Effects of a parental health shock to adult children's income- The role of informal long-term care *

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— PRELIMINARY VERSION, PLEASE DO NOT CIRCULATE —

Abstract

We analyze the dynamic effects of a parental health shock and the related informal care provision on employment, earnings and public transfers of adult children and their partners. We use unique data from the Netherlands which combines intergenerational administrative data and survey data including information about informal care provision. For the identification of a causal effect we use the sudden and unexpected parental health shock in an event-study design. We show that a sudden parental health shock reduces employment by about 0.14 percentage point (0.2%) and earnings by about €163 per year (0.4%) over the five years after the shock. We further show that disability benefits partially mitigate the earnings effect while there are no compensating effects from unemployment benefits and other transfers. The adverse employment and earnings effects are larger on the household level since earnings of the partner are also negatively affected by the parental health shock. Finally, the decrease in earnings for informal caregivers is much larger (€-1,799 or -5.2%) than for the overall study population suggesting that caregiving is the main mechanism.

*The results presented in this article are based on calculations by the authors using non-public microdata from Statistics Netherlands (CBS). The datasets used include the Gezondheidsmonitor Volwassenen en Ouderen 2016 and 2020, provided by the GGDs, CBS and RIVM. Under certain conditions and a confidentiality agreement, these microdata are accessible for statistical and scientific research. For further information: microdata@cbs.nl. We thank for financial support by the German Science Foundation via CRC TRR 190 (project number 280092119) and FOR 5675 (project number 518302089)

1 Introduction

The organization of long-term care (LTC) is a key challenge for welfare states in all OECD countries. The demand for LTC services has been increasing in the past and is expected to grow even further (OECD 2023). LTC provision consists of a combination of informal care and formal community-based or institutional care arrangements that the care-dependent person and family members choose. Informal care, which is in general provided by spouses or children, plays an important role in all countries. Globally, 748 million people (708 million women; 40 million men) do not have a job because of unpaid care work (ILO 2023). While care for dependent children is traditionally responsible for the bulk of unpaid care work, in the Netherlands, the old-age dependency ratio exceeds the young-age dependency ratio (CBS 2025) suggesting the former is rapidly becoming more relevant. In monetary terms, the opportunity costs of informal long term care are estimated to be 1-2% of GDP (Gruber & McGarry 2025).

In addition to the direct opportunity cots, informal care may cause negative employment and earnings effects for the care providers and can thus lead to long-lasting detrimental career effects. Previous studies provide evidence for these spillover effects by showing that sudden negative health shocks of parents have long-lasting negative implications for employment and earnings of their children (Frimmel et al. 2025, Chen et al. 2024, Massner & Wikström 2025).

In this paper we extend the literature in two important dimensions. First, in addition to potential negative employment and earnings effects for children, we analyze the implications of a sudden parental health shock for total income of the child both at the individual and the household level. This is necessary in in order to quantify the full indirect effects of parental health shocks on children. Specifically, public transfers, including pensions, may provide insurance and help mitigate the adverse impact on earnings. In addition, parental health shocks can also influence the employment and earnings of the partner. The effect on the partner is ambiguous: on the one hand, the partner may compensate for the earnings loss through an added worker effect, as documented in the case of spousal unemployment (e.g., Halla et al. 2020). On the other hand, the partner's employment and earnings may also decline due to increased involvement in informal caregiving or the need to substitute for other caregiving duties within the household. As second contribution of the paper we provide evidence about the mechanism for the spill-over effect of a parental health shock on children and link the effect to informal care provision. Thus, we can speak not only to the overall effect of a parental health shock but

can also separately analyze the effect for children who provide informal care.

For the analysis we use unique data from the Netherlands which combines inter-generational administrative data for the period 1999 to 2023 and hospitalization data for the period 2013 to 2021 with a survey with more than 450,000 observations per wave including information about informal care provision. This data allows us to link information of parents who experience a health shock with labor market information, earnings and information of public transfers of their children and their partners. In contrast to the previous literature, we observe for a sizable subsample of the data (about 6500 observations) if children provide informal care or not. This feature of the data allows us to link the inter-generational effect to informal care provision of children for the parents. Our comprehensive dataset enables us to examine heterogeneous effects by gender, age, and family status.

To identify a causal effect, we follow prior literature (Frimmel et al. 2025, Chen et al. 2024) and employ a staggered difference-in-differences design, using later treated individuals as the control group. Specifically, we compare employment, earnings, and income from public transfers for children aged 35-64 and their partners, whose parents experience the same type of sudden health shock (heart attack, stroke or hip fracture) at different times.

To validate our identification strategy, we first examine outcomes for parents. Following a heart attack, stroke, or hip fracture, we observe a marked increase in the use of cardiovascular medications, which remains elevated in subsequent years, consistent with the pattern of disability benefit receipt. The use of nervous system medications, including pain killers, also rises significantly at the time of the health shock but gradually declines thereafter.

Then, in line with Frimmel et al. (2025) we show that parental health shocks related to a heart attack, a stroke or a hip fracture have a negative effect on employment and earnings of children which is increasing over time. Over the five years after the health shock employment is on average reduced by about 0.14 percentage points (–0.2%) and earnings by about €163 (–0.4%) per year. We further show that these effects are roughly similar for men and women, but differ by parental marital status (with larger effects when the parent is single rather than partnered) and by the sibling status of adult children (with larger effects when they do not have sisters).

We extend the analysis and quantify how public transfers and the social security system can mitigate the adverse effects on employment and earnings. We focus on the three most important programs in the Netherlands: disability insurance, unemployment benefits and means-tested

transfers. While we find no significant effects of unemployment benefits and means-tested transfers, we can show that take-up of disability insurance increases after a parental health shock. Specifically, disability insurance take-up increase over the three years after the parental health shock by 0.8%. This effect is driven by men and individuals who do not have sisters. We also quantify how the public transfers compensate the reduction in earnings. Overall, they reduce the earnings loss by €12, and the total individual income loss stands to €134 (corresponding to a 18% reduction of initial loss). Further, we show that the compensation for earnings losses is only driven by men.

