and behavioral disorders, *F00-F99*). Among others, this Chapter includes organic mental disorders, mood disorders, neurotic, stress-related and somatoform disorders, behavioral syndromes associated with physiological disturbances and physical factors, mental retardation, and psychological development disorders (WHO, 2015).

3 Empirical strategy

We adopt a quasi-experimental approach proposed by Fadlon and Nielsen (2019, 2021), to account for the endogeneity of a severe parental illness. We restrict the sample to children who experience a parental health shock at some point in time and exploit the timing of

[8] In section 4.3, we provide a robustness analysis at the intensive margin where we estimate health care expenditures (in €) for all outcomes.

health shocks in a dynamic DID setting. Children in the treatment group who experience a severe parental health shock in year t are compared to a control group who are affected by the same shock τ years later. As long as τ is small, children in the treatment and control groups can be expected to have similar observable and unobservable characteristics since they experience the same shock only τ years apart. In our baseline specification, τ is five years.

To identify a causal effect, we assume that the health outcomes of children in the treatment and control groups would have continued along a parallel trend in the absence of the shock. This assumption is credible as long as a first-time diagnosis of heart attack, stroke, or cancer tends to be unexpected and sudden. Then, the exact timing of a severe parental health shock within τ is expected to be quasi-random.[9] Throughout the analysis, we examine the dynamic treatment effects before the shock ($r < 0$) to demonstrate that the two experimental groups have parallel pre-trends.

The construction of treatment and control group with $\tau = 5$ is illustrated in Figure 1. Children who experience a severe parental health shock in year t are assigned to the treatment group. Children in the control group experience the shock in year $t + 5$. They are assigned a placebo shock in t. This procedure is repeated for each shock year t. As a consequence, a child may appear in both the treatment and control groups but never serves as a control for themself. If a child experiences a parental health shock in $t = 2012$, they belong to the treatment group. The same child serves as a control for another child experiencing the shock in $t = 2007$. The year relative to the parental health shock is defined as: r = calendar year - shock year t. This setting allows the estimation of dynamic treatment effects up to four years after the health shock ($r = 4$).

Histograms of parental and children's age for the treatment and control groups are depicted in Figure 2. Children's age (Panel A) and children's age at parental shock (Panel B) match well, whereas Panel C indicates the shift in the age distribution by five years since control children experience their shock five years later. The distributions of parents' birthyear and their age at the health shock (Panels D and E) illustrate that parents in the treatment group are slightly older than those in the control group. We control for parental age at health shock in all estimations.

Comprehensive descriptive statistics for the treatment and control group in the analyzed sample are presented in Table 1. The treatment and control groups are well balanced. Children in the treatment group are slightly older than their counterparts in the control group, and their probability of visiting a GP or pediatrician in the pre-shock period is 0.85

[9]Numerous studies have exploited the timing of an event to identify causal effects of fatal or non-fatal health shocks (Bockerman et al., 2021; Kristiansen, 2021; Druedahl and Martinello, 2021; Frimmel et al., 2020; García-Miralles and Gensowski, 2020; Rellstab et al., 2020; Norén, 2020; Fadlon and Nielsen, 2019; Le and Nguyen, 2017; Mühlenweg et al., 2016; Alam, 2015; Bratti and Mendola, 2014), job displacements (Ahammer et al., 2020; Halla et al., 2020; Jacobson et al., 1993; Ruhm, 1991), family disruption (Persson and Rossin-Slater, 2018), or closing of administrative social security units (Deshpande and Li, 2019).

percentage points lower. All other variables measured before the parental health shock are not significantly different. In contrast, health care services used after the shock are significantly higher in the treatment group. This applies both to the utilization of medical services for treatment of mental and behavioral disorders and the amount of health care expenditures in the outpatient and inpatient sector. Only the number of GP and pediatrician visits do not differ in the two groups. Descriptive statistics suggest that severe parental health problems may affect children's mental health, which is reflected in their increased utilization of related health care services.

We estimate the following empirical model:

$$y_{i,r,t,b,p} = \alpha + \beta T_{i,t} + \sum_{s\neq-1;s=-5}^{4} \gamma_s \times I(r=s) + \sum_{s\neq-1;s=-5}^{4} \delta_s \times I(r=s) \times T_{i,t} + \lambda girl_i + \\ + \phi_t + \theta_b + \omega_p + \epsilon_{i,r,t,b,p} \tag{1}$$

where $y_{i,r,t,b,p}$ is the health outcome of child i in relative year r, shock year t, birth year b, and parental age at shock p. r is the year relative to the parental health shock year t, which is five years prior the actual year for children in the control group. $T_{i,t}$ is an indicator variable equal to 1 if parent of child i has a health shock in shock year t and equal to 0 if the health shock is in shock year $t + 5$. $I(r = s)$ are indicator variables equal to 1 for observations in relative year r. δ_s are the coefficients of main interest that capture the treatment effect of parental health shocks on child mental health outcomes in r relative to one year prior to the shock (r = *-1*). $girl_i$ is equal to 1 if the child is female. ϕ_t, θ_b, and ω_p are the shock year, birth year, and parental age at shock fixed effects, respectively. The error term is represented by $\epsilon_{i,r,t,b,p}$. Since a parent's illness may affect multiple children in a family, standard errors are clustered at the parent level.

A drawback of this approach is the limited analysis horizon, as children in the control group are treated in $t + \tau$. As a consequence, the post-shock period is limited to $\tau - 1$ years after the parental health shock. The identification strategy entails a tradeoff between comparability of experimental groups and the length of the analysis horizon. The greater τ is, the longer is the period after the shock that can be analyzed. However, at the same time, this will lead to less similar treatment and control groups. In our baseline specification, we choose $\tau = 5$ to guarantee a reasonable post-shock time horizon and at the same time to ensure that the treatment and control groups remain similar. From this assumption and the availability of the data, it follows that children in the treatment group experience the parental health shock between ages 2 and 18, while the control children experience the shock between ages 7 and 23. In Section 4.4 we show that our results are robust across different values of τ.

4 Results

This section presents our empirical findings. We begin by examining how the health shock affects the utilization of health care services and labor market participation of the affected parents themselves (Section 4.1). The effects of parental health shocks on the children's utilization of outpatient, inpatient, and medication mental health service categories are provided in section 4.2. Heterogeneous treatment effects are reported in Section 4.3. We distinguish between younger and older, male and female children, children from blue- or white-collar families, and between children who have experienced a fatal versus non-fatal health shock. Finally, section 4.4 includes the results of our robustness analyses.

4.1 Effects on affected parents

The dynamic effects of parental health shocks on health care service utilization and labor market outcomes of affected parents are depicted in Figure 3. The x-axes display the years relative to the parental health shock that occurs in year 0. The treatment effects are presented on the y-axes. They represent the point estimates of coefficients of main interest (δ_s) in equation (1) together with 95% confidence bands (gray area) and 90% confidence intervals (dashed lines).[10]

With the onset of the disease, affected parents experience a sharp increase in health care expenditures for medical attendance in the outpatient sector (Panel A), for medication (Panel B), and for hospital treatment (Panel C). All expenditure components decrease in the subsequent years; however, four years after the health shock, they are still significantly higher than before the shock.

The significant increase in health care spending is accompanied by a marked reduction in parental labor market participation. While the number of days in employment decreases significantly with the onset of the disease (Panel D), there is a sharp increase in both sick leave and retirement days (Panels E and F). For example, sick leave days increase more than fivefold in the shock year. Although employment increases again in the following years and sick leave days level off at the pre-shock level after four years, Panel F reveals a permanent increase in retirements due to health problems.

These initial estimation results indicate that there is a massive impact on the health and ability to work of the affected parents, the extent of which has the potential to affect the (mental) health of the children.

[10] The descriptives for parents in the treatment and control group are presented in Appendix Table A.1. Appendix Table A.2 includes the full estimation output for parental outcomes.

4.2 Effects on children's mental health

Outpatient service utilization: The dynamic effects of a severe parental health shock on the probability of children's outpatient mental health-related services (extensive margin) are depicted in Figure 4.[11] We present two different outcomes, psychotherapy visits and visits to the GP or pediatrician. From Panel A, the probability that a child has any psychotherapy visit increases after the shock by a maximum of 0.47 percentage points (pp) in year two after the health shock. With a yearly average psychotherapy use of 0.67 % in the pre-period, this means a 70 % increase. The estimates for the years before the shock ($r < 0$) are all insignificant, suggesting no differential trend between treatment and control groups in the pre-period. The percentage increase in psychotherapy use is very similar to Kristiansen (2021). However, our point estimates are smaller in absolute terms due to the generally higher use of psychotherapy in the Danish sample.

Psychotherapists are typically not the first medical contact when mental health problems arise. Owing to their special role as gatekeepers in the Austrian health care system, primary care physicians are the most common point of contact for patients with mental health problems. GPs and pediatricians can make an initial diagnosis, refer patients to psychotherapists, or prescribe psychiatric medications. The effects on children's probability of any GP or pediatrician visit are illustrated in Panel B of Figure 4. The point estimates for the post-period are consistently positive with a maximum of 3.55 pp (4.5%) in the fourth year after the health shock. From period two on, the coefficients are statistically significant at the 95% level. With one exception ($r = -5$), the estimates in the pre-period ($r < 0$) are insignificant.

Medication: The visualized estimation results of the effect of a parental health shock on children's use of medication for the nervous system are depicted in Figure 5. We use different aggregation levels of drug groups. Panel A covers the effects on the entire ATC-N drug group (psychotropic drugs), whereas Panel B is restricted to the sum of the more relevant drug groups of antidepressants, anxiolytics, and sedatives. Finally, Panel C depicts estimation results for pain drugs.

After the shock children's psychotropic prescription probability increases continuously from 0.41 pp (11.1 %) in post-period one up to 1.24 pp (33.6 %) in post-period four. The estimates for post-periods two, three, and four are statistically significant. Estimates for the group of antidepressants, anxiolytics, and sedatives reveal an identical picture. The utilization of drugs from this group also increases continuously after the shock. Four years after the shock, the increase is highly statistically significant with a point estimate of 0.62 pp, which corresponds to a percentage increase of more than 147 %.

Panel C reveals that the positive effects on the prescription probability of pain drugs in post-periods one to four are between 0.5 and 0.65 pp which translates into a significant

[11] Full estimation output is presented in Table B.1 in Appendix B.

increase between 25.8 and 33.5 %. In addition to the higher level of medical attendance, a parental health shock leads to a significant increase in consumption of mental health-related medication.

Hospitalization: The analysis of mental health-related inpatient medical services completes the view on baseline effects. The development of children's probability of hospitalization for mental and behavioral disorders is depicted in Figure 6. From period one after the shock, all point estimates are positive. With 0.46 pp (88.5 %) and 0.40 pp (76.9 %), the strongest effects can be observed for post-period two (significant at the 5 % level) and post-period four (significant at the 10 % level). The effects for post-periods one and three are insignificant.

The utilization of different components of health care services may reflect the state of (mental) health differently. Hospitalization and the consumption of psychotropics are plausible indicators of individual health status. On the other hand, primary care doctor visits, the use of psychotherapy and, to a certain extent, the use of antidepressants and anxiolytics say something about individual health behavior. Even if we cannot unequivocally distinguish health effects from behavioral effects, we are confident that the significant increase in medical attendance, psychotherapy use, and consumption of psychotropic drugs clearly indicates a deteriorating mental health status in affected children. Although statistically less significant, the results on inpatient treatment of mental and behavioral disorders confirm the hypothesis of a negative influence of severe parental health shocks on children's mental health.

4.3 Effect heterogeneity

In this section, we analyze heterogeneous effects for different groups of children and parents. We distinguish between younger and older, male and female children, and divide the sample by parental labor market status into blue- and white-collar children. We further analyze the impact of the health shock type and severity (fatal or non-fatal course and cardiovascular versus cancer disease). For the split samples, we compare the utilization of psychotherapies, GPs and pediatricians, the prescription of antidepressants, anxiolytics, sedatives, and pain drugs, and also their inpatient treatment of mental and behavioral disorders. The most striking heterogeneous effects are graphically represented in Figures 7 to 10. Full estimation output is presented in Appendix Tables B.2 to B.5.

Age groups: Figure 7 indicates that older and younger children respond differently to parental health shocks. Among children in the 2 to 13 years age group, there is a highly significant increase in GP and pediatrician visits and in prescriptions for pain drugs. Starting from post-period one, the probability of GP/pediatrician visits increase by 2.4 to 5.7 %. In the same period, the use of pain drugs increases by 35.1 to 50.6 %. These results are consistent in that pain drugs are predominantly prescribed by primary care physicians.

While these service components do not change as a result of the shock in the older group of children (14 to 18 years), adolescents respond inversely with more than a doubling in the utilization of antidepressants, anxiolytics, and sedatives in post-periods two to four. The use of inpatient mental health services in the post period is also higher among older children. Finally, we observe no differences in the use of psychotherapy services (see Table B.2).

Girls and boys: Different reactions to the use of mental health care services after a parental health shock can also be observed between girls and boys (see Figure 8). Only daughters make greater use of outpatient psychotherapeutic services (more than a twofold increase in post-periods two and three) and of mental health-related inpatient hospital services (also more than a twofold increase in post-periods one and two). Moreover, gender differences are observed in the consumption pattern of psychotropic drugs. Females are significantly more likely to consume antidepressants, anxiolytics, and sedatives (up to a twofold increase in post-periods two and three), while males are up to 45.5 % (in post-period four) more likely to be prescribed pain drugs (see Table B.3). There is hardly any difference with regard to primary care physician services. The results indicate a more conservative symptom-based treatment for boys.

Blue- and white-collar children: We map possible socio-economic differences using the blue- or white-collar status of the affected parent. According to Figure 9, only children of blue-collar families are more likely to seek psychotherapy after the shock (more than a twofold increase in post-periods two and four). In terms of psychotropic prescribing, white-collar children have higher use of antidepressants, anxiolytics, and sedatives (up to a twofold increase in post-periods three and four) whereas children of blue-collar workers significantly increase their consumption of pain drugs by 43.4 to 83.9 %.

As can be seen from Table B.4, the effects on inpatient hospital treatment and on GP and pediatrician visits are rather similar in both groups. While the greater use of pain medication for children from blue -collar families supports the hypothesis of a status-driven orientation toward symptom-based treatment, we do not observe an increase in the use of psychotherapeutic services among children from white-collar families.

Severity of illness: Finally, we examine how the course of the parent's disease affects the children's utilization of health care services in a sample split in which we distinguish the children according to whether or not the parents die within four years after the shock. According to Figure 10, as expected, the increase in mental health treatment is significantly greater among children who lose their parents after the health shock. The impacts are quantitatively and qualitatively stronger. Thus, the significant increase in the use of psychotherapy and psychotropic medication is only observable among children whose parents die. The largest increases in this group of affected children are 177.5 % in post-period three, 385.9 % for antidepressants, anxiolytics, and sedatives in post-period 4, and 49.8 % for pain medications (also in post-period four). The full estimation Table B.5 indicates that in the group of children whose parents survive the disease, there is no significant increase in mental health-related services, with the exception of GP and pediatrician utilization. This means that the increase in the use of psychotherapy and psychotropic drugs is driven by children whose parents do not survive four years after the health shock.[12]

4.4 Robustness analyses

Our baseline specification uses a bandwidth of five years. In a first robustness check, we vary τ and re-estimate equation (1) for the main outcomes. Second, we provide results on the intensive margin where we estimate expenditure levels for the health outcomes.