As mentioned above, theoretically the effect of the parental health shock on earnings of the partner is ambiguous. However, we find clear evidence that the health shock has also negative effects on the partner's employment and earnings. The effect is only driven by daughters in-law and the effect size is similar to the average earnings reduction of female children. Over the five-year period after the health shock earnings of the daughter in-law is reduced by 110 euros (-0.4%) per year.

By summarizing all earnings and income effects at the household level, we can determine the overall loss in household income resulting from a parental health shock and decompose its various components. Since the earnings of both partners are negatively affected and public transfers provide only partial compensation, the negative income effects at the household level are greater in absolute terms than the individual earnings effects previously discussed in the literature. Over a five-year period, we find that household income is reduced by €195 (–0.3%).

We provide several robustness checks and placebo tests for the analyses. First, we can show that the pre-trends of all outcome variables are not significant. Second, results are not sensitive to stricter sample selections (acute hospitalization, only parents who go back home after hospitalization). Third we show that the results are robust to alternative specifications (Sun & Abraham 2021, Callaway & Sant'Anna 2021). Fourth, we show that the results do not differ when we increase data granularity (months vs. years). Finally, we show in a placebo tests that pre- and post-event outcomes are close to zero and not significant when randomly assigning the parental health shock.

In the second part of the analysis we combine the administrative data to the survey data and quantify the effect for individuals who provide informal care to better understand the mechanism of the negative inter-generational effect. First, we show that the parental health shock induces an increase in the share of individual who declare that they provide care. Then, we split

the sample between children who provide more than three hours of care and other children. We find a clear difference in the earnings effects. As expected the earnings effects for children who do not provide care are not significant. But we find sizable negative earnings effects for those who provide informal care. Over the five-year period following the health shock, earnings for this group are reduced by more than 5%.

Our paper contributes to several strands of the literature. First, we build on previous studies that examine the effects of a parental health shock on children's earnings and career trajectories (Frimmel et al. 2025, Brito & Contreras 2023, Chen et al. 2024, Norén 2020, Rellstab et al. 2020), or on their sick leave take-up (Lizardi et al. 2024, Norén 2020). We extend this literature in several ways. Rather than focusing solely on children's earnings or sick leave, we systematically quantify both earnings and the compensating effects of unemployment benefits, disability benefits, welfare programs, and the pension system. Moreover, we analyze the implications at the household level by also accounting for the effects on the partner. With these extensions, we provide novel and broader evidence on the effects of a sudden parental health shock on children. Moreover, since we observe adult children from labor market entry to retirement, we are able to study heterogeneous effects across different stages of the working life. This is important, as employment and earnings trajectories – as well as the implications of employment interruptions – differ significantly depending on career stage. We thus extend previous analyses (e.g. Frimmel et al. 2025), which focused on a relatively young sample, which may differ from the typical population experiencing parental health shocks. Relatedly, we examine heterogeneity by family status and earnings position within the household. Finally, our results also contribute to understanding the career and earnings effects of informal caregiving, as we can separately analyze the impact on children who provide informal care.

Second, our study relates to the literature examining the relationship between informal care provision and formal employment, typically based on survey data that include caregiving information (see Bauer & Sousa-Poza 2015, for a review). Most studies in this literature find a negative association between informal care and employment and working hours (Heger & Korfhage 2020, Simard-Duplain 2022, Korfhage & Fischer-Weckemann 2024). However, the decision to provide informal care is endogenous to labor market outcomes, as caregivers tend to have lower income and weaker labor market attachment even before they begin caregiving (Maestas et al. 2024). Nonetheless, Maestas et al. also document a further decline in earnings and employment following the onset of caregiving. Our identification strategy differs from

theses studies by leveraging sudden parental health shocks, which are arguably exogenous, rather than relying on self-reported entry into informal care.[1] Our approach also differs from Korfhage & Fischer-Weckemann (2024), who quantify the negative employment effects of caregiving using a structural life-cycle model.

Finally, our paper contributes to the broader literature on the impact of negative health shocks on labor market outcomes. Most existing studies have focused on the effects of individuals' own health shocks (García-Gómez et al. 2013, Dobkin et al. 2018), while those examining family spillovers have primarily focused on spouses (García-Gómez et al. 2013, Fadlon & Nielsen 2021).

2 Institutional context

2.1 Healthcare in the Netherlands

The Netherlands maintains a universal, comprehensive social health insurance system that covers hospitalizations at all regular hospitals. Rehabilitation care following hospitalization (comparable to Skilled Nursing Facilities in the United States) and home care are covered through public health insurance in the Netherlands.[2] Permanent nursing home admissions and alternative care in non-institutional settings are covered through universal public long-term care insurance. Additionally, municipalities provide support services, subsidized housing adaptations, and caregiver support programs. Virtually all long-term care is publicly funded (Bakx et al. 2023), with supplementary private health insurance covering additional outpatient services, such as extra physical therapy or prescription glasses.

In addition to formal care, many individuals with functional limitations receive informal care from relatives, friends, or others. 13% percent of the adult population report providing informal care. The average caregiver provides 12 hours of care per week; 19% report that caregiving is a heavy burden[3]. Approximately 75% of all caregivers are aged 40–69; 60% are women (Bakx et al. 2023).

Access to healthcare is determined by care providers for hospital care, rehabilitation care

[1] It is worth noting that recent papers have leveraged reforms to the formal long-term care system (Shen 2024, Massner & Wikström 2025), showing that increased generosity in such programs raises the labor supply of adult children who are likely to provide care to their parents.

[2] Before 2013, rehabilitation care was covered by public long-term care insurance; home care was similarly covered before the 2015 reform.

[3] CBS. (2023). Statline series: Informal care statistics.

and home care. For a nursing home admission, an independent eligibility assessment is needed and municipalities determine eligibility for the additional support services that they organize based on pre-determined criteria (Bakx et al. 2023).

User fees for hospital care and rehabilitation care are low and consist only of the annual deductible, which is €385 and may be increased to €885 at the start of the year for an insurance premium discount. Personal care and nursing provided at home are exempt from the deductible. Most support organized by the municipality are subject to a monthly user fee of €21 [4]. Nursing home care and substitute services are subject to a copayment that is a function of age, household composition, income and wealth (Bakx et al. 2023). User fees make up a smaller share of total health care expenditures than in all-but-three other European countries and the share of households with impoverishing health spending is under 1% and the lowest in Europe (WHO Europe 2023).

There are wait lists for elective hospital care and nursing home admissions. There are no waiting lists for home care.

2.2 Public income support in the Netherlands

Individuals who work as employees receive an income over which they pay income tax at the national level. Business owners who work in their own business (e.g. as director) pay themselves a usual wage for tax purposes according to Tax Office rules. Furthermore, individuals may be self-employed.

The labor force participation rate in the Netherlands is high compared to the OECD average (85.4% of the 25-64 year-old)[5]. Part-time work is common, particularly among women (female: 52% of the working-age population; male: 18%) and the highest among industrialized countries[6].

All employees have the right to care leave when providing informal care. Short-term care leave up to ten days per year is paid at least 70% of the regular wage rate; very few caregivers use the right to unpaid long-term care leave (more than 6 weeks per year).[7]

Individuals who do not work may receive welfare payments if their household income and wealth are sufficiently low. They may also be eligible for unemployment benefits, disability

[4] This fee was income-dependent before 2019.
[5] OECD Indicators: Participation rates
[6] OECD Indicators: Part-time employment rates
[7] www.cbs.nl

insurance benefits, or retirement benefits. Unemployment benefits depend on the wage earned in the last month of work, with duration based on years worked, capped at two years since 2016 (previously 38 months from 2006–2016) (Garcia-Gomez et al. 2023). Disability insurance benefits begin after a two-year waiting period, during which the employer continues to pay the regular salary; these benefits depend on pre-disability earnings and working capacity, and partial benefits may be combined with part-time work (Garcia-Gomez et al. 2023). Retirement benefits include state pensions, occupational pensions, and private pension benefits. The statutory pension age was 65 until 2012 and gradually increased to 67 between 2013 and 2024 (Rabaté et al. 2024). Early retirement schemes were abolished for most workers during the study period (Rabaté et al. 2024).

In contrast, self-employed individuals cannot claim standard unemployment or disability insurance benefits but may opt for private insurance, informal arrangements, or savings (Garcia-Gomez et al. 2023).

3 Data and strategy

3.1 Data

The study population includes all Dutch non-institutionalized residents aged 35–64 whose parent experienced a sudden health shock (defined as an acute medical event requiring hospitalization) between 2014–2021. We use register data collected and maintained by Statistics Netherlands (CBS), which cover the entire Dutch population. Each record contains a unique personal identifier, enabling us to merge datasets and construct rich individual-level information.

We use register data (2009–2023) to link adult children to their parents and, via household data, to their partners, including cohabiting partners, civil partners, and spouses. Earnings and social security benefits information is drawn from CBS socioeconomic category datasets (1999–2023), which compile data from tax records, social security, and pension funds. To identify health shocks, we use hospitalization data (2013–2021), drawing on ICD-10 diagnoses. We also use survey information linked to administrative data via the unique personal identifier. The Health Monitor (Gezondheidsmonitor), a cross-sectional survey conducted every four years by the Municipal Health Services (GGDs) and CBS, provides self-reported data on informal care provision from the 2016 and 2020 waves. Detailed information on the datasets' names and versions is presented in Appendix Table A.1.

Our analysis focuses on adult children aged below 65, the state pension age for the oldest cohort in the study population. We exploit sudden health shocks as exogenous events to estimate their spillover effects. Following previous studies (Frimmel et al. 2020, Chen et al. 2024, Lizardi et al. 2024), we focus on heart attacks, strokes, and hip fractures[8].

Hospitalization data are available from 2013 onward. We focus on the first hospitalization during the study period, using 2013 data to exclude parents with prior hospitalizations, making 2014 the earliest year for a qualifying health shock. We then follow adult children's income trajectories for five years before and after the shock, using income data from 2009–2023 (the last available year).

The study population includes all adult children whose parent experienced a health shock, including all siblings who reside in the Netherlands. For each child, we analyze the first hospitalization of either parent during the study period.

Regarding income, we set negative earnings to zero and winsorize at the 99th percentile. All values are gross income, expressed in 2023 euros using the national consumer price index.

For a subsample of individuals, we can merge information on informal care provision using data from the Health Monitor survey. Specifically, we rely on two questions: (1) "H*ave you provided informal care in the past 12 months?*" and (2) "*How many hours of informal care do you currently provide per week?*". We define an individual as a caregiver if they responded "yes" to the first question and reported at least five hours per week on the second. We also ensure that the survey occurred within one calendar year of the health shock (i.e., either in the same year or the year after).

The main outcome variables of interest are employment, earnings, and social security benefits, measured at both the individual (child and partner) and household levels. Employment is a dummy variable equal to 1 if earnings are strictly positive, and 0 otherwise. Similarly, social security benefit take-up is captured using dummy variables, equal to 1 when the corresponding benefit amount is positive, and 0 otherwise. We consider three types of benefits: unemployment insurance, disability insurance, and welfare benefit. At the household level, we sum the income sources of both partners (spouses or cohabiting partners) to construct total household income. We focus on different subpopulations throughout the paper. Below are the definitions of the various groups considered: **Civil status:** we restrict the analysis to *stable households*, defined as those with the same number of adults throughout the study period. Civil status is

[8]ICD-10 codes: heart attacks (I21); strokes (I60, I611, I622, I629, I63, I650–I652, I658–I659, I660–I663, I668–I669, I67); hip fractures (S720–S724, S727–S729)

classified as *single* for one-adult households and *couple* for two-adult households. Couples include married individuals, registered partners, and cohabitants. **Parent household type:** refers to parent's marital situation one year before the health shock. Parents can either be classified in *single parent* or *parent in a couple*. We also distinguish between **women** and **men**, between **mothers** and **fathers**, as well as individuals based on **age** (below or above 52 at the time of the health shock, with 52 being the median age in the sample), and finally whether individuals have sisters.[9]

3.2 Descriptive statistics

Our sample consists of 118,776 individuals. Table 1 provides descriptive statistics for the main analysis sample, both overall and by gender. As expected, employment rates are high in the Netherlands: one year before the parental health shock, 79% of individuals were employed. Employment is higher among men than women. In the year preceding the shock, 7% of individuals received unemployment benefits and 8% received disability benefits. Only 3% received welfare benefits, while 5% received old-age pension benefits—this includes survivor benefits for widows or widowers, as well as early retirement benefits. Average individual income is approximately €44,000, and is higher among men. On average, 77% of individuals have a partner (defined as being married, in a registered partnership, or cohabiting). Partners' income adds, on average, €33,000 to household income. In the case of single-person households, the partner's income is considered to be zero. Overall, average household income is €77,000, of which 8% come from social security benefits.