Appendix Table C.1 depicts estimations of main outcomes for τ running from three to seven. The smaller τ, the more similar the experimental and control group should become. On the other hand, this reduces the length of the period that can be analyzed after a health shock. The robustness checks strongly confirm our baseline results. The point estimates of all variants are positive and the significance levels are higher in most cases compared to the baseline scenario ($\tau = 5$). For the specifications $\tau = 6$ and $\tau = 7$, we establish, as before, strong effects of a parental health shock on the use of psychotherapy. The quantitative and qualitative effects are similar. An extension of the post-shock period reveals that significant effects on the use of psychotherapy can also be observed five to six years after the health event.

The effects on drug consumption are also similar. The significant results in the baseline scenario are confirmed in all other specifications. The point estimates of all variants are larger than those for $\tau = 5$, the significance levels are equal or higher, and also for five and six years after the shock, we find significant effects on the use of drugs for the nervous system (ATC-N group). As in the baseline specification, the robustness tests yield the weakest results for inpatient mental health-related treatment. The alternative specifications with $\tau = 6$ and $\tau = 7$ confirm significant point estimates for single post shock periods.

Health care expenditures capture a different dimension of health care utilization. As opposed to whether one uses a particular service in a year, health care expenditures reflect the intensity of treatment as well as its cost, among other things. For this reason, we provide the results on the intensive margin in a further robustness test and compare them with our baseline estimations. The descriptive statistics and the estimation table of main outcomes for health care expenditures are depicted in Appendix Tables C.2 and C.3, respectively. As can be seen from the estimation output, the results differ qualitatively from the baseline estimations. While the effects on medical attendance in the outpatient sector are basically confirmed, those on the consumption of medical drugs for

[12] A sample split that distinguishes children according to whether their parents have a cardiovascular or oncological disease confirms these results (see Appendix Table B.6). The effects on health care utilization for treatment of mental illness are stronger when they are triggered by a parent's cancer.

the nervous system remain insignificant. A parental health shock increases the children's expenditures for psychotherapies in post-shock periods two and four by 2.77 € and 2.45 €, respectively. This corresponds to a percentage change of approximately 145 % and 129 %, respectively. The percentage changes are higher compared to the baseline specification, indicating an increase in the extensive and intensive margin. The expenditures for primary care physician visits in the period after the parental health shock increase by 2.66 € to 3.18 € corresponding with a percentage change of 4 % to 5 %, respectively, which perfectly matches the results on the extensive margin.

The results on the effects on pain medications are also consistent with those of the extensive margin. After the health shock, there is a significant increase in spending on pain drugs, which is in the range of 29 % to 48 %. This is in excellent agreement with the values from the baseline estimate (26 % to 33 %). However, the post-treatment effects of parental health shock on drug use of the entire ATC-N group as well as on antidepressants, anxiolytics, and sedatives are insignificant. Although the use of psychotropic drugs increases significantly, expenditures on these are not rising. The effects of parental health shock on mental health-related hospitalizations, which are relatively weak in the baseline variant, remain insignificant at the intensive margin. We do not find an increase in expenditures for inpatient mental health treatment.

5 Discussion and conclusion

Using extensive administrative health register data of Upper Austria and based on an identification strategy that exploits the random timing of a severe health shock to parents, we estimate the causal impact of the parental health shock on children's utilization of health care services for treatment of mental illness. Affected children make greater use of psychotherapies and consume more medical drugs for the nervous system, in particular antidepressants, anxiolytics, sedatives, and painkillers. The likelihood of seeking psychotherapeutic services after a shock increases by up to 70 %, and that of using psychotropic drugs by slightly more than 30 %. The probability of GP and pediatrician visits also increases significantly (up to 4,5 %), while the greater use of mental health-related inpatient treatment is only marginally significant. Estimates on the intensive margin confirm the effects on medical attendance and the utilization of painkillers. Expenditures for psychotherapies and primary care doctor visits are rising, as are those for prescription of pain drugs. In contrast, we do not find significant effects on expenditures for antidepressants, anxiolytics, and sedatives and the aggregated ATC-N medication group.

The increased utilization of these medications does not result in a corresponding increase in expenditures. On the one hand, this is due to the prescription of relatively cheap drugs, which are often available as generics. In addition, pain drugs, which play an important role in terms of volume, are cheap relative to other psychotropic drugs. In the higher-level ATC-N group, the increase in the volume of pain drugs has a strong impact, but this has hardly any effect on the total expenditures for psychotropics.[13]

Our heterogeneous estimation results for different groups of children reveal interesting insights in the context of treatment choice. For the younger cohort (2-13 years old), we find an increase in the likelihood of GP and pediatrician visits together with more prescriptions of painkillers.[14] On the other hand, for older children (14-18 years old), prescriptions for antidepressants, anxiolytics, and sedatives are increasing significantly. This indicates that younger children are mainly prescribed painkillers by their primary care physicians to combat symptoms such as headaches, while older children and adolescents are increasingly treated with antidepressants and anxiety medication. This is consistent with the fact that fewer of these drugs are being approved for use in younger children (Huscsava et al., 2020).

We find a similar tendency toward more conservative and symptom-based treatment of mental and behavioral disorders among boys and children of blue-collar workers. While girls make greater use of psychotherapies in response to the parental health shock, utilization of therapeutic sessions does not increase among children from white-collar families. A total of two obvious mechanisms can be considered for this result. First, it is possible that the need for psychotherapeutic services is lower in the group of white-collar children. Second, the proportion of privately funded psychotherapeutic services may be higher in the group of white-collar children. In section 2.3, it was already highlighted that only about 25 % of psychotherapy services are covered by social health insurance. The greater part must be financed privately by the patients. In addition, for those therapies that are funded exclusively by social health insurance, patients have to accept relatively long waiting times. These arguments suggest that families with higher socioeconomic status are more likely to be able and willing to afford these services privately. The results of a sample split according to income support the hypothesis of higher self-involvement in families with higher purchasing power. As can be seen from Table B.7, children of parents with a below-median income experience an increase in their psychotherapy use from post period three on (at the 10 % level), whereas the utilization of such therapies in the above-median income group remains insignificant.

Estimations of another sample split reveal that the effects of parental health shocks on the increase of mental health care utilization is predominantly driven by children whose parents die. Children whose parents do not have a severe course of illness do not consume more psychotherapies, nor do they take more psychotropic drugs.

The present study does not allow us to clearly identify the mechanisms behind the quantitative results. The psychological stress of the children associated with the illness of the parents can have several causes. It is obvious that the children worry about their

[13] Against this background, the result of Frimmel et al. (2020) can be explained, whose influence of a parental stroke on the level of expenditure of the ATC-N group also remains insignificant. The authors do not estimate the extensive margin or subcomponents of psychotropic drugs.

[14] Pediatricians in Austria offer medical care for children up to the age of 14.

parents due to the illness, which can trigger grief, anxiety, and depressive episodes. At the same time, the illness of one of the parents calls into question care functions for the children that were previously exercised. The idea of being more self-reliant in the future than before can trigger great uncertainty and future fears. The mechanisms will thus depend on (i) the closeness of the relationship between the affected parent and the child, and (ii) which parent has so far taken over the care duties. Information on this is naturally not available. However, in another heterogeneity analysis, we distinguish whether the mother or father suffers the health shock or whether the different gender composition between the parent and the child affects the results. The estimation results separated according to whether the mother or the father is affected by the health shock are depicted in Appendix Table B.8. It can be seen that both the quantitative effects and significance levels vary over both groups. However, a clear trend that the effects would be greater in one group than in the other cannot be derived. Assuming that, in Austria, the care and support of children is still predominantly provided by mothers, the estimation results suggest that the deterioration of children's mental health is not driven by fears about their (material) care.[15]

Our study has several limitations. First, we cannot directly observe the children's mental health status. Different components of health care services may correlate with health status to varying degrees. Inpatient treatment and the use of medical drugs seem to be plausible indicators of individual health. Other components, such as GP and pediatrician visits may also reflect a preventive character that says something about health behavior. In the case of mental health treatment, interpreting health care utilization is particularly difficult because mental health problems often go untreated. In such cases, lower levels of health care utilization do not indicate a better state of health, but rather inadequate provision of therapeutic and medicinal resources. Even if it is not possible to clearly differentiate health effects from behavioral effects, we interpret the increase in mental health-related services as a therapeutic necessity to adequately treat mental health problems.

Second, our data do not include mental health-related expenditure components raised by the patients themselves. We monitor all service components that are at least partially billed by the regional health insurance fund. This includes all physicians' fees that are not exclusively borne by patients, as well as all drug prescriptions that cost more than the prescription fee. The number of services is thus very well represented. However, deductibles and private copayments are missing from the expenditure volumes, which is particularly striking in the case of expenditure for psychotherapy.

Our findings suggest that severe parental health shocks trigger mental and behavioral disorders in their children. As a consequence, adequate medical care for children in such

[15] Additional heterogeneity tests for the different gender compositions between the affected parent and the child confirm this result. The estimation output is available on request.

exceptional situations is essential. This includes low-threshold access to specialist care and appropriate drug treatments. However, access to psychotherapy services at short notice and free of charge is particularly important. This will require the expansion of appropriate treatment facilities, presumably not only in Austria.

This research further demonstrates that all efforts devoted to health-promoting measures are not only beneficial to adults at high risk of adverse health shocks but also to their children. Several studies reveal that mental health issues during childhood lead to adverse economic consequences in the long term. Improving parents' health could therefore have positive effects on their children's health and economic status.

References

Ahammer, Alexander, Dominik Grübl and Rudolf Winter-Ebmer (2020), The Health Externalities of Downsizing, IZA Discussion Paper No. 13984.

Alam, Shamma Adeeb (2015), 'Parental Health Shocks, Child Labor and Educational Outcomes: Evidence from Tanzania', *Journal of Health Economics* **44**, 161–175.

Andersen, Dana C and Pinar Mine Gunes (2018), 'The Role of Adolescent Health in Adult SES Outcomes', *The BE Journal of Economic Analysis & Policy* **18**(2).

Appel, Charlotte Weiling, Christoffer Johansen, Isabelle Deltour, Kirsten Frederiksen, Henrik Hjalgrim, Susanne Oksbjerg Dalton, Annemarie Dencker, Jes Dige, Per Bøge, Bo Andreassen Rix, Atle Dyregrov, Preben Engelbrekt, Eva Helweg, Ole Abildgaard Mikkelsen, Mette Terp Høybye and Pernille Envold Bidstrup (2013), 'Early Parental Death and Risk of Hospitalization for Affective Disorder in Adulthood', *Epidemiology* **24**(4), 608–615.

Appel, Charlotte Weiling, Christoffer Johansen, Jane Christensen, Kirsten Frederiksen, Henrik Hjalgrim, Susanne Oksbjerg Dalton, Annemarie Dencker, Jes Dige, Per Bøge, Atle Dyregrov, Ole Abildgaard Mikkelsen, Lasse Wegener Lund, Mette Terp Høybye and Pernille Envold Bidstrup (2016), 'Risk of Use of Antidepressants Among Children and Young Adults Exposed to the Death of a Parent', *Epidemiology* **27**(4), 578–585.

Auersperg, Felicitas, Thomas Vlasak, Ivo Ponocny and Alfred Barth (2019), 'Long-Term Effects of Parental Divorce on Mental Health-A Meta-Analysis', *Journal of Psychiatric Research* **119**, 107–115.

Bauer, Jan Michael and Alfonso Sousa-Poza (2015), 'Impacts of Informal Caregiving on Caregiver Employment, Health, and Family', *Journal of Population Ageing* **8**(3), 113–145.

Bellini, Benedetta, Marco Arruda, Alessandra Cescut, Cosetta Saulle, Antonello Persico, Marco Carotenuto, Michela Gatta, Renata Nacinovich, Fausta Paola Piazza, Cristiano Termine et al. (2013), 'Headache and Comorbidity in Children and Adolescents', *The Journal of Headache and Pain* **14**(1), 1–11.

Berg, Lisa, Mikael Rostila and Anders Hjern (2016), 'Parental Death during Childhood and Depression in Young Adults A National Cohort Study', *Journal of Child Psychology and Psychiatry* **57**(9), 1092–1098.

Berg, Lisa, Mikael Rostila, Arzu Arat and Anders Hjern (2019), 'Parental Death during Childhood and Violent Crime in Late Adolescence to Early Adulthood: A Swedish National Cohort Study', *Palgrave Communications* **5**, 74.

Bergquist, Savannah and Mathijs de Vaan (2022), 'Hospitalizations Reduce Health Care Utilization of Household Members', *Health Services Research* pp. 1–14.

Bobinac, Ana, N. Job A. van Exel, Frans F.H. Rutten and Werner B.F. Brouwer (2010), 'Caring for and Caring About: Disentangling the Caregiver Effect and the Family Effect', *Journal of Health Economics* **29**(4), 549–556.

Bockerman, Petri, Mika Haapanen and Christopher Jepsen (2021), Dark Passage: Mental Health Consequences of Parental Death, CESifo Working Paper No. 9099.

Bom, Judith, Pieter Bakx, Frederik Schut and Eddy van Doorslaer (2019), 'Health Effects of Caring for and about Parents and Spouses', *The Journal of the Economics of Ageing* **14**, 100196.

Bratti, Massimiliano and Mariapia Mendola (2014), 'Parental Health and Child Schooling', *Journal of Health Economics* **35**, 94–108.

Brent, David, Nadine Melhem, M. Bertille Donohoe and Monica Walker (2009), 'The Incidence and Course of Depression in Bereaved Youth 21 Months After the Loss of a Parent to Suicide, Accident, or Sudden Natural Death', *American Journal of Psychiatry* **166**(7), 786–794.

Cas, Ava Gail, Elizabeth Frankenberg, Wayan Suriastini and Duncan Thomas (2014), 'The Impact of Parental Death on Child Well-being: Evidence From the Indian Ocean Tsunami', *Demography* **51**(2), 437–457.

Cerel, Julie, Mary A Fristad, Joseph Verducci, Ronald A Weller and Elizabeth B Weller (2006), 'Childhood Bereavement: Psychopathology in the 2 Years Postparental Death', *Journal of the American Academy of Child & Adolescent Psychiatry* **45**(6), 681–690.

Chatterji, Pinka and Sara Markowitz (2001), 'The Impact of Maternal Alcohol and Illicit Drug use on Children's Behavior Problems: Evidence from the Children of the National Longitudinal Survey of Youth', *Journal of Health Economics* **20**(5), 703–731.

Chen, Stacey H, Yen-Chien Chen and Jin-Tan Liu (2009), 'The Impact of Unexpected Maternal Death on Education: First Evidence from Three National Administrative Data Links', *American Economic Review* **99**(2), 149–153.