Table 2 presents the same descriptive statistics for the survey subsample. Individuals in this subsample exhibit slightly higher employment rates and earnings, although the overall picture remains broadly similar to that of the main sample. We further distinguish between individuals who reported providing care following the parental health shock and those who did not. Notably, even one year before the shock, care providers had lower employment rates and earned less on average (€37,000 vs. €48,000). They also relied more heavily on social security benefits (8% vs. 6%).

[9] We considered splitting the sample by sibling status, but the number of individuals without siblings is very small.

Table 1: Main sample: descriptive statistics of children one year before a parents health shock

Outcome	Full sample	Women	Men
Employment (%)	78.86	74.71	82.89
Earnings	40257.84	26598.24	53552.54
Unemployment insurance take-up (%)	7.24	7.07	7.41
Unemployment benefits	1058.37	825.42	1285.09
Disability insurance take-up (%)	7.83	8.23	7.44
Disability benefits	1411.76	1316.69	1504.30
Welfare take-up (%)	3.34	3.62	3.07
Welfare benefits	426.40	476.04	378.09
Pension benefits take-up (%)	5.52	5.39	5.65
Pension benefits	796.69	682.44	907.90
Social security benefits	3693.22	3300.59	4075.37
Total income	43951.07	29898.83	57627.91
Partner income			
Employment (%)	60.52	63.95	57.19
Earnings	30787.48	42374.66	19509.84
Unemployment insurance take-up (%)	5.04	5.34	4.74
Disability insurance take-up (%)	5.06	5.47	4.66
Disability benefits	922.36	1179.48	672.11
Welfare take-up (%)	0.78	0.66	0.90
Welfare benefits	66.01	57.79	74.01
Pension benefits take-up (%)	4.30	5.60	3.03
Pension benefits	774.06	1303.01	259.24
Social security benefits	2533.85	3604.02	1492.27
Total income	33321.33	45978.68	21002.11
Number of adults in the household	1.77	1.77	1.77
Household income			
Social security benefits	6227.07	6904.61	5567.64
Total income	77272.39	75877.51	78630.02
Number of observations	118776	58584	60192

SCOPE: Individuals aged 35 to 64 whose parent experienced a heart attack, a stroke or a hip fracture for the first time between 2014 and 2021.
SOURCE: Statistics Netherlands.

3.3 Identification strategy

We use an event-study design to identify the causal effect of a health shock on the employment, earnings and income trajectories of adult children. Since we do not observe individuals' income dynamics in the absence of the event, we use later-treated individuals as the control group to construct counterfactual trajectories. The experience of a health shock may be correlated with certain individual characteristics, making the group of treated individuals not directly comparable to a group of non-treated individuals whose parents do not experience a health

Table 2: Health Monitor subsample: descriptive statistics of children one year before a parents health shock

Outcome	Full sample	Women	Men	Carers	Non carers
Employment (%)	85.52	81.01	90.75	82.59	86.60
Earnings	45047.68	29980.83	62510.40	37452.08	48653.79
Unemployment insurance take-up (%)	5.74	5.58	5.93	5.98	5.59
Unemployment benefits	957.80	682.00	1277.46	999.84	930.85
Disability insurance take-up (%)	6.48	6.73	6.19	7.50	6.62
Disability benefits	1179.34	1083.60	1290.30	1420.97	1185.36
Welfare take-up (%)	1.61	1.94	1.23	1.20	1.67
Welfare benefits	198.28	231.74	159.50	154.42	198.79
Pension benefits take-up (%)	5.50	5.28	5.76	5.71	5.47
Pension benefits	730.87	617.21	862.59	846.89	711.03
Social security benefits	3066.28	2614.55	3589.85	3422.12	3026.03
Total income	48113.96	32595.38	66100.25	40874.20	51679.81
Partner income					
Employment (%)	67.90	70.51	64.86	64.90	68.44
Earnings	36543.79	48155.73	23085.38	37913.75	34946.01
Unemployment insurance take-up (%)	4.63	4.91	4.29	4.67	4.75
Disability insurance take-up (%)	4.83	4.96	4.68	6.17	4.45
Disability benefits	929.62	1102.11	729.71	1353.67	816.21
Welfare take-up (%)	0.35	0.32	0.39	0.33	0.31
Welfare benefits	28.43	23.09	34.62	28.42	22.93
Pension benefits take-up (%)	4.64	5.50	3.63	5.78	4.46
Pension benefits	758.14	1216.17	227.26	1200.01	635.70
Social security benefits	2499.20	3403.67	1450.90	3455.65	2179.43
Total income	39042.99	51559.39	24536.28	41369.40	37125.43
Number of adults in the household	1.84	1.83	1.86	1.83	1.86
Household income					
Social security benefits	5565.48	6018.22	5040.76	6877.77	5205.45
Total income	87156.95	84154.77	90636.53	82243.60	88805.25
Number of observations	6489	3483	3006	1463	3313

SCOPE: Individuals aged 35 to 64 whose parent experienced a heart attack, a stroke or a hip fracture for the first time between 2014 and 2021. Subsample of Table 1 with individuals who participated in the Health Monitor survey. The information on care provision is missing for approximately one-fourth of the overall sample.
SOURCE: Statistics Netherlands and GGDs.

shock. Therefore, to identify the causal effect of the health shock on income, we rely on the exogenous timing of the event, and compare the outcome variables, of treated individuals to those of not-yet-treated individuals who will experience a parental health shock a few years later.

The identification of the causal effect relies on assumption that the timing of the health

shock is not correlated with the outcome variables before their parents' health shock. We provide evidence for this assumption by (1) formally testing the parallel trends before the event and (2) conducting a falsification test in which the date of the health shock is randomly assigned to parents (see Section 4). Our main specification is the following:

$$Y_{it} = \alpha_i + \lambda_{b,t} + \beta_{<-5} \cdot \mathbb{1}(E_{it} < -5) + \sum_{\substack{k=-5 \\ k \neq -1}}^{5} \beta_k \cdot \mathbb{1}(E_{it} = k) + \varepsilon_{it}, \tag{1}$$

where Y_{it} denotes the outcome variable (employment, earnings, or benefits) for individual i at time t; α_i and $\lambda_{b,t}$ are individual and date of birth-by-time fixed effects, respectively. The date of birth-by-time fixed effects flexibly account for cohort-specific life-cycle events which capture potential career effects and time patterns in outcomes. The event time relative to the health shock is given by $E_{it} = k$, where k varies between 5 years before individual i's parent experienced a health shock and 5 years after. The indicator variable $\mathbb{1}(E_{it} = k)$ equals 1 if i is observed k periods after the health shock and 0 otherwise, and β_k captures the effect of the health shock at event time k. We omit event time dummy at $k = -1$, standardizing its coefficient to 0. The error term is represented by ε_{it}. We report robust standard errors clustered at the individual level.

The parameter β_k represents the dynamic treatment effect k years to the shock relative to the reference period one year before the shock. In event-study models without never-treated units, dynamic treatment effects are only identified up to a linear trend (Schmidheiny & Siegloch 2023). To address this, we follow Frimmel et al. (2025) and restrict the effect window by binning the endpoints: treatment effects are assumed constant before five years prior to the shock, and observations outside this window are assigned to the control group, which helps pin down the secular time trends.

To interpret the event-study coefficients as causal effects of the parental health shock, we assume that—after controlling for cohort-specific time effects and individual fixed effects—the timing of the shock is unrelated to the outcome variable. In other words, absent the health shock, outcomes would have evolved in parallel across individuals in the same cohort who experienced the shock at different times. Our design allows us to check this assumption by examining outcomes up to five years before the shock.

We focus on health shocks occurring between the years 2014 and 2021, which leads to a staggered adoption of the treatment. Moreover, consistent with previous literature (Frimmel

et al. 2020), we expect the effects of a health shock to evolve dynamically over time. As pointed out by recent studies (Callaway & Sant'Anna 2021, Sun & Abraham 2021), estimating event studies with staggered treatment timing requires particular caution to avoid biased results due to forbidden comparisons or contamination from early-treated cohorts. In our main estimation, we assume that households do not anticipate the parental health shock differently depending on its timing, and that treatment effects are homogeneous across cohorts. Patterns before the shock can help assess this assumption. However, to properly address the mentioned concerns, we also apply alternative estimators by Sun & Abraham (2021) and Callaway & Sant'Anna (2021) that allow for heterogeneous effects. We find results very similar to our baseline, supporting the plausibility of the homogeneity assumption (see Section 4).

4 Results

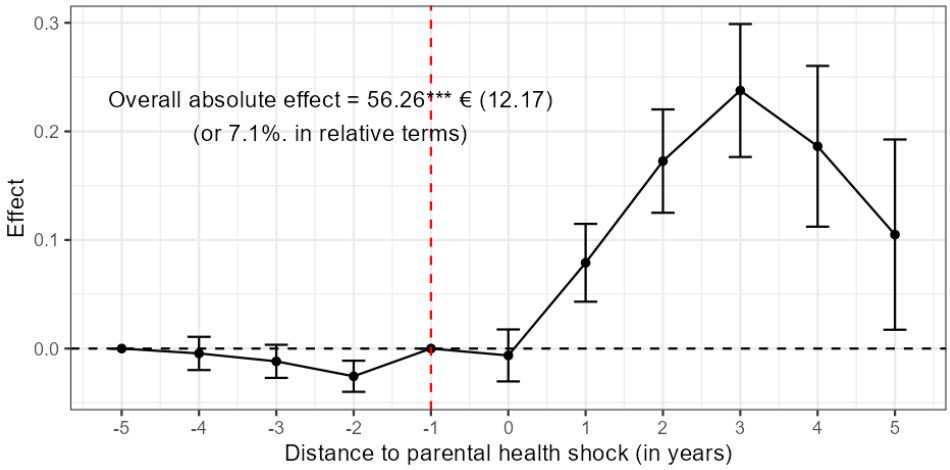
In what follows, we present the estimation results. We begin with parents' outcomes to verify our identification strategy, and then turn to their adult children. For the latter, we first examine the effects of a parental health shock on employment and earnings of their children, before extending the analysis to social security benefits. Then, we consider household-level effects by looking at the partner's earnings. In addition to the average effects we also consider heterogeneous effects. Importantly, in Section 4.5 we differentiate the effects between children with and without care provision. These findings allow us to speak to the role of providing informal care as a mechanism for the negative effect of a parental health shock for their adult children.

4.1 Effects on parents

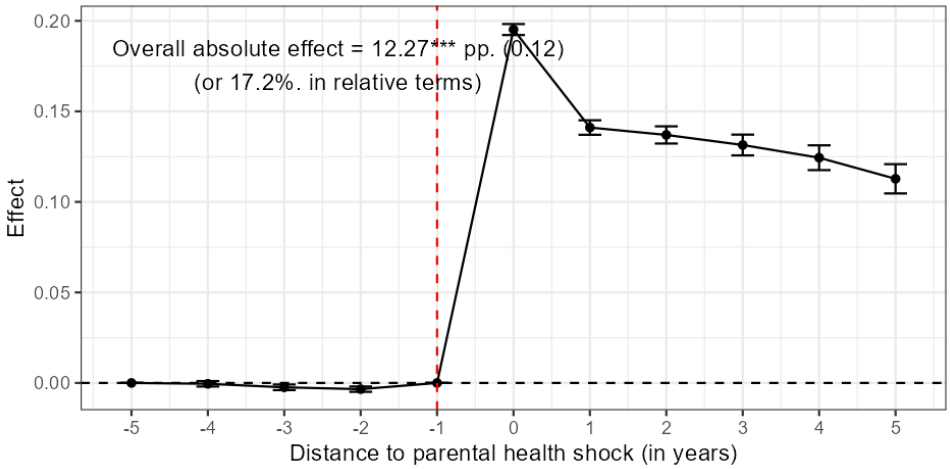
First, we verify that health-related measures increase substantially, making it plausible that such shocks trigger responses among the affected individuals' children. Figure 1 shows that following a heart attack, stroke, or hip fracture, there is a marked rise in disability benefits received. On average, benefits increase by €56, or 7.1%, relative to the baseline one year before the shock. We also observe a sharp increase in the use of cardiovascular medications, which remains elevated in subsequent years: over the five years following a health shock, consumption rises by 12.3 percentage points, corresponding to a 17.2% increase. The use of nervous system medications, which include painkillers, also increases sharply at the time of the shock but gradually declines in the following years.