Cornaglia, Francesca, Elena Crivellaro and Sandra McNally (2015), 'Mental Health and Education Decisions', *Labour Economics* **33**, 1–12.

Currie, Janet and Mark Stabile (2006), 'Child Mental Health and Human Capital Accumulation: The Case of ADHD', *Journal of Health Economics* **25**(6), 1094–1118.

Deshpande, Manasi and Yue Li (2019), 'Who Is Screened Out? Application Costs and the Targeting of Disability Programs', *American Economic Journal: Economic Policy* **11**(4), 213–248.

Ding, Weili, Steven F Lehrer, J Niels Rosenquist and Janet Audrain-McGovern (2009), 'The Impact of Poor Health on Academic Performance: New Evidence using Genetic Markers', *Journal of Health Economics* **28**(3), 578–597.

Druedahl, Jeppe and Alessandro Martinello (2021), 'Long-Run Saving Dynamics: Evidence from Unexpected Inheritances', *The Review of Economics and Statistics* **Forthcoming**.
URL: *https://doi.org/10.1162/rest_a_01004*

Fadlon, Itzik and Torben Heien Nielsen (2019), 'Family Health Behaviors', *American Economic Review* **109**(9), 3162–3191.

Fadlon, Itzik and Torben Heien Nielsen (2021), 'Family Labor Supply Responses to Severe Health Shocks: Evidence from Danish Administrative Records', *American Economic Journal: Applied Economics* **13**(3), 1–30.

Fletcher, Jason M (2008), 'Adolescent Depression: Diagnosis, Treatment, and Educational Attainment', *Health Economics* **17**(11), 1215–1235.

Fletcher, Jason M. (2010), 'Adolescent Depression and Educational Attainment: Results using Sibling Fixed Effects', *Health Economics* **19**(7), 855–871.

Fletcher, Jason M (2014), 'The Effects of Childhood ADHD on Adult Labor Market Outcomes', *Health Economics* **23**(2), 159–181.

Fletcher, Jason M and Steven F Lehrer (2011), 'Genetic Lotteries within Families', *Journal of Health Economics* **30**(4), 647–659.

Frimmel, Wolfgang, Martin Halla, Jörg Paetzold and Julia Schmieder (2020), Health of Elderly Parents, Their Children's Labor Supply, and the Role of Migrant Care Workers, IZA Discussion Papers No. 13774.

Gallo, Erika Alejandra Giraldo, Tiago Neuenfeld Munhoz, Christian Loret de Mola and Joseph Murray (2018), 'Gender Differences in the Effects of Childhood Maltreatment on Adult Depression and Anxiety: A Systematic Review and Meta-Analysis', *Child Abuse & Neglect* **79**, 107–114.

García-Miralles, Esteban and Miriam Gensowski (2020), 'Are Children's Socio-Emotional Skills Shaped by Parental Health Shocks?', *Available at SSRN 3647155* .

Gertler, Paul, David I. Levine and Minnie Ames (2004), 'Schooling and Parental Death', *Review of Economics and Statistics* **86**(1), 211–225.

Gimenez, Lea, Shin-Yi Chou, Jin-Tan Liu and Jin-Long Liu (2013), 'Parental Loss and Children's Well-Being', *Journal of Human Resources* **48**(4), 1035–1071.

Hackl, Franz, Michael Hummer and Gerald J. Pruckner (2015), 'Old boys' network in general practitioners' referral behavior?', *Journal of Health Economics* **43**, 56–73.

Hakulinen, C., M. Elovainio, M. Arffman, S. Lumme, S. Pirkola, I. Keskimäki, K. Manderbacka and P. Böckerman (2019), 'Mental disorders and long-term labour market outcomes: nationwide cohort study of 2 055 720 individuals', *Acta Psychiatrica Scandinavica* **140**(4), 371–381.
URL: *https://onlinelibrary.wiley.com/doi/abs/10.1111/acps.13067*

Halla, Martin, Julia Schmieder and Andrea Weber (2020), 'Job Displacement, Family Dynamics, and Spousal Labor Supply', *American Economic Journal: Applied Economics* **12**(4), 253–287.

Heger, Dörte (2017), 'The Mental Health of Children Providing Care to their Elderly Parent', *Health Economics* **26**(12), 1617–1629.

Hiyoshi, Ayako, Lisa Berg, Alessandra Grotta, Ylva Almquist and Mikael Rostila (2021), 'Parental Death in Childhood and Pathways to Increased Mortality across the Life Course in Stockholm, Sweden: A cohort study', *PLOS Medicine* **18**(3), e1003549.

Høeg, Beverley Lim, Jane Christensen, Linda Banko, Kirsten Frederiksen, Charlotte Weiling Appel, Susanne Oksbjerg Dalton, Atle Dyregrov, Mai-Britt Guldin, Sanne Ellegaard Jørgensen, Martin Lytje et al. (2021), 'Psychotropic medication among children who experience parental death to cancer', *European Child & Adolescent Psychiatry* pp. 1–11.

Hofmarcher, M.M. and C. Singhuber (2019), 'Leistungskraft regionaler Gesundheitssysteme. Krankenanstalten im Bundesländervergleich', *Health System Intelligence, Fact Book* .

Huscsava, Mercedes, Christine Vesely, Christian Scharinger and Paul Plener (2020), 'Review über Psychopharmaka mit Zulassung in Österreich für die Anwendung an Kindern und/oder Jugendlichen', *Neuropsychiatrie* **34**(1), 1–4.

Jacobson, Louis S., Robert J. LaLonde and Daniel G. Sullivan (1993), 'Earnings Losses of Displaced Workers', *The American Economic Review* **83**(4), 685–709.
URL: *http://www.jstor.org/stable/2117574*

Johnston, David W., Stefanie Schurer and Michael A. Shields (2013), 'Exploring the Intergenerational Persistence of Mental Health: Evidence from three Generations', *Journal of Health Economics* **32**(6), 1077–1089.

Kailaheimo-Lönnqvist, Sanna and Jani Erola (2020), 'Child's Age at Parental Death and University Education', *European Societies* **22**(4), 1–23.

Kailaheimo-Lönnqvist, Sanna and Sanni Kotimäki (2020), 'Cause of Parental Death and Child's Health and Education: The Role of Parental Resources', *SSM - Population Health* **11**, 100632.

Kristiansen, Ida Lykke (2021), 'Consequences of Serious Parental Health Events on Child Mental Health and Educational Outcomes', *Health Economics* **30**(8), 1772–1817.
URL: *https://onlinelibrary.wiley.com/doi/abs/10.1002/hec.4278*

Lawrence, Peter J., Kou Murayama and Cathy Creswell (2019), 'Systematic Review and Meta-Analysis: Anxiety and Depressive Disorders in Offspring of Parents With Anxiety Disorders', *Journal of the American Academy of Child & Adolescent Psychiatry* **58**(1), 46–60.

Le, Huong Thu and Ha Trong Nguyen (2017), 'Parental Health and Children's Cognitive and Noncognitive Development: New Evidence from the Longitudinal Survey of Australian Children', *Health Economics* **26**(12), 1767–1788.

Luca, Dara Lee and David E Bloom (2018), The Returns to Parental Health: Evidence from Indonesia, Working Paper 25304, National Bureau of Economic Research.
URL: *http://www.nber.org/papers/w25304*

Lund, Ingunn Olea, Espen Moen Eilsertsen, Line C. Gjerde, Fartein Ask Torvik, Espen Røysamb, Ted Reichborn-Kjennerud and Eivind Ystrom (2019), 'Maternal Drinking and Child Emotional and Behavior Problems', *Pediatrics* **145**(3), e20192007.

Lundborg, Petter, Anton Nilsson and Dan-Olof Rooth (2014), 'Adolescent Health and Adult Labor Market Outcomes', *Journal of Health Economics* **37**, 25–40.

Lytje, Martin and Atle Dyregrov (2019), 'The Price of Loss – A Literature Review of the Psychosocial and Health Consequences of Childhood Bereavement', *Bereavement Care* **38**(1), 1–10.

Marks, Nadine F., Heyjung Jun and Jieun Song (2007), 'Death of Parents and Adult Psychological and Physical Well-Being', *Journal of Family Issues* **28**(12), 1611–1638.

Mousteri, Victoria, Michael Daly, Liam Delaney, Per Tynelius and Finn Rasmussen (2019), 'Adolescent Mental Health and Unemployment over the Lifespan: Population Evidence from Sweden', *Social Science & Medicine* **222**, 305–314.

Mühlenweg, Andrea M., Franz G. Westermaier and Brant Morefield (2016), ‘Parental Health and Child Behavior: Evidence from Parental Health Shocks’, *Review of Economics of the Household* **14**(3), 577–598.

Norén, Anna (2020), Sick of my Parents? Consequences of Parental Ill Health on Adult Children, Working Paper No. 2020:1, Institute for Evaluation of Labour Market and Education Policy (IFAU).
URL: *http://hdl.handle.net/10419/227849*

Norman, Rosana E., Munkhtsetseg Byambaa, Rumna De, Alexander Butchart, James Scott and Theo Vos (2012), ‘The Long-Term Health Consequences of Child Physical Abuse, Emotional Abuse, and Neglect: A Systematic Review and Meta-Analysis’, *PLoS Medicine* **9**(11), e1001349.

Ogemdi, Iwuozor Kingsley (2019), ‘A Review on the Properties and Uses of Paracetamol’, *International Journal of Pharmacy and Chemistry* **5**(3), 31–35.

Persson, Petra and Maya Rossin-Slater (2018), ‘Family Ruptures, Stress, and the Mental Health of the Next Generation’, *American Economic Review* **108**(4-5), 1214–1252.

Rellstab, Sara, Pieter Bakx, Pilar García-Gómez and Eddy van Doorslaer (2020), ‘The Kids are Alright - Labour Market Effects of Unexpected Parental Hospitalisations in the Netherlands’, *Journal of Health Economics* **69**, 102275.

Rostila, Mikael and Jan M. Saarela (2011), ‘Time Does Not Heal All Wounds: Mortality Following the Death of a Parent’, *Journal of Marriage and Family* **73**(1), 236–249.

Rostila, Mikael, Lisa Berg, Arzu Arat, Bo Vinnerljung and Anders Hjern (2016), ‘Parental Death in Childhood and Self-inflicted Injuries in Young Adults-A National Cohort Study from Sweden’, *European Child & Adolescent Psychiatry* **25**(10), 1103–1111.

Ruhm, Christopher J (1991), ‘Displacement Induced Joblessness’, *The Review of Economics and Statistics* **73**(3), 517–522.

Sands, Amy, Ellen J. Thompson and Darya Gaysina (2017), ‘Long-term Influences of Parental Divorce on Offspring Affective Disorders: A Systematic Review and Meta-Analysis’, *Journal of Affective Disorders* **218**, 105–114.

Srivastava, Preety and Trong-Anh Trinh (2021), ‘The Effect of Parental Smoking on Children’s Cognitive and Non-Cognitive Skills’, *Economics & Human Biology* **41**, 100978.

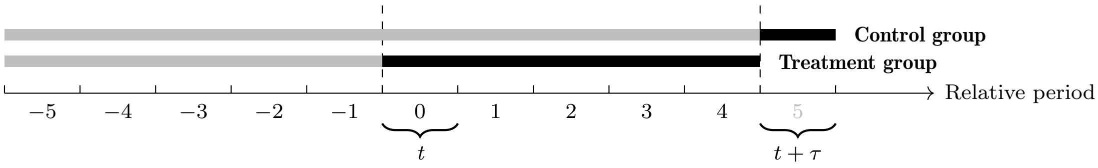
WHO (2015), *International Statistical Classification of Diseases and Related Health Problems*, 10th revision, fifth edn, World Health Organization.

Wilcox, Holly C., Satoko J. Kuramoto, Paul Lichtenstein, Niklas Långström, David A. Brent and Bo Runeson (2010), 'Psychiatric Morbidity, Violent Crime, and Suicide Among Children and Adolescents Exposed to Parental Death', *Journal of the American Academy of Child & Adolescent Psychiatry* **49**(5), 514–523.

Zweimüller, Josef, Rudolf Winter-Ebmer, Rafael Lalive, Andreas Kuhn, Jean-Philippe Wuellrich, Oliver Ruf and Simon Büchi (2009), 'Austrian Social Security Database', *Available at SSRN 1399350* .

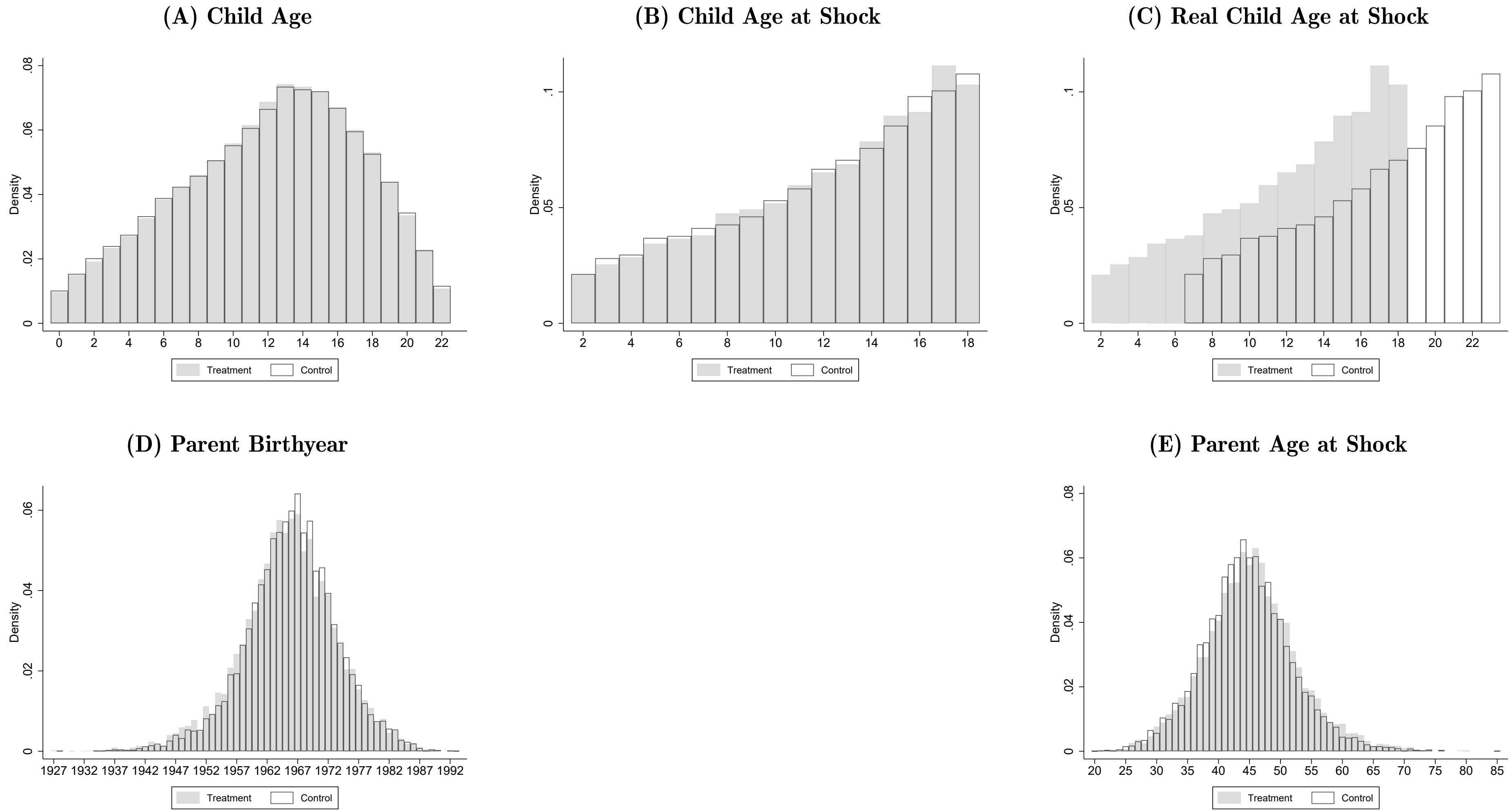
6 Tables and Figures

Figure 1: Construction of treatment and control group



Notes: This figure illustrates the construction of treatment and control groups to be used in the dynamic difference-in-differences (DID) setting.