Figure 1: Effects of a sudden health shock on parents disability benefits and medications

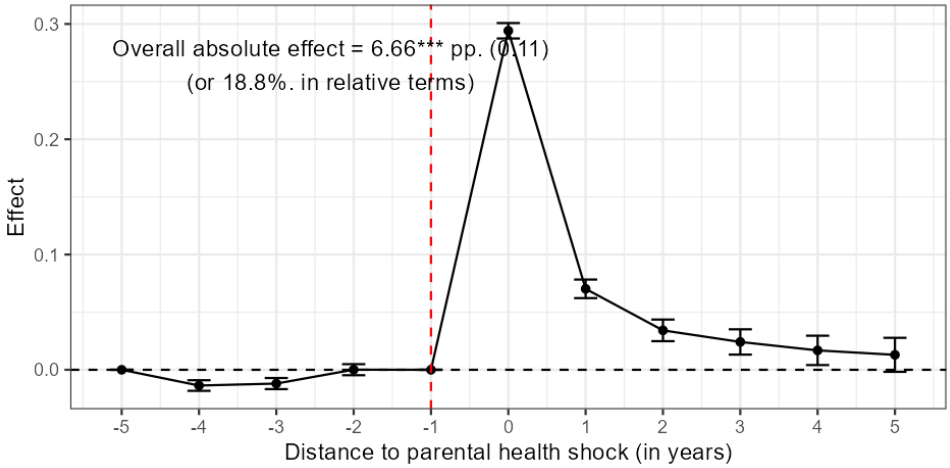
(a) Disability benefits



(b) Use of cardiovascular medications



(c) Use of nervous system medications



NOTE: Confidence intervals are at the 95% level. P-value: *** p<0.01; ** p<0.05; * p<0.1.
SCOPE: Individuals who experienced a heart attack, a stroke or a hip fracture for the first time between 2014 and 2021 and who have children aged between 35 and 64.
SOURCE: Statistics Netherlands.

4.2 Effects on individual earnings and employment

The empirical results show that a sudden parental health shock has long lasting negative effects on children's employment and earnings. While we find no pre-treatment effects in the event-study analysis, employment and earnings are strongly declining after the shock (Figure 2). Five years after the event, employment is reduced by 0.23 percentage points (0.3%) and earnings by about €431 (1.1%).

In Table 3 we present the related two-way fixed effects results and provide sensitivity checks. Over the five year period following the health shock, employment is reduced by 0.14 percentage points and yearly earnings by about €163. This corresponds to relative effects of over 0.18% for employment and 0.41% for earnings. The results are robust to several changes in specification. First, we verify that the magnitude is not sensitive to sample restrictions. Columns (2) and (3) present results for more restricted samples: column (2) includes only acute hospitalizations, while column (3) focuses on cases where the parent returned home after hospitalization. The estimates remain within the same range as our main results. Second, we test robustness to alternative specifications. In particular, we apply the estimators of Sun & Abraham (2021) and Callaway & Sant'Anna (2021), which allow for heterogeneous treatment effects across cohorts. As shown in Appendix Figure A.1, the results are very similar across specifications. Finally, we use a more granular version of the dataset, relying on individual-by-month rather than individual-by-year data. The corresponding results, displayed in Appendix Figure A.2, again show similar effects of a parental health shock on children's labor supply across time bases.

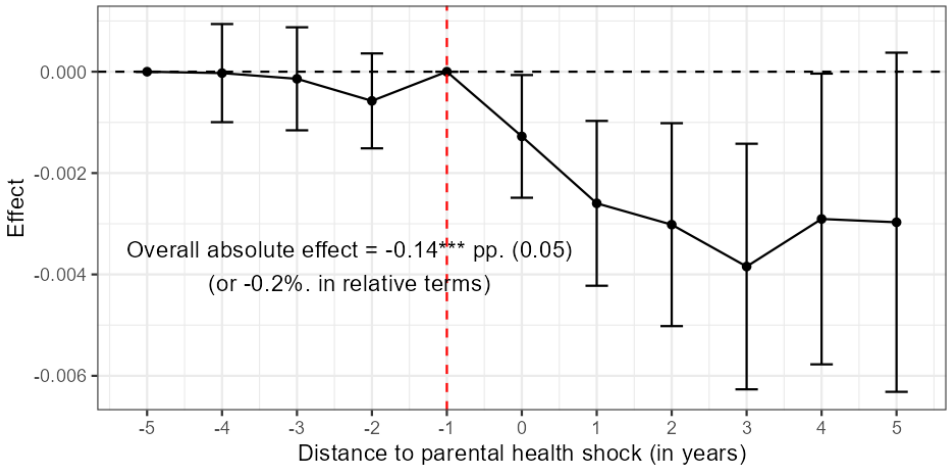
In addition, we perform a placebo analysis. Using the same specification as in our baseline, but replacing the actual parental health shock with a randomly drawn event from the observed distribution of shocks, we obtain small and statistically insignificant point estimates, as expected (see Figure 3).

The negative career effects we document are consistent with previous studies on similar health shocks. However, direct comparison of point estimates is difficult, as sample composition and institutional contexts differ across studies. For instance, Frimmel et al. (2025) find that a parental stroke reduces employment by 3.5% and earnings by 5.7%, but their analysis focuses on adult children who are, on average, 30 years old at the time of the shock, and, importantly, institutional formal care is less widespread in Austria than in our setting. In Norway—a context closer to the Netherlands institutionally—Lizardi et al. (2024) report negative effects on

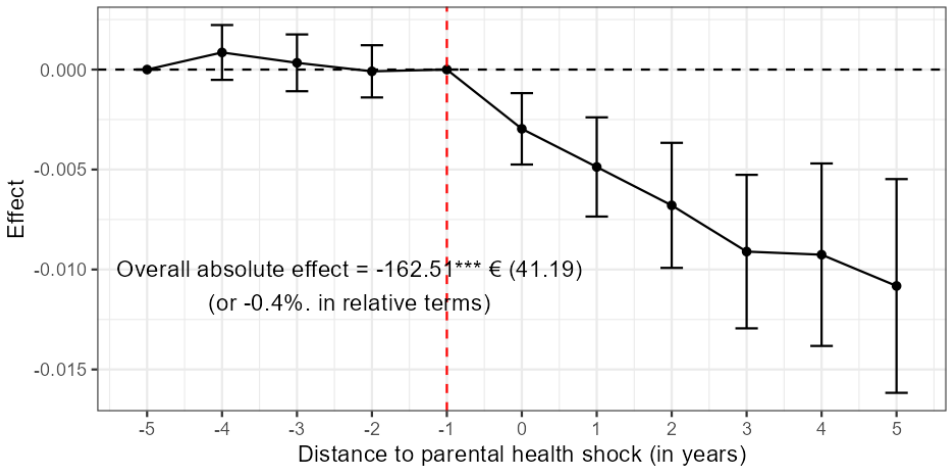
employment and earnings in the two years following the event that are similar in magnitude to ours, with earnings dropping by 0.5% of mean baseline earnings. Our results differ from the findings of Rellstab et al. (2020) who use a broader definition of a health shock and do not find negative employment or earnings effects of a parental health shock in the Netherlands.

Figure 2: Effects of a health shock on adult children employment and earnings

(a) Employment



(b) Earnings



NOTE: Earnings include income from wages, self-employment, and other activities. Employment is a dummy equal to 1 if earnings are strictly positive, and 0 otherwise. Confidence intervals are at the 95% level. P-value: *** p<0.01; ** p<0.05; * p<0.1.
SCOPE: Individuals aged 35 to 64 whose parent experienced a heart attack, a stroke or a hip fracture for the first time between 2014 and 2021.
SOURCE: Statistics Netherlands.

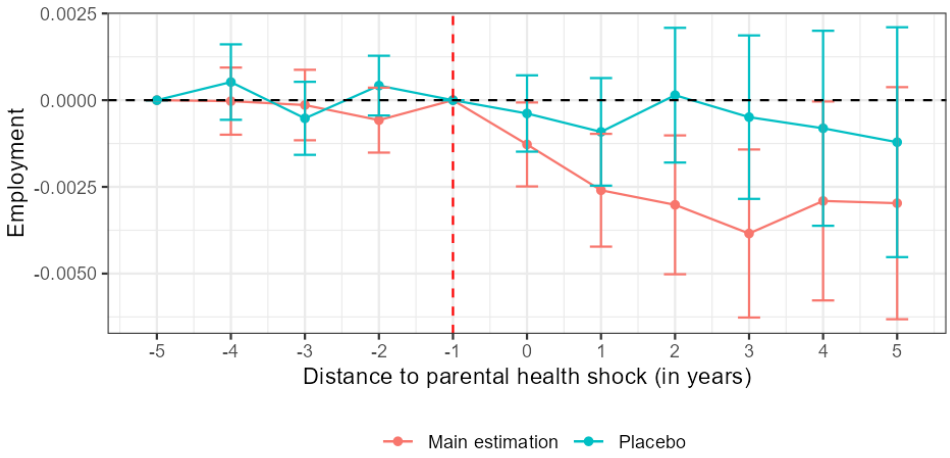
Table 3: Main estimates

	(1)	(2)	(3)
	— Employment —		
Absolute effect (p.p.)	-0.14***	-0.15***	-0.12
	(0.05)	(0.06)	(0.07)
Relative effect (%)	-0.18	-0.19	-0.15
	— Earnings —		
Absolute effect (euros)	-162.51***	-167.68***	-110.99**
	(41.19)	(43.04)	(55.74)
Relative effect (%)	-0.41	-0.42	-0.28
Sample restriction	×	acute hospi	back home
Observations	5,099,994	4,703,996	2,719,455

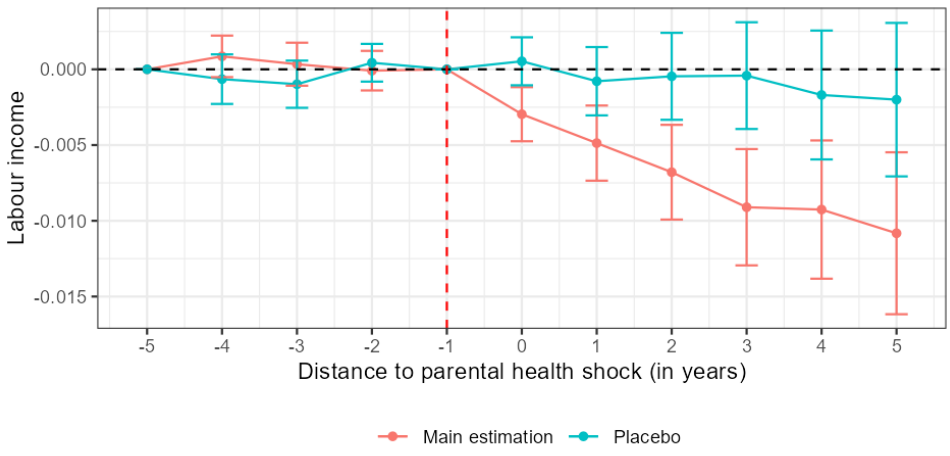
NOTE: Earnings include income from wages, self-employment, and other activities. Employment is a dummy equal to 1 if earnings are strictly positive, and 0 otherwise. Column (1) is our main specification. Columns (2) and (3) show results for more restricted samples: column (2) includes only acute hospitalisations, while column (3) focuses on cases where the parent returned home after hospitalisation. P-value: *** p<0.01; ** p<0.05; * p<0.1.
SCOPE: Individuals aged 35 to 64 whose parent experienced a heart attack, a stroke or a hip fracture for the first time between 2014 and 2021.
SOURCE: Statistics Netherlands.