Figure 2: Parental and children's age



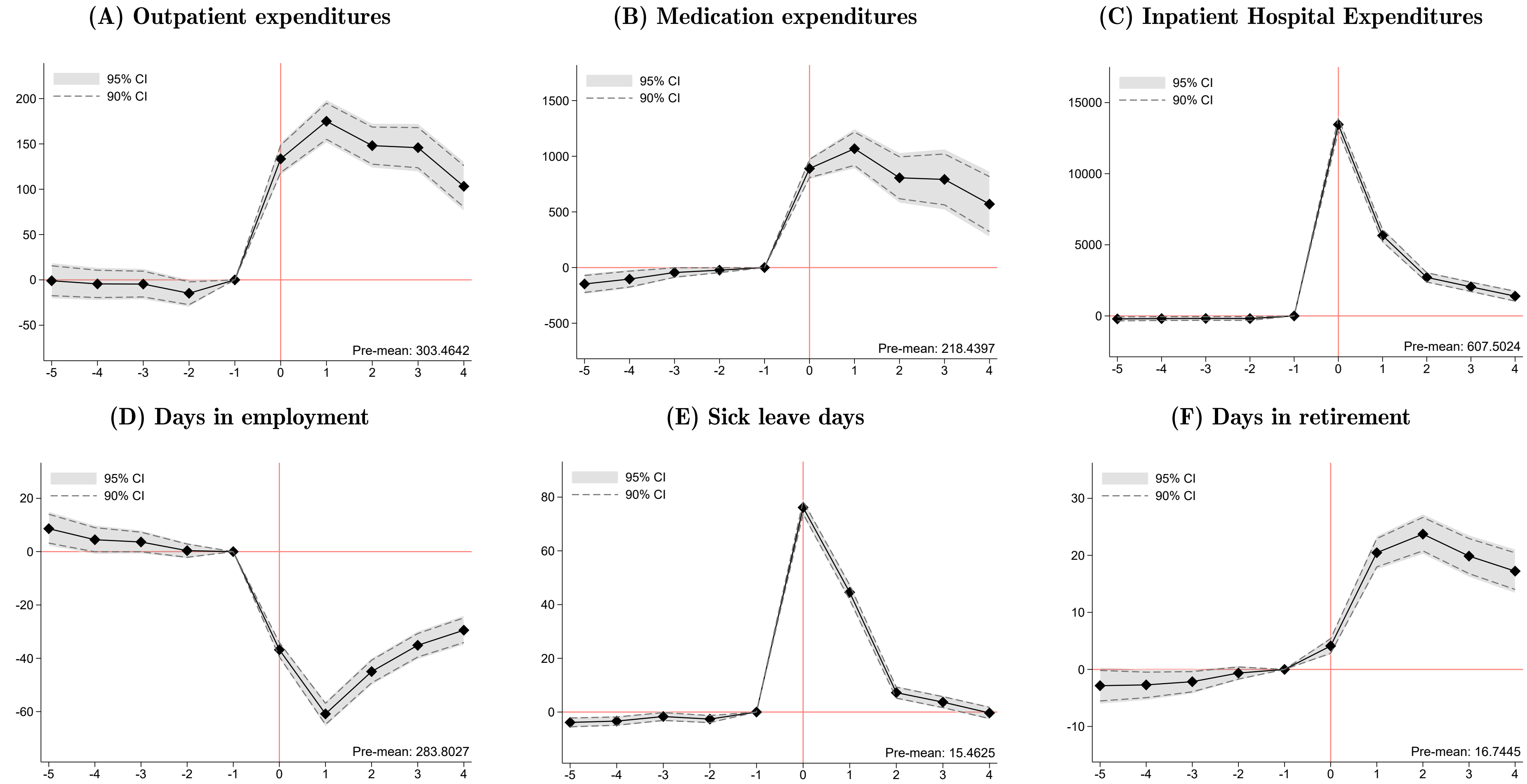
Notes: The figure depicts the distribution of children's age (Panel A), age at shock (Panel B), and real age at shock (Panel C), parent's birthyear (Panel D), and parental age at shock (Panel E) for the treatment and control group. Treated children experience the parental health shock between ages 2 and 18. Children in the control group experience the parental health shock between ages 7 and 23.

Table 1: Descriptives Children

	Ø Full Sample	Ø Treatment	Ø Control	Diff.	Sign.	N
General (Number children = 18277)						
Age at parental health shock	12.1779	12.2162	12.1528	0.0634	***	167,883
Female	0.4824	0.4827	0.4823	0.0004		167,883
Healthcare (Pre-Shock)						
Psychotherapy & psychology (0/1)	0.0067	0.0062	0.0070	-0.0008		73,919
GP & pediatrician (0/1)	0.7857	0.7806	0.7891	-0.0085	***	73,919
Medication for nervous system (0/1)	0.0369	0.0376	0.0364	0.0012		73,919
Antidepressants, anxiolytics, sedatives (0/1)	0.0042	0.0045	0.0041	0.0004		73,919
Anilide (e.g. Paracetamol) (0/1)	0.0194	0.0195	0.0194	0.0001		73,919
Inpatient stays for mental and behavioural disorders (0/1)	0.0052	0.0055	0.0050	0.0005		73,919
Outpatient expenditures[a]	172.0081	172.8612	171.4449	1.4164		73,919
Medication expenditures[a]	47.7763	51.0421	45.6200	5.4221		73,919
Inpatient expenditures[a]	271.9063	264.3398	276.9020	-12.5622		73,919
Healthcare (Post-Shock)						
Psychotherapy & psychology (0/1)	0.0124	0.0139	0.0114	0.0025	***	93,964
GP & pediatrician (0/1)	0.7734	0.7736	0.7732	0.0004		93,964
Medication for nervous system (0/1)	0.0455	0.0506	0.0422	0.0084	***	93,964
Antidepressants, anxiolytics, sedatives (0/1)	0.0136	0.0151	0.0127	0.0025	***	93,964
Anilide (e.g. Paracetamol) (0/1)	0.0159	0.0200	0.0132	0.0067	***	93,964
Inpatient stays for mental and behavioural disorders (0/1)	0.0099	0.0111	0.0091	0.0020	***	93,964
Outpatient expenditures[a]	203.2252	205.6856	201.6215	4.0641	**	93,964
Medication expenditures [a]	68.0173	81.0140	59.5454	21.4686	*	93,964
Inpatient expenditures[a]	305.9557	339.2225	284.2706	54.9518	***	93,964

Notes: This table presents descriptive statistics for children in the treatment and control groups. The sample includes children of parents who experience a first-time severe health shock between 2007 and 2019. Outcomes can be observed between 2005 and 2019. [a] Expenditures in € per year. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

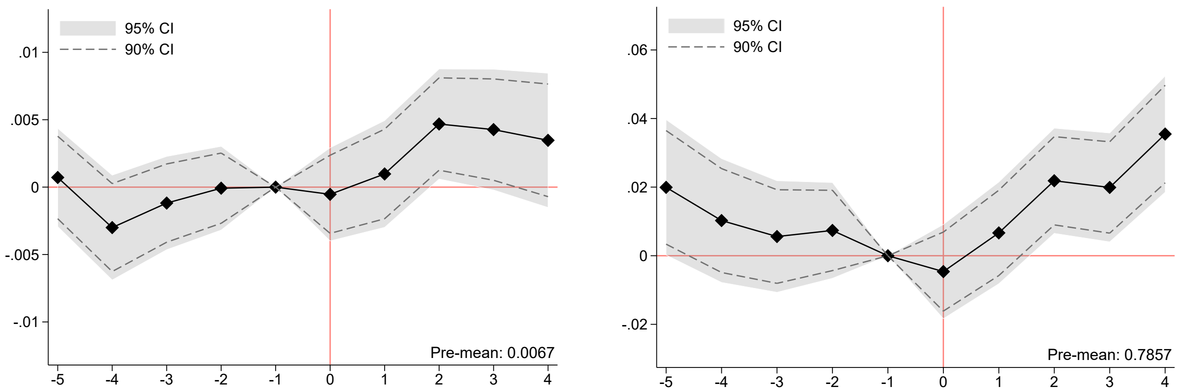
Figure 3: Effects on affected parents



Notes: The figure plots the estimated coefficients and their 90% and 95% confidence intervals for the effect of a parental health shock on different parental health and labor market outcomes (see Table A.2).

Figure 4: Outpatient medical attendance

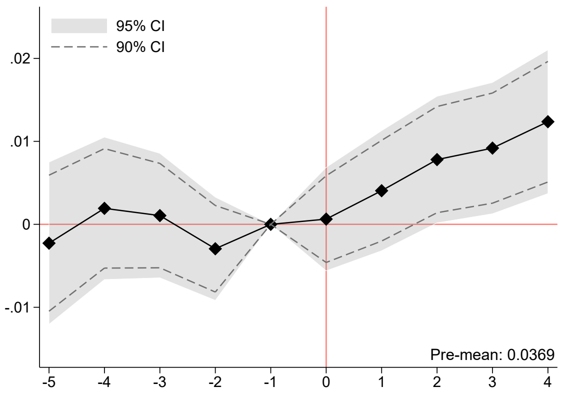
(A) Psychotherapy & Psychology **(B) GP & Pediatrician**



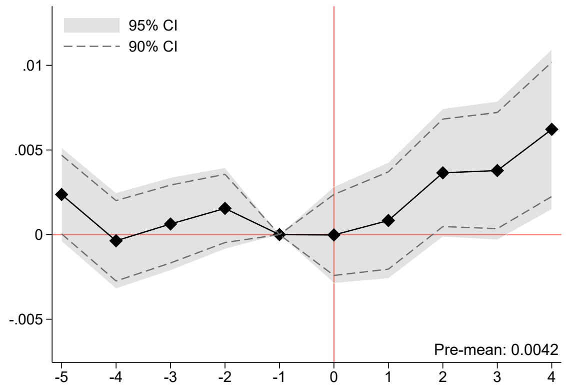
Notes: The figure plots the estimated coefficients and their 90% and 95% confidence intervals for the effect of a parental health shock on children's outpatient medical attendance (see Table B.1).

Figure 5: Medication

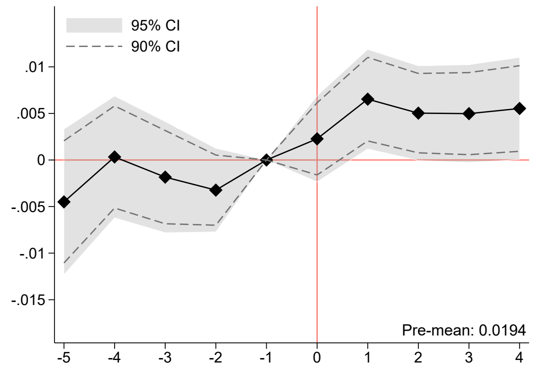
(A) Psychotropic Drugs



(B) Antidepressants, Anxiolytics & Sedatives

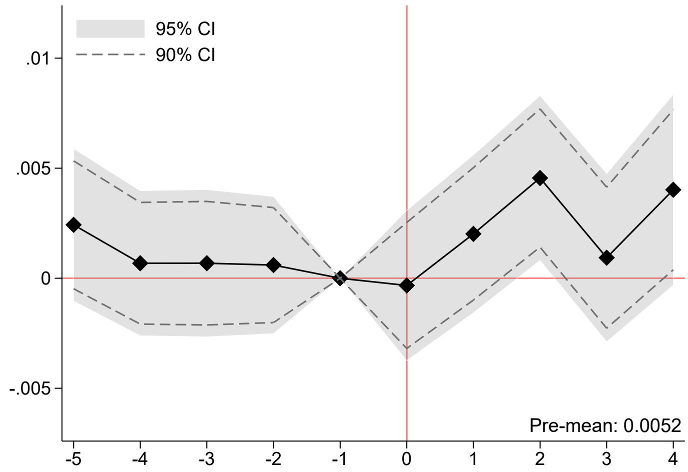


(C) Pain Drugs



Notes: The figure plots the estimated coefficients and their 90% and 95% confidence intervals for the effect of a parental health shock on children's psychotropic medication (see Table B.1).

Figure 6: Inpatient treatment of mental & behavioral disorders

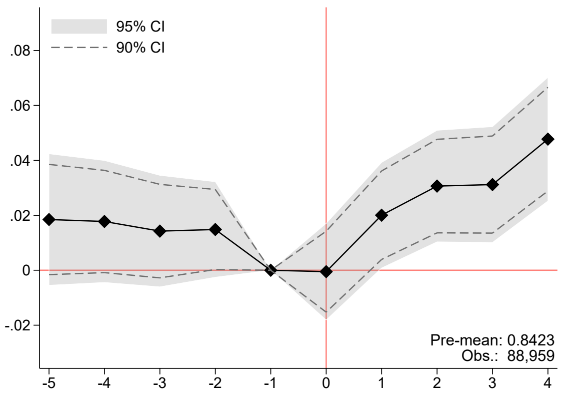


Notes: The figure plots the estimated coefficients and their 90% and 95% confidence intervals for the effect of a parental health shock on children's hospitalization for mental and behavioral disorders (see Table B.1).

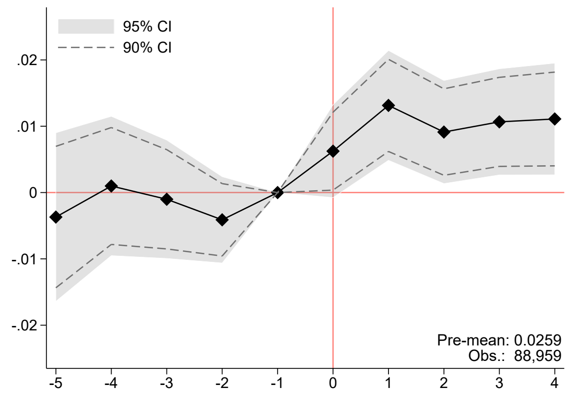
Figure 7: Heterogeneous effects: Different age groups

2-13 years

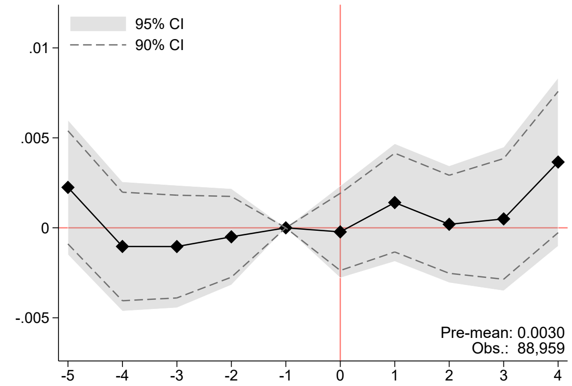
GP & Pediatrician



Pain Drugs

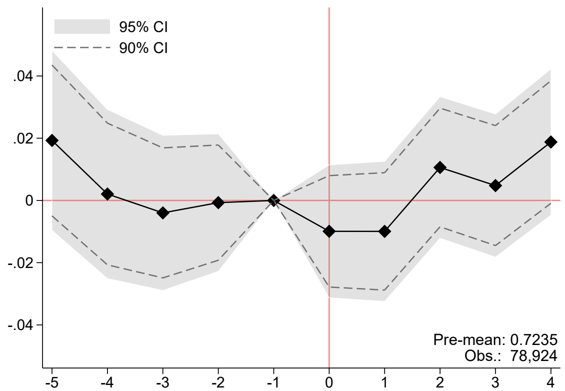


Antidepressants, Anxiolytics & Sedatives

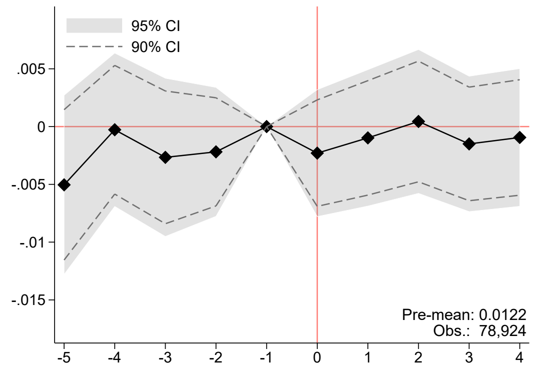


14-18 years

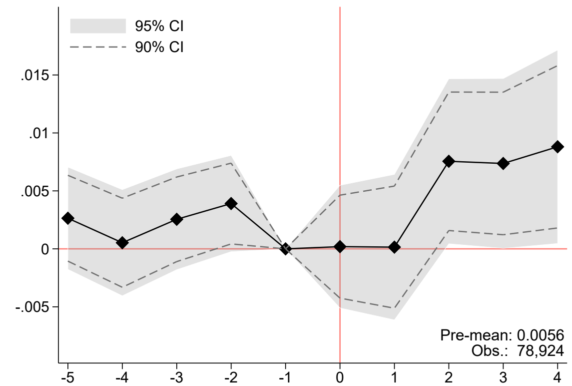
GP & Pediatrician



Pain Drugs



Antidepressants, Anxiolytics & Sedatives

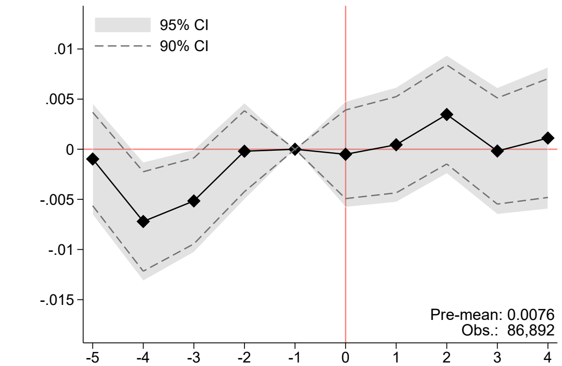


Notes: The figure plots the estimated coefficients and their 90% and 95% confidence intervals for the effect of a parental health shock on the utilization of primary care physicians and medication of selected psychotropics for different age groups of children (see Table B.2).

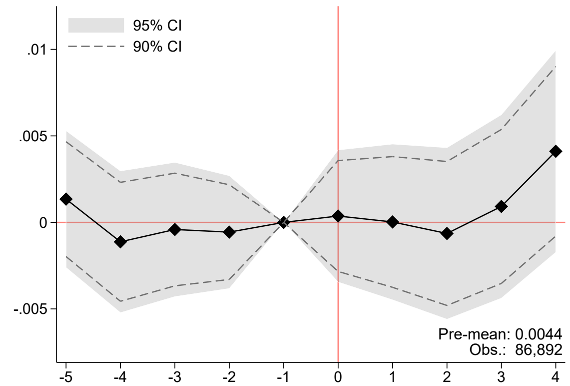
Figure 8: Heterogeneous effects: Boys and girls

Boys

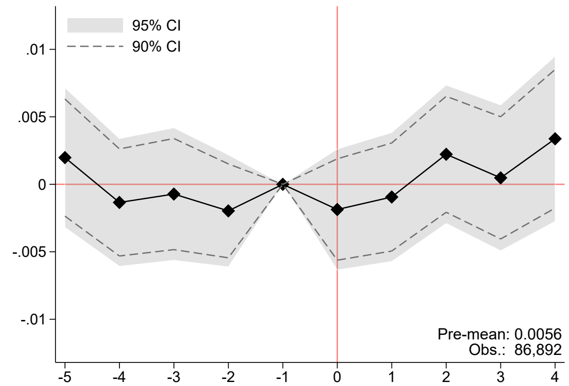
Psychotherapy & Psychology



Antidepressants, Anxiolytics & Sedatives

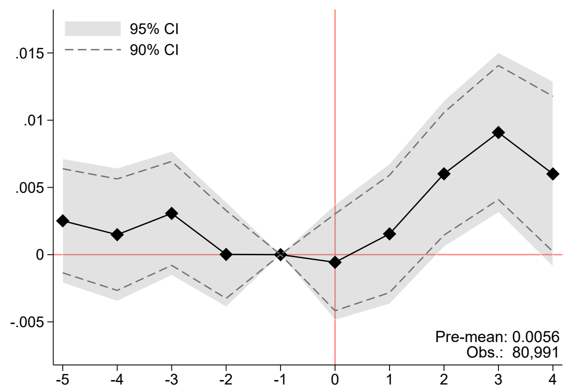


Mental & Behavioral Disorders

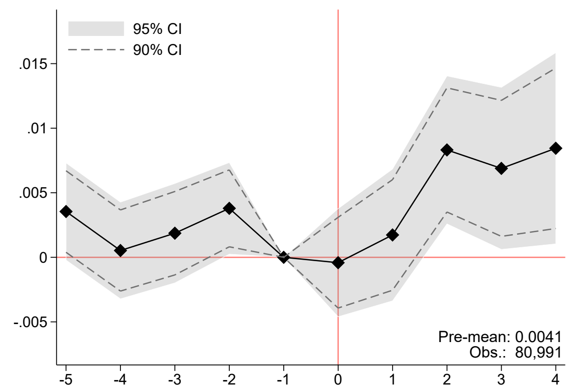


Girls

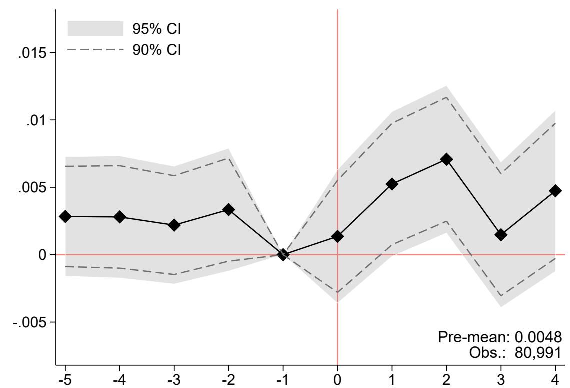
Psychotherapy & Psychology



Antidepressants, Anxiolytics & Sedatives

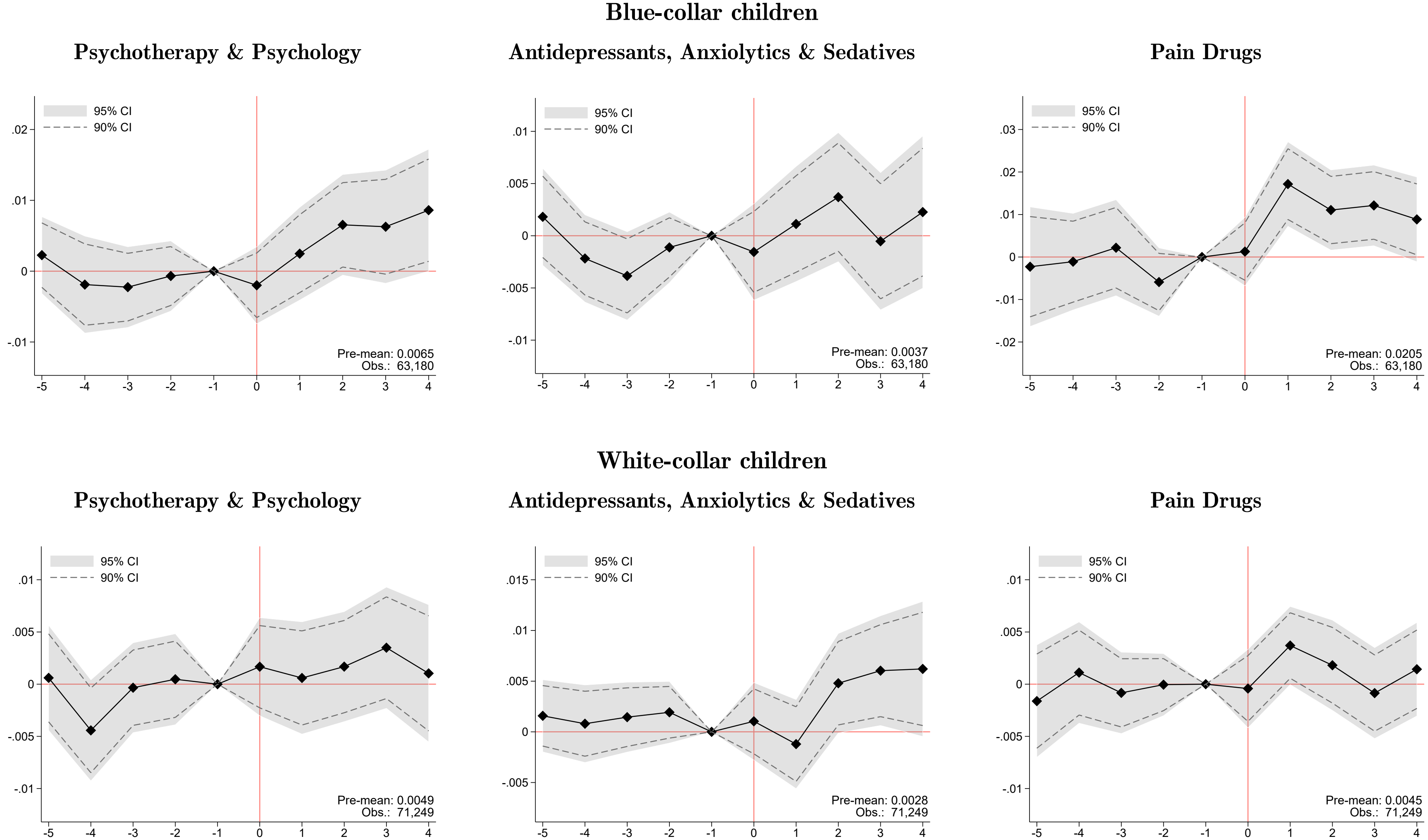


Mental & Behavioral Disorders



Notes: The figure plots the estimated coefficients and their 90% and 95% confidence intervals for the effect of a parental health shock on psychotherapy use, prescription of antidepressants, anxiolytics, and sedatives, and hospitalization for mental and behavioral disorders for boys and girls (see Table B.3).

Figure 9: Heterogeneous effects: Blue- and white-collar children

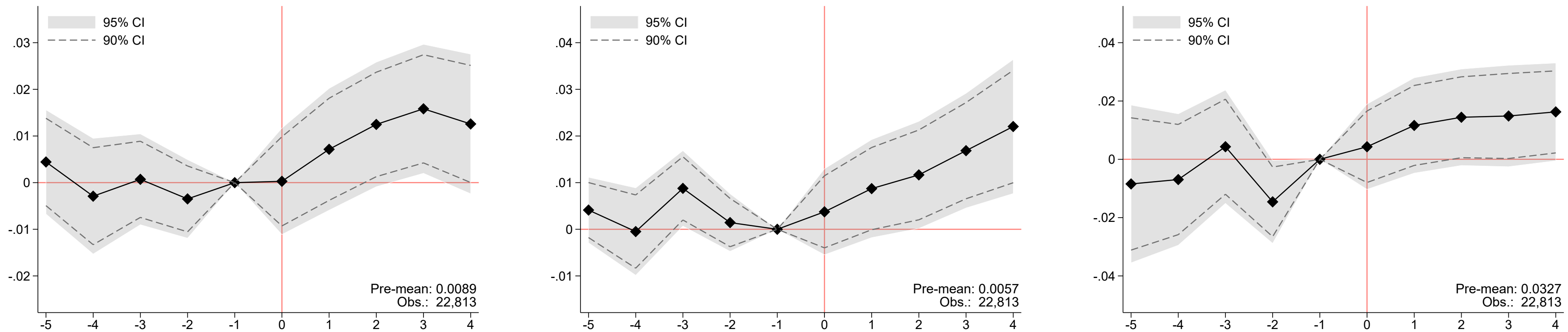


Notes: The figure plots the estimated coefficients and their 90% and 95% confidence intervals for the effect of a parental health shock on psychotherapy use, prescription of antidepressants, anxiolytics, sedatives, and pain drugs (see Table B.4).

Figure 10: Heterogeneous effects: Severity of disease

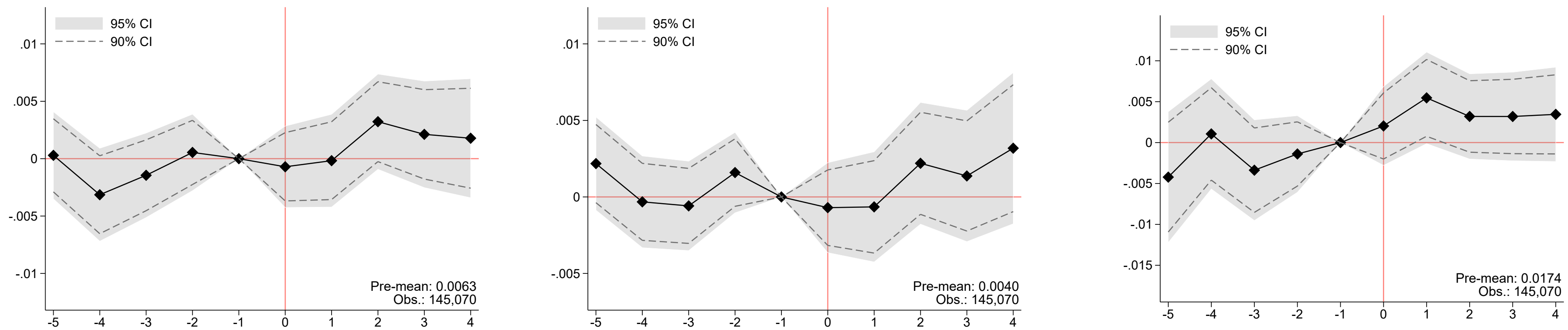
Death

Psychotherapy & Psychology | **Antidepressants, Anxiolytics & Sedatives** | **Pain Drugs**



No death

Psychotherapy & Psychology | **Antidepressants, Anxiolytics & Sedatives** | **Pain Drugs**



Notes: The figure plots the estimated coefficients and their 90% and 95% confidence intervals for the effect of a parental health shock on psychotherapy use, prescription of antidepressants, anxiolytics, sedatives, and pain drugs (see Table B.5).

Web Appendix

This online appendix is not for publication, but provides additional material discussed in the unpublished manuscript 'A Hard Pill to Swallow? Parental Health Shocks and Children's Mental Health ' by Felix Glaser and Gerald J. Pruckner. It is comprised of three sections: Section A includes descriptives for the sample of parents and the estimation table for the effect of parent's health shocks on their subsequent labor market outcomes and health care service utilization. Section B presents full estimation output for the effects of parental health shocks on children's health care services, and section C provides estimation results of the robustness analysis.

A Affected parents

Table A.1: Sample of parents: Descriptives

	Ø Full Sample	Ø Treatment	Ø Control	Diff.	Sign.	N
General (Number parents = 11713)						
Age at health shock	45.4795	45.8371	45.2505	0.5866	***	114,144
Female	0.4078	0.4169	0.4019	0.0150	***	114,144
Diagnosis						
Acute myocardial infarction (I21)	0.1705	0.1594	0.1776	-0.0182	***	114,144
Heart failure (I50)	0.0342	0.0322	0.0354	-0.0032	***	114,144
Cerebrovascular diseases (I60-I64)	0.1580	0.1601	0.1566	0.0035		114,144
Malignant neoplasms	0.6374	0.6483	0.6304	0.0178	***	114,144
Characteristics (Pre-Shock)						
Number of days in employment	283.8027	278.9284	287.0964	-8.1680	***	51,783
Number of sick leave days	15.4625	16.3842	14.8525	1.5317	***	45,482
Number of days in unemployment	23.6215	23.7821	23.5130	0.2691		51,783
Number of days in retirement	16.7445	20.2428	14.3807	5.8621	***	51,783
Outpatient expenditures[a]	303.4642	313.7608	296.5067	17.2541	***	51,783
Medication expenditures[a]	218.4397	276.6407	179.1123	97.5284	***	51,783
Inpatient expenditures[a]	607.5024	723.5835	529.0644	194.5191	***	51,783
Characteristics (Post-Shock)						
Number of days in employment	264.9895	232.4684	284.9080	-52.4396	***	62,361
Number of sick leave days	29.8430	51.6143	17.7647	33.8496	***	52,379
Number of days in unemployment	24.1814	23.4159	24.6502	-1.2343	**	62,361
Number of days in retirement	34.4521	48.5034	25.8460	22.6573	***	62,361
Outpatient expenditures[a]	452.6179	552.6459	391.3529	161.2930	***	62,361
Medication expenditures[a]	683.4799	1,291.0723	311.3426	979.7297	***	62,361
Inpatient expenditures[a]	3,087.9291	6,639.7437	912.5184	5,727.2253	***	62,361

Notes: This table presents descriptive statistics for parents in the treatment and control group. The sample includes parents who experience a first-time severe health shock between 2007 and 2019. Outcomes can be observed between 2005 and 2019. [a] Expenditures in € per year. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A.2: Estimation results: Effects of parental health shocks on health and labor market outcomes of parents

	Health Care Services			Labor Market Outcomes		
	Outpatient Expenditures[a]	Medication Expenditures[a]	Inpatient Expenditures[a]	Employed Days[b]	Sick Leave Days[b]	Retirement Days[b]
	(1)	(2)	(3)	(4)	(5)	(6)
-5 x Treated	-0.9427	-147.3953***	-209.1148**	8.6102***	-3.8483***	-2.8516*
	(10.0262)	(46.3160)	(84.3014)	(3.2842)	(0.9989)	(1.6260)
-4 x Treated	-4.4418	-103.3310**	-187.4680**	4.4686	-3.3698***	-2.7123**
	(9.1661)	(43.4229)	(81.2038)	(2.7507)	(0.9360)	(1.3596)
-3 x Treated	-4.6084	-44.6270*	-179.1168**	3.6197	-1.6647*	-2.1501**
	(8.6404)	(25.8457)	(78.7990)	(2.2318)	(0.8917)	(1.0757)
-2 x Treated	-14.7760*	-23.2966*	-185.4185**	0.3638	-2.6156***	-0.6353
	(7.6482)	(13.3596)	(77.8987)	(1.5120)	(0.7963)	(0.6462)
-1 x Treated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	(.)	(.)	(.)	(.)	(.)	(.)
0 x Treated	133.5412***	890.0163***	13455.2668***	-36.7859***	76.1375***	4.1163***
	(9.1602)	(49.5498)	(280.0895)	(1.6317)	(1.4486)	(0.7838)
1 x Treated	175.0333***	1067.8744***	5652.0219***	-60.8557***	44.5609***	20.4616***
	(12.0846)	(90.8907)	(261.5306)	(2.4007)	(1.6688)	(1.5085)
2 x Treated	148.1204***	806.4184***	2709.9495***	-44.9749***	7.2305***	23.7224***
	(12.4321)	(114.2980)	(199.6539)	(2.5837)	(1.2450)	(1.7841)
3 x Treated	145.8854***	792.0317***	2045.2626***	-35.1272***	3.6915***	19.8690***
	(13.4692)	(138.8189)	(198.1366)	(2.6780)	(1.2393)	(1.8682)
4 x Treated	103.2232***	569.9587***	1389.4798***	-29.4634***	-0.3314	17.2291***
	(13.8657)	(150.0603)	(210.5445)	(2.8060)	(1.2774)	(1.9535)
Pre-period mean of outcome	303.46	218.44	607.50	283.80	15.46	16.74
Number of affected parents	11,713	11,713	11,713	11,713	11,000	11,713
Number of observations	114,144	114,144	114,144	114,144	97,861	114,144

Notes: Regressions include shock year and birth year fixed effects, and an indicator to denote females. The sample is restricted to parents who experience a first-time severe health shock between 2007 and 2019. Outcomes can be observed between 2005 and 2019. The lines indicate the relative year to the parental health shock. [a] Expenditures in € per year. [b] Labor market outcomes in days per year. Standard errors (in parentheses) are clustered at the parental level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

B Effects on children

Table B.1: Estimation results: Effects of parental health shocks on children's service utilization

	Outpatient		Medication			Inpatient
	Psychotherapy & Psychology	GP & Pediatrician	Psychotropic	Antidepressants, Anxiolytics & Sedatives	Pain	Mental & Behavioral Disorders
	(1)	(2)	(3)	(4)	(5)	(6)
-5 x Treated	0.0007	0.0199**	-0.0023	0.0024*	-0.0045	0.0024
	(0.0019)	(0.0101)	(0.0050)	(0.0014)	(0.0040)	(0.0018)
-4 x Treated	-0.0030	0.0103	0.0019	-0.0004	0.0003	0.0007
	(0.0020)	(0.0092)	(0.0044)	(0.0014)	(0.0033)	(0.0017)
-3 x Treated	-0.0012	0.0056	0.0011	0.0006	-0.0018	0.0007
	(0.0018)	(0.0083)	(0.0038)	(0.0014)	(0.0030)	(0.0017)
-2 x Treated	-0.0001	0.0074	-0.0029	0.0015	-0.0032	0.0006
	(0.0016)	(0.0071)	(0.0032)	(0.0012)	(0.0023)	(0.0016)
-1 x Treated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	(.)	(.)	(.)	(.)	(.)	(.)
0 x Treated	-0.0005	-0.0046	0.0006	-0.0000	0.0023	-0.0003
	(0.0018)	(0.0070)	(0.0032)	(0.0015)	(0.0024)	(0.0017)
1 x Treated	0.0010	0.0067	0.0041	0.0008	0.0065**	0.0020
	(0.0020)	(0.0076)	(0.0037)	(0.0017)	(0.0027)	(0.0018)
2 x Treated	0.0047**	0.0219***	0.0078**	0.0037*	0.0050*	0.0046**
	(0.0021)	(0.0078)	(0.0039)	(0.0019)	(0.0026)	(0.0019)
3 x Treated	0.0043*	0.0199**	0.0092**	0.0038*	0.0050*	0.0009
	(0.0023)	(0.0081)	(0.0040)	(0.0021)	(0.0027)	(0.0019)
4 x Treated	0.0035	0.0355***	0.0124***	0.0062***	0.0055**	0.0040*
	(0.0025)	(0.0086)	(0.0044)	(0.0024)	(0.0028)	(0.0022)
Pre-period mean of outcome	0.0067	0.7857	0.0369	0.0042	0.0194	0.0052
Number of children	18,277	18,277	18,277	18,277	18,277	18,277
Number of affected parents	11,760	11,760	11,760	11,760	11,760	11,760
Number of observations	167,883	167,883	167,883	167,883	167,883	167,883

Notes: Regressions include shock year, birth year, and parental age at shock fixed effects, and an indicator to denote females. The sample is restricted to children who experience a first-time parental health shock between 2007 and 2019. Outcomes can be observed between 2005 and 2019. The lines indicate the relative year to the parental health shock. All outcome variables are measured as dummy variables (0/1). Standard errors (in parentheses) are clustered at the parental level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table B.2: Heterogeneous effects: Different age groups

	Outpatient		Medication			Inpatient
	Psychotherapy & Psychology	GP & Pediatrician	Psychotropic	Antidepressants, Anxiolytics & Sedatives	Pain	Mental & Behavioral Disorders
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: 2 to 13 years						
0 x Treated	0.0021	-0.0005	0.0058	-0.0002	0.0062*	-0.0012
	(0.0025)	(0.0090)	(0.0043)	(0.0013)	(0.0036)	(0.0021)
1 x Treated	0.0017	0.0200**	0.0090*	0.0014	0.0131***	0.0006
	(0.0027)	(0.0098)	(0.0051)	(0.0017)	(0.0042)	(0.0020)
2 x Treated	0.0053*	0.0306***	0.0084*	0.0002	0.0091**	0.0019
	(0.0031)	(0.0103)	(0.0051)	(0.0017)	(0.0040)	(0.0022)
3 x Treated	0.0039	0.0312***	0.0171***	0.0005	0.0107***	-0.0003
	(0.0033)	(0.0107)	(0.0052)	(0.0020)	(0.0041)	(0.0023)
4 x Treated	0.0040	0.0477***	0.0186***	0.0037	0.0111***	0.0008
	(0.0036)	(0.0115)	(0.0056)	(0.0024)	(0.0043)	(0.0025)
Pre-period mean of outcome	0.0053	0.8423	0.0402	0.0030	0.0259	0.0034
Number of children	10,233	10,233	10,233	10,233	10,233	10,233
Number of affected parents	7,073	7,073	7,073	7,073	7,073	7,073
Number of observations	88,959	88,959	88,959	88,959	88,959	88,959
Panel B: 14 to 18 years						
0 x Treated	-0.0036	-0.0099	-0.0054	0.0002	-0.0023	0.0007
	(0.0025)	(0.0109)	(0.0045)	(0.0027)	(0.0028)	(0.0028)
1 x Treated	0.0001	-0.0099	-0.0017	0.0001	-0.0010	0.0036
	(0.0029)	(0.0115)	(0.0052)	(0.0032)	(0.0030)	(0.0031)
2 x Treated	0.0040	0.0106	0.0070	0.0076**	0.0004	0.0077**
	(0.0028)	(0.0116)	(0.0059)	(0.0036)	(0.0032)	(0.0032)
3 x Treated	0.0048	0.0048	-0.0002	0.0074**	-0.0015	0.0025
	(0.0030)	(0.0117)	(0.0060)	(0.0037)	(0.0030)	(0.0032)
4 x Treated	0.0031	0.0188	0.0045	0.0088**	-0.0009	0.0079**
	(0.0033)	(0.0120)	(0.0066)	(0.0043)	(0.0030)	(0.0034)
Pre-period mean of outcome	0.0082	0.7235	0.0331	0.0056	0.0122	0.0073
Number of children	9,515	9,515	9,515	9,515	9,515	9,515
Number of affected parents	7,436	7,436	7,436	7,436	7,436	7,436
Number of observations	78,924	78,924	78,924	78,924	78,924	78,924

Notes: Estimation results for the younger (Panel A) and older (Panel B) age group. Regressions include shock year, birth year, and parental age at shock fixed effects, and an indicator to denote females. The sample is restricted to children who experience a first-time parental health shock between 2007 and 2019. Outcomes can be observed between 2005 and 2019. The lines indicate the relative year to the parental health shock. All outcome variables are measured as dummy variables (0/1). Standard errors (in parentheses) are clustered at the parental level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table B.3: Heterogeneous effects: Boys and girls

	Outpatient		Medication			Inpatient
	Psychotherapy & Psychology	GP & Pediatrician	Psychotropic	Antidepressants, Anxiolytics & Sedatives	Pain	Mental & Behavioral Disorders
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Boy						
0 x Treated	-0.0005	-0.0109	0.0020	0.0004	0.0038	-0.0019
	(0.0027)	(0.0097)	(0.0042)	(0.0019)	(0.0031)	(0.0023)
1 x Treated	0.0004	0.0070	0.0025	0.0000	0.0080**	-0.0009
	(0.0029)	(0.0104)	(0.0048)	(0.0023)	(0.0034)	(0.0024)
2 x Treated	0.0035	0.0315***	-0.0010	-0.0006	0.0054	0.0022
	(0.0030)	(0.0108)	(0.0052)	(0.0025)	(0.0034)	(0.0026)
3 x Treated	-0.0002	0.0159	0.0073	0.0009	0.0083**	0.0005
	(0.0032)	(0.0110)	(0.0054)	(0.0027)	(0.0033)	(0.0028)
4 x Treated	0.0011	0.0307***	0.0108*	0.0041	0.0091***	0.0034
	(0.0036)	(0.0117)	(0.0057)	(0.0030)	(0.0033)	(0.0031)
Pre-period mean of outcome	0.0076	0.7907	0.0411	0.0044	0.0200	0.0056
Number of children	9,398	9,398	9,398	9,398	9,398	9,398
Number of affected parents	7,467	7,467	7,467	7,467	7,467	7,467
Number of observations	86,892	86,892	86,892	86,892	86,892	86,892
Panel B: Girl						
0 x Treated	-0.0006	0.0020	-0.0008	-0.0004	0.0006	0.0014
	(0.0022)	(0.0099)	(0.0046)	(0.0021)	(0.0035)	(0.0025)
1 x Treated	0.0015	0.0063	0.0056	0.0017	0.0050	0.0052*
	(0.0027)	(0.0106)	(0.0054)	(0.0026)	(0.0040)	(0.0027)
2 x Treated	0.0060**	0.0115	0.0171***	0.0083***	0.0047	0.0071**
	(0.0028)	(0.0110)	(0.0055)	(0.0029)	(0.0038)	(0.0028)
3 x Treated	0.0091***	0.0243**	0.0111*	0.0069**	0.0014	0.0015
	(0.0030)	(0.0115)	(0.0057)	(0.0032)	(0.0039)	(0.0028)
4 x Treated	0.0060*	0.0405***	0.0137**	0.0084**	0.0017	0.0047
	(0.0035)	(0.0123)	(0.0066)	(0.0038)	(0.0044)	(0.0030)
Pre-period mean of outcome	0.0056	0.7803	0.0323	0.0041	0.0188	0.0048
Number of children	8,879	8,879	8,879	8,879	8,879	8,879
Number of affected parents	7,105	7,105	7,105	7,105	7,105	7,105
Number of observations	80,991	80,991	80,991	80,991	80,991	80,991

Notes: Estimation results for boys (Panel A) and girls (Panel B). Regressions include shock year, birth year, and parental age at shock fixed effects, and an indicator to denote females. The sample is restricted to children who experience a first-time parental health shock between 2007 and 2019. Outcomes can be observed between 2005 and 2019. The lines indicate the relative year to the parental health shock. All outcome variables are measured as dummy variables (0/1). Standard errors (in parentheses) are clustered at the parental level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table B.4: Heterogeneous effects: Blue- and white-collar children

	Outpatient		Medication			Inpatient
	Psychotherapy & Psychology	GP & Pediatrician	Psychotropic	Antidepressants, Anxiolytics & Sedatives	Pain	Mental & Behavioral Disorders
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Blue Collar						
0 x Treated	-0.0020	-0.0231**	-0.0004	-0.0016	0.0013	0.0014
	(0.0028)	(0.0110)	(0.0053)	(0.0024)	(0.0041)	(0.0031)
1 x Treated	0.0025	0.0109	0.0138**	0.0011	0.0172***	0.0032
	(0.0033)	(0.0120)	(0.0066)	(0.0028)	(0.0051)	(0.0030)
2 x Treated	0.0065*	0.0287**	0.0164**	0.0037	0.0111**	0.0066**
	(0.0036)	(0.0124)	(0.0068)	(0.0032)	(0.0048)	(0.0031)
3 x Treated	0.0063	0.0225*	0.0120*	-0.0005	0.0121**	0.0009
	(0.0041)	(0.0130)	(0.0068)	(0.0034)	(0.0048)	(0.0031)
4 x Treated	0.0086**	0.0392***	0.0082	0.0023	0.0089*	0.0042
	(0.0044)	(0.0139)	(0.0074)	(0.0037)	(0.0051)	(0.0036)
Pre-period mean of outcome	0.0065	0.8055	0.0359	0.0037	0.0205	0.0056
Number of children	6,737	6,737	6,737	6,737	6,737	6,737
Number of affected parents	4,264	4,264	4,264	4,264	4,264	4,264
Number of observations	63,180	63,180	63,180	63,180	63,180	63,180
Panel B: White Collar						
0 x Treated	0.0017	0.0111	-0.0009	0.0010	-0.0004	-0.0020
	(0.0024)	(0.0111)	(0.0038)	(0.0019)	(0.0019)	(0.0018)
1 x Treated	0.0006	0.0157	0.0014	-0.0012	0.0037*	0.0011
	(0.0027)	(0.0118)	(0.0040)	(0.0022)	(0.0019)	(0.0022)
2 x Treated	0.0017	0.0297**	0.0062	0.0048*	0.0018	0.0018
	(0.0027)	(0.0123)	(0.0045)	(0.0025)	(0.0022)	(0.0023)
3 x Treated	0.0035	0.0226*	0.0074	0.0060**	-0.0009	0.0023
	(0.0030)	(0.0126)	(0.0049)	(0.0028)	(0.0022)	(0.0025)
4 x Treated	0.0010	0.0437***	0.0128**	0.0062*	0.0014	0.0030
	(0.0034)	(0.0135)	(0.0057)	(0.0034)	(0.0023)	(0.0026)
Pre-period mean of outcome	0.0049	0.7647	0.0203	0.0028	0.0045	0.0029
Number of children	7,755	7,755	7,755	7,755	7,755	7,755
Number of affected parents	5,003	5,003	5,003	5,003	5,003	5,003
Number of observations	71,249	71,249	71,249	71,249	71,249	71,249

Notes: Estimation results for blue -collar (Panel A) and white-collar (Panel B) children. Regressions include shock year, birth year, and parental age at shock fixed effects, and an indicator to denote females. The sample is restricted to children who experience a first-time parental health shock between 2007 and 2019. Outcomes can be observed between 2005 and 2019. The lines indicate the relative year to the parental health shock. All outcome variables are measured as dummy variables (0/1). Standard errors (in parentheses) are clustered at the parental level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table B.5: Heterogeneous effects: Severity of disease

	Outpatient		Medication			Inpatient
	Psychotherapy & Psychology	GP & Pediatrician	Psychotropic	Antidepressants, Anxiolytics & Sedatives	Pain	Mental & Behavioral Disorders
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Death						
0 x Treated	0.0003	-0.0088	-0.0019	0.0037	0.0043	0.0035
	(0.0058)	(0.0184)	(0.0096)	(0.0047)	(0.0074)	(0.0055)
1 x Treated	0.0071	0.0230	0.0201*	0.0087	0.0116	0.0004
	(0.0067)	(0.0205)	(0.0111)	(0.0054)	(0.0083)	(0.0052)
2 x Treated	0.0125*	0.0442**	0.0292**	0.0117**	0.0144*	0.0134**
	(0.0068)	(0.0204)	(0.0117)	(0.0058)	(0.0084)	(0.0057)
3 x Treated	0.0158**	0.0617***	0.0253**	0.0169***	0.0149*	0.0034
	(0.0070)	(0.0215)	(0.0117)	(0.0063)	(0.0089)	(0.0060)
4 x Treated	0.0126*	0.0698***	0.0381***	0.0220***	0.0163*	0.0105
	(0.0076)	(0.0229)	(0.0130)	(0.0073)	(0.0085)	(0.0066)
Pre-period mean of outcome	0.0089	0.7728	0.0493	0.0057	0.0327	0.0065
Number of children	2,536	2,536	2,536	2,536	2,536	2,536
Number of affected parents	1,688	1,688	1,688	1,688	1,688	1,688
Number of observations	22,813	22,813	22,813	22,813	22,813	22,813
Panel B: No Death						
0 x Treated	-0.0007	-0.0033	0.0010	-0.0007	0.0020	-0.0009
	(0.0018)	(0.0076)	(0.0033)	(0.0015)	(0.0025)	(0.0018)
1 x Treated	-0.0002	0.0036	0.0009	-0.0006	0.0055*	0.0023
	(0.0021)	(0.0081)	(0.0039)	(0.0018)	(0.0029)	(0.0020)
2 x Treated	0.0032	0.0180**	0.0038	0.0022	0.0032	0.0030
	(0.0021)	(0.0085)	(0.0041)	(0.0020)	(0.0027)	(0.0020)
3 x Treated	0.0021	0.0123	0.0063	0.0014	0.0032	0.0002
	(0.0024)	(0.0088)	(0.0043)	(0.0022)	(0.0028)	(0.0020)
4 x Treated	0.0018	0.0284***	0.0075	0.0032	0.0035	0.0028
	(0.0026)	(0.0094)	(0.0047)	(0.0025)	(0.0029)	(0.0023)
Pre-period mean of outcome	0.0063	0.7876	0.0350	0.0040	0.0174	0.0050
Number of children	15,741	15,741	15,741	15,741	15,741	15,741
Number of affected parents	10,072	10,072	10,072	10,072	10,072	10,072
Number of observations	145,070	145,070	145,070	145,070	145,070	145,070

Notes: Estimation results for fatal (Panel A) and non-fatal (Panel B) health shocks. Regressions include shock year, birth year, and parental age at shock fixed effects, and an indicator to denote females. The sample is restricted to children who experience a first-time parental health shock between 2007 and 2019. Outcomes can be observed between 2005 and 2019. The lines indicate the relative year to the parental health shock. All outcome variables are measured as dummy variables (0/1). Standard errors (in parentheses) are clustered at the parental level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table B.6: Heterogeneous effects: Type of disease

	Outpatient		Medication			Inpatient
	Psychotherapy & Psychology	GP & Pediatrician	Psychotropic	Antidepressants, Anxiolytics & Sedatives	Pain	Mental & Behavioral Disorders
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Cancer						
0 x Treated	0.0011	-0.0023	-0.0001	-0.0004	0.0023	-0.0015
	(0.0021)	(0.0088)	(0.0038)	(0.0017)	(0.0028)	(0.0021)
1 x Treated	0.0019	0.0128	0.0027	0.0003	0.0045	0.0010
	(0.0024)	(0.0095)	(0.0043)	(0.0021)	(0.0031)	(0.0021)
2 x Treated	0.0053**	0.0163*	0.0067	0.0037	0.0037	0.0049**
	(0.0026)	(0.0098)	(0.0046)	(0.0022)	(0.0029)	(0.0023)
3 x Treated	0.0073**	0.0226**	0.0123**	0.0055**	0.0049	0.0028
	(0.0028)	(0.0100)	(0.0049)	(0.0024)	(0.0032)	(0.0024)
4 x Treated	0.0055*	0.0413***	0.0110**	0.0059**	0.0036	0.0039
	(0.0030)	(0.0109)	(0.0052)	(0.0028)	(0.0030)	(0.0025)
Pre-period mean of outcome	0.0063	0.7806	0.0335	0.0038	0.0166	0.0045
Number of children	11,851	11,851	11,851	11,851	11,851	11,851
Number of affected parents	7,595	7,595	7,595	7,595	7,595	7,595
Number of observations	108,053	108,053	108,053	108,053	108,053	108,053
Panel B: Circulatory						
0 x Treated	-0.0035	-0.0076	0.0018	0.0007	0.0022	0.0018
	(0.0031)	(0.0116)	(0.0057)	(0.0026)	(0.0044)	(0.0030)
1 x Treated	-0.0008	-0.0046	0.0068	0.0018	0.0102*	0.0042
	(0.0036)	(0.0125)	(0.0069)	(0.0032)	(0.0053)	(0.0035)
2 x Treated	0.0034	0.0334**	0.0097	0.0038	0.0076	0.0037
	(0.0036)	(0.0130)	(0.0071)	(0.0036)	(0.0051)	(0.0034)
3 x Treated	-0.0017	0.0160	0.0027	0.0006	0.0050	-0.0026
	(0.0038)	(0.0138)	(0.0070)	(0.0039)	(0.0050)	(0.0033)
4 x Treated	-0.0002	0.0253*	0.0148*	0.0068	0.0089	0.0047
	(0.0046)	(0.0143)	(0.0083)	(0.0045)	(0.0057)	(0.0043)
Pre-period mean of outcome	0.0073	0.7948	0.0428	0.0050	0.0244	0.0066
Number of children	6,426	6,426	6,426	6,426	6,426	6,426
Number of affected parents	4,165	4,165	4,165	4,165	4,165	4,165
Number of observations	59,830	59,830	59,830	59,830	59,830	59,830

Notes: Estimation results for cancer-driven (Panel A) and circulatory (Panel B) health shocks. Regressions include shock year, birth year, and parental age at shock fixed effects, and an indicator to denote females. The sample is restricted to children who experience a first-time parental health shock between 2007 and 2019. Outcomes can be observed between 2005 and 2019. The lines indicate the relative year to the parental health shock. All outcome variables are measured as dummy variables (0/1). Standard errors (in parentheses) are clustered at the parental level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table B.7: Heterogeneous effects: Low and high parental income

	Outpatient		Medication			Inpatient
	Psychotherapy & Psychology	GP & Pediatrician	Psychotropic	Antidepressants, Anxiolytics & Sedatives	Pain	Mental & Behavioral Disorders
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Low Income (below median)						
0 x Treated	0.0041	-0.0043	0.0004	-0.0006	0.0015	0.0002
	(0.0027)	(0.0107)	(0.0050)	(0.0022)	(0.0038)	(0.0028)
1 x Treated	0.0038	-0.0018	0.0138**	-0.0008	0.0185***	0.0048*
	(0.0032)	(0.0116)	(0.0058)	(0.0026)	(0.0044)	(0.0027)
2 x Treated	0.0065*	0.0199	0.0137**	0.0059**	0.0073*	0.0078***
	(0.0033)	(0.0121)	(0.0061)	(0.0030)	(0.0041)	(0.0030)
3 x Treated	0.0070*	0.0144	0.0097	0.0030	0.0073*	0.0048
	(0.0037)	(0.0125)	(0.0062)	(0.0032)	(0.0043)	(0.0029)
4 x Treated	0.0069*	0.0418***	0.0138**	0.0022	0.0090*	0.0052
	(0.0040)	(0.0134)	(0.0069)	(0.0035)	(0.0047)	(0.0032)
Pre-period mean of outcome	0.0065	0.7897	0.0371	0.0035	0.0213	0.0054
Number of children	7,424	7,424	7,424	7,424	7,424	7,424
Number of affected parents	4,713	4,713	4,713	4,713	4,713	4,713
Number of observations	68,447	68,447	68,447	68,447	68,447	68,447
Panel B: High Income (above median)						
0 x Treated	-0.0041*	-0.0052	-0.0006	0.0007	-0.0008	-0.0013
	(0.0024)	(0.0116)	(0.0039)	(0.0021)	(0.0019)	(0.0022)
1 x Treated	-0.0019	0.0220*	0.0012	-0.0004	0.0026	-0.0011
	(0.0028)	(0.0122)	(0.0046)	(0.0024)	(0.0025)	(0.0025)
2 x Treated	0.0009	0.0380***	0.0080	0.0016	0.0057**	-0.0002
	(0.0029)	(0.0125)	(0.0050)	(0.0026)	(0.0029)	(0.0024)
3 x Treated	0.0012	0.0288**	0.0096*	0.0028	0.0036	-0.0016
	(0.0032)	(0.0131)	(0.0053)	(0.0028)	(0.0025)	(0.0027)
4 x Treated	0.0018	0.0364***	0.0079	0.0060*	0.0013	0.0012
	(0.0037)	(0.0140)	(0.0059)	(0.0036)	(0.0025)	(0.0030)
Pre-period mean of outcome	0.0050	0.7781	0.0196	0.0030	0.0044	0.0032
Number of children	7,350	7,350	7,350	7,350	7,350	7,350
Number of affected parents	4,725	4,725	4,725	4,725	4,725	4,725
Number of observations	68,419	68,419	68,419	68,419	68,419	68,419

Notes: Estimation results for children of affected low income (Panel A) and high-income (Panel B) parents. Regressions include shock year, birth year, and parental age at shock fixed effects, and an indicator to denote females. The sample is restricted to children who experience a first-time parental health shock between 2007 and 2019. Outcomes can be observed between 2005 and 2019. The lines indicate the relative year to the parental health shock. All outcome variables are measured as dummy variables (0/1). Standard errors (in parentheses) are clustered at the parental level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table B.8: Heterogeneous effects: Shock of mother and father

	Outpatient		Medication			Inpatient
	Psychotherapy & Psychology	GP & Pediatrician	Psychotropic	Antidepressants, Anxiolytics & Sedatives	Pain	Mental & Behavioral Disorders
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Health shock of mother						
0 x Treated	0.0011	0.0070	0.0023	-0.0005	0.0034	0.0010
	(0.0028)	(0.0114)	(0.0050)	(0.0021)	(0.0036)	(0.0029)
1 x Treated	0.0006	0.0062	0.0045	0.0027	0.0063	0.0029
	(0.0032)	(0.0120)	(0.0055)	(0.0027)	(0.0040)	(0.0027)
2 x Treated	0.0064*	0.0136	0.0003	0.0047	0.0011	0.0068**
	(0.0034)	(0.0124)	(0.0058)	(0.0029)	(0.0037)	(0.0030)
3 x Treated	0.0038	0.0159	0.0069	0.0055*	0.0056	0.0049
	(0.0038)	(0.0127)	(0.0062)	(0.0032)	(0.0041)	(0.0031)
4 x Treated	0.0025	0.0374***	0.0109*	0.0067*	0.0032	0.0053
	(0.0041)	(0.0138)	(0.0065)	(0.0036)	(0.0040)	(0.0033)
Pre-period mean of outcome	0.0075	0.7840	0.0347	0.0038	0.0175	0.0050
Number of children	7,542	7,542	7,542	7,542	7,542	7,542
Number of affected parents	4,850	4,850	4,850	4,850	4,850	4,850
Number of observations	68,580	68,580	68,580	68,580	68,580	68,580
Panel B: Health shock of father						
0 x Treated	-0.0017	-0.0125	-0.0005	0.0002	0.0015	-0.0013
	(0.0023)	(0.0088)	(0.0041)	(0.0020)	(0.0031)	(0.0022)
1 x Treated	0.0013	0.0070	0.0037	-0.0006	0.0067*	0.0014
	(0.0026)	(0.0098)	(0.0049)	(0.0023)	(0.0037)	(0.0025)
2 x Treated	0.0034	0.0282***	0.0130**	0.0029	0.0079**	0.0029
	(0.0026)	(0.0101)	(0.0052)	(0.0026)	(0.0036)	(0.0025)
3 x Treated	0.0045	0.0228**	0.0105**	0.0025	0.0045	-0.0019
	(0.0028)	(0.0105)	(0.0053)	(0.0027)	(0.0036)	(0.0025)
4 x Treated	0.0041	0.0345***	0.0132**	0.0058*	0.0072*	0.0031
	(0.0032)	(0.0111)	(0.0060)	(0.0032)	(0.0038)	(0.0030)
Pre-period mean of outcome	0.0061	0.7869	0.0383	0.0045	0.0207	0.0054
Number of children	10,735	10,735	10,735	10,735	10,735	10,735
Number of affected parents	6,910	6,910	6,910	6,910	6,910	6,910
Number of observations	99,303	99,303	99,303	99,303	99,303	99,303

Notes: Estimation results for children of affected mothers (Panel A) and fathers (Panel B). Regressions include shock year, birth year, and parental age at shock fixed effects, and an indicator to denote females. The sample is restricted to children who experience a first-time parental health shock between 2007 and 2019. Outcomes can be observed between 2005 and 2019. The lines indicate the relative year to the parental health shock. All outcome variables are measured as dummy variables (0/1). Standard errors (in parentheses) are clustered at the parental level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

C Robustness analysis

Table C.1: Different specifications of τ

	P(Psychotherapy and Psychology)					P(Medication for Nervous System)					P(Inpatient Stays for Mental and Behavioral Disorders)				
	$\tau = 3$	$\tau = 4$	$\tau = 5$	$\tau = 6$	$\tau = 7$	$\tau = 3$	$\tau = 4$	$\tau = 5$	$\tau = 6$	$\tau = 7$	$\tau = 3$	$\tau = 4$	$\tau = 5$	$\tau = 6$	$\tau = 7$
-5 x Treated	-0.0015	-0.0038*	0.0007	-0.0003	0.0014	0.0015	-0.0005	-0.0023	0.0044	0.0032	0.0019	0.0017	0.0024	0.0027	0.0025
	(0.0020)	(0.0023)	(0.0019)	(0.0019)	(0.0021)	(0.0042)	(0.0049)	(0.0050)	(0.0054)	(0.0058)	(0.0018)	(0.0019)	(0.0018)	(0.0020)	(0.0019)
-4 x Treated	-0.0002	0.0005	-0.0030	0.0016	0.0035*	0.0014	0.0008	0.0019	0.0023	0.0017	0.0002	0.0010	0.0007	0.0021	0.0013
	(0.0022)	(0.0020)	(0.0020)	(0.0019)	(0.0021)	(0.0044)	(0.0041)	(0.0044)	(0.0048)	(0.0051)	(0.0017)	(0.0017)	(0.0017)	(0.0017)	(0.0018)
-3 x Treated	-0.0010	-0.0007	-0.0012	-0.0039**	0.0017	0.0058*	-0.0007	0.0011	0.0060	0.0029	0.0004	-0.0002	0.0007	0.0015	0.0005
	(0.0018)	(0.0018)	(0.0018)	(0.0019)	(0.0018)	(0.0035)	(0.0036)	(0.0038)	(0.0042)	(0.0045)	(0.0016)	(0.0016)	(0.0017)	(0.0017)	(0.0018)
-2 x Treated	-0.0016	-0.0009	-0.0001	-0.0011	-0.0019	0.0047	-0.0014	-0.0029	0.0003	-0.0014	0.0001	0.0016	0.0006	0.0022	0.0006
	(0.0017)	(0.0016)	(0.0016)	(0.0016)	(0.0018)	(0.0030)	(0.0030)	(0.0032)	(0.0034)	(0.0036)	(0.0015)	(0.0015)	(0.0016)	(0.0016)	(0.0016)
-1 x Treated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)
0 x Treated	0.0005	-0.0000	-0.0005	0.0005	0.0014	0.0037	-0.0042	0.0006	0.0031	0.0003	0.0015	0.0003	-0.0003	0.0021	-0.0010
	(0.0017)	(0.0018)	(0.0018)	(0.0018)	(0.0019)	(0.0030)	(0.0031)	(0.0032)	(0.0034)	(0.0037)	(0.0016)	(0.0017)	(0.0017)	(0.0018)	(0.0020)
1 x Treated	0.0029	0.0028	0.0010	0.0013	0.0028	0.0117***	0.0064*	0.0041	0.0117***	0.0116***	0.0011	0.0027	0.0020	0.0022	0.0021
	(0.0020)	(0.0020)	(0.0020)	(0.0021)	(0.0021)	(0.0034)	(0.0036)	(0.0037)	(0.0039)	(0.0043)	(0.0017)	(0.0017)	(0.0018)	(0.0018)	(0.0019)
2 x Treated	0.0029	0.0043*	0.0047**	0.0047**	0.0033	0.0114***	0.0090**	0.0078**	0.0094**	0.0136***	0.0030	0.0025	0.0046**	0.0038*	0.0026
	(0.0024)	(0.0022)	(0.0021)	(0.0022)	(0.0023)	(0.0039)	(0.0038)	(0.0039)	(0.0042)	(0.0045)	(0.0019)	(0.0019)	(0.0019)	(0.0020)	(0.0021)
3 x Treated		0.0009	0.0043*	0.0052**	0.0047*		0.0116***	0.0092**	0.0119***	0.0100**		0.0027	0.0009	0.0029	0.0016
		(0.0025)	(0.0023)	(0.0023)	(0.0024)		(0.0041)	(0.0040)	(0.0043)	(0.0046)		(0.0020)	(0.0019)	(0.0020)	(0.0020)
4 x Treated			0.0035	0.0052**	0.0075***			0.0124***	0.0123***	0.0124**			0.0040*	0.0049**	0.0074***
			(0.0025)	(0.0025)	(0.0025)			(0.0044)	(0.0045)	(0.0048)			(0.0022)	(0.0022)	(0.0023)
5 x Treated				0.0021	0.0046*				0.0103**	0.0092*				0.0029	0.0038*
				(0.0026)	(0.0026)				(0.0046)	(0.0049)				(0.0022)	(0.0023)
6 x Treated					0.0012					0.0114**					0.0019
					(0.0027)					(0.0051)					(0.0023)
Pre-period mean of outcome	0.0077	0.0075	0.0067	0.0061	0.0058	0.0376	0.0369	0.0369	0.0370	0.0359	0.0058	0.0055	0.0052	0.0050	0.0046
Number of children	16,826	17,674	18,277	18,282	17,007	16,826	17,674	18,277	18,282	17,007	16,826	17,674	18,277	18,282	17,007
Number of affected parents	10,893	11,373	11,760	11,794	11,061	10,893	11,373	11,760	11,794	11,061	10,893	11,373	11,760	11,794	11,061
Number of observations	150,122	160,544	167,883	167,897	161,936	150,122	160,544	167,883	167,897	161,936	150,122	160,544	167,883	167,897	161,936

Notes: Regressions include shock year fixed effects, birth year fixed effects, parental age at shock fixed effects, and an indicator to denote females. The sample is restricted to children who experience a first-time parental health shock between 2007 and 2019. Outcomes can be observed between 2005 and 2019. The lines indicate the relative year to the parental health shock. All outcome variables are measured as dummy variables (0/1). Standard errors (in parentheses) are clustered at the parental level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table C.2: Descriptives Children - Expenditures

	Ø Full Sample	Ø Treatment	Ø Control	Diff.	Sign.	N
General (Number children = 18277)						
Age at parental health shock	12.1779	12.2162	12.1528	0.0634	***	167,883
Female	0.4824	0.4827	0.4823	0.0004		167,883
Health care expenditures (Pre-Shock)						
Outpatient	172.0081	172.8612	171.4449	1.4164		73,919
Medication	47.7763	51.0421	45.6200	5.4221		73,919
Inpatient	271.9063	264.3398	276.9020	-12.5622		73,919
Psychotherapy & psychology	1.9062	1.6244	2.0923	-0.4679	**	73,919
GP & pediatrician	63.9384	63.0796	64.5055	-1.4259	***	73,919
Medication for nervous system	4.2879	4.6475	4.0505	0.5970		73,919
Antidepressants, anxiolytics, sedatives	0.1787	0.2181	0.1526	0.0655	*	73,919
Anilide (e.g. Paracetamol)	0.0455	0.0417	0.0479	-0.0062	**	73,919
Inpatient stays for mental and behavioural disorders	30.7559	32.0659	29.8910	2.1749		73,919
Health care expenditures (Post-Shock)						
Outpatient	203.2252	205.6856	201.6215	4.0641	**	93,964
Medication	68.0173	81.0140	59.5454	21.4686	*	93,964
Inpatient	305.9557	339.2225	284.2706	54.9518	***	93,964
Psychotherapy & psychology	4.1165	4.9326	3.5845	1.3481	***	93,964
GP & pediatrician	61.9524	62.7605	61.4257	1.3349	***	93,964
Medication for nervous system	7.9944	7.3364	8.4233	-1.0869		93,964
Antidepressants, anxiolytics, sedatives	0.8604	0.9056	0.8309	0.0747		93,964
Anilide (e.g. Paracetamol)	0.0310	0.0384	0.0262	0.0122	***	93,964
Inpatient stays for mental and behavioural disorders	84.0114	103.1539	71.5333	31.6206	***	93,964

Notes: This table reports descriptive statistics for children's health care expenditures in € per year. The sample includes children whose parents experience a first-time severe health shock between 2007 and 2019. Outcomes can be observed between 2005 and 2019. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table C.3: Estimation results: Expenditures

	Outpatient		Medication			Inpatient
	Psychotherapy & Psychology	GP & Pediatrician	Psychotropic	Antidepressants, Anxiolytics & Sedatives	Pain	Mental & Behavioral Disorders
	(1)	(2)	(3)	(4)	(5)	(6)
-5 x Treated	-0.4355	1.2466	0.4560	0.1198	-0.0147	5.1881
	(0.6224)	(1.7209)	(1.5204)	(0.1048)	(0.0120)	(21.2923)
-4 x Treated	-1.1070	-0.9886	0.9241	0.1079	0.0107	-14.8587
	(0.6941)	(1.4357)	(1.2459)	(0.1181)	(0.0100)	(20.9505)
-3 x Treated	-0.8168	-0.8513	0.9026	0.1215	-0.0092	-21.1286
	(0.6415)	(1.2287)	(1.1794)	(0.1096)	(0.0097)	(26.8937)
-2 x Treated	-0.1810	-1.4613	1.0472	0.1661**	-0.0007	-5.8573
	(0.5485)	(1.0303)	(0.8654)	(0.0720)	(0.0069)	(24.7630)
-1 x Treated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	(.)	(.)	(.)	(.)	(.)	(.)
0 x Treated	-0.8363	-1.0964	-1.2418	-0.1332	0.0102	15.9666
	(0.5621)	(0.9595)	(0.8305)	(0.1211)	(0.0067)	(14.2234)
1 x Treated	0.9753	2.6621**	-0.3945	-0.0933	0.0219***	23.8320
	(0.8997)	(1.0965)	(1.2602)	(0.1934)	(0.0077)	(27.4132)
2 x Treated	2.7673***	2.9732**	-0.6181	0.1071	0.0186**	45.0622
	(1.0258)	(1.1644)	(1.5217)	(0.1747)	(0.0074)	(35.8324)
3 x Treated	1.3747	3.0744**	-1.3206	0.3658*	0.0132*	17.4286
	(0.9842)	(1.2261)	(1.8302)	(0.2039)	(0.0076)	(32.5223)
4 x Treated	2.4509**	3.1799**	-1.3879	0.3418	0.0158**	7.7754
	(1.2073)	(1.3661)	(1.9580)	(0.2439)	(0.0073)	(40.9158)
Pre-period mean of outcome	1.9062	63.9384	4.2879	0.1787	0.0455	30.7559
Number of children	18,277	18,277	18,277	18,277	18,277	18,277
Number of affected parents	11,760	11,760	11,760	11,760	11,760	11,760
Number of observations	167,883	167,883	167,883	167,883	167,883	167,883

Notes: Regressions include shock year, birth year, and parental age at shock fixed effects, and an indicator to denote females. The sample is restricted to children who experience a first-time parental health shock between 2007 and 2019. Outcomes can be observed between 2005 and 2019. The lines indicate the relative year to the parental health shock. Expenditures are expressed in € per year. Standard errors (in parentheses) are clustered at the parental level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.