Figure 3: Placebo: "fake" health shock on adult children employment and earnings

(a) Employment



(b) Earnings



NOTE: Earnings include income from wages, self-employment, and other activities. Employment is a dummy equal to 1 if earnings are strictly positive, and 0 otherwise. Confidence intervals are at the 95% level. P-value: *** p<0.01; ** p<0.05; * p<0.1.
SCOPE: Individuals aged 35 to 64 whose parent experienced a heart attack, a stroke or a hip fracture for the first time between 2014 and 2021.
SOURCE: Statistics Netherlands.

In Table 4 we focus on heterogeneous effects. We do not find meaningful differences by gender or by age. While employment effects for women and individuals above age 52 are not significant, the earnings variation (compared to the one year before the health shock) is the same for men and women, as well as for individual younger than 52 and those who are 52 or above at the time of the health shock.

In contrast, we find heterogeneity across certain individual characteristics. First, consistent with Frimmel et al. (2025), the effects are mainly driven by strokes, which lead to a 0.3% decline in employment and a 0.6% reduction in earnings. By comparison, hip fractures significantly affect only earnings, while heart attacks show no immediate impact on labor supply. This can be explained by dynamics patterns: the impact of heart attacks on children's decisions occur later, whereas those of hip fractures fade out over time (Appendix Figure A.3). Second, we expect larger responses when the affected parent is single, since parents in couples are more likely to receive care from their spouse. Consistent with this expectation, we find larger earnings effects for single parents than for partnered parents, while the employment effects are of similar magnitude in both groups. Third, consistent with the idea that siblings share the care burden, we find that the employment effects of a parental health shock are mainly driven by individuals without sisters.[10] However, the earnings effects are similar for individuals regardless of whether they have sisters.

[10]We considered splitting the sample by sibling status, but the number of individuals without siblings is very small.

Table 4: Heterogeneity estimates

	Employment effect			**Earnings effect**			
Group	Absolute (pp.)	std.	Relative (%)	Absolute (€)	std.	Relative (%)	N
				— Sex —			
women	-0.10	(0.08)	-0.13	-104.11**	(41.97)	-0.39	2,499,280
men	-0.18***	(0.07)	-0.22	-219.58***	(69.70)	-0.42	2,600,714
				— Disease type —			
heart attack	-0.04	(0.09)	-0.04	-45.46	(71.67)	-0.11	1,528,831
hip fracture	-0.15	(0.10)	-0.20	-166.84**	(75.70)	-0.42	1,650,932
stroke	-0.20**	(0.09)	-0.26	-254.68***	(67.01)	-0.64	1,920,231
				— Age at health shock —			
below 52	-0.13*	(0.07)	-0.17	-130.37**	(57.90)	-0.32	2,275,953
52 or older	-0.11	(0.08)	-0.14	-162.72***	(61.59)	-0.41	2,590,777
				— Civil status —			
single	-0.21	(0.14)	-0.37	-123.51	(80.61)	-0.50	752,754
couple	-0.12*	(0.07)	-0.14	-135.63**	(55.50)	-0.31	2,858,205
				— Parent household type —			
parent in a couple	-0.17**	(0.07)	-0.21	-166.58***	(57.97)	-0.39	2,506,314
single parent	-0.18**	(0.08)	-0.24	-229.01***	(59.25)	-0.61	2,360,416
				— Has sisters? —			
has sisters	-0.09	(0.07)	-0.11	-170.57***	(51.14)	-0.43	3,291,960
doesn't have sisters	-0.24***	(0.09)	-0.31	-149.46**	(69.56)	-0.37	1,808,034

NOTE: Earnings include income from wages, self-employment, and other activities. Employment is a dummy equal to 1 if earnings are strictly positive, and 0 otherwise. An individual is in a single if remained a one-adult household throughout the period of the study and is in a couple if remained in a two-adult household throughout the period of the study. We classify parents as single or in a couple depending on their civil status one year before the health shock. P-value: *** p<0.01; ** p<0.05; * p<0.1.
SCOPE: Individuals aged 35 to 64 whose parent experienced a heart attack, a stroke or a hip fracture for the first time between 2014 and 2021.
SOURCE: Statistics Netherlands.

4.3 The role of Social Security benefits

In the following we analyze to what extend public insurance programs can compensate for the adverse effects of a parental health shock for children. Specifically, we focus on the role of unemployment insurance, disability pensions and welfare programs. In Figure 4 we show the take-up effects of the programs before and after the health shock using the event study design. We only find clear take-up effects for disability pension. The effect over the five-year period following the health shock is +0.8%.

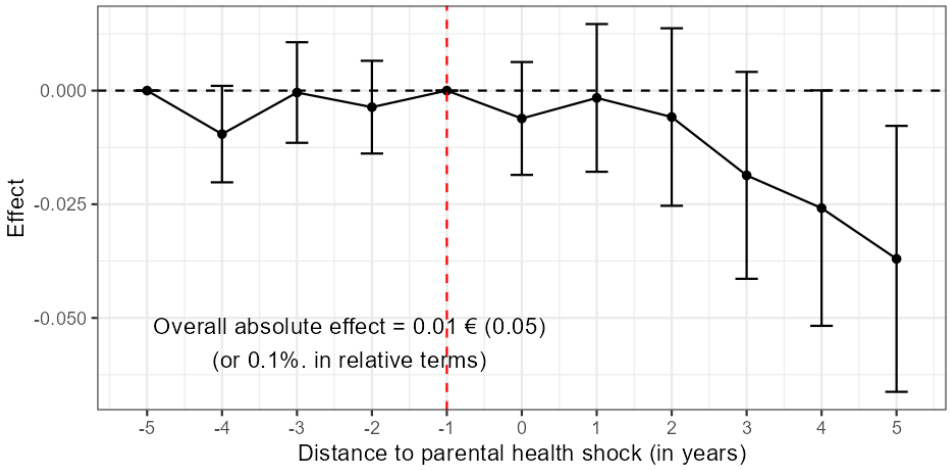
We then examine heterogeneous responses. As shown in Table 8, the increase in disability insurance following a parental health shock is mainly driven by men: benefits rise by an average of €23 over the five years after the shock, corresponding to a 1.4% increase. Consistent with a larger care burden for individuals without sisters, the effect is significant only for them, and not for those who have sisters. Finally, when comparing families where fathers versus mothers experienced a health shock, we find that the effect on adult children is driven entirely by families in which fathers had a health shock.

— Table 8 about here —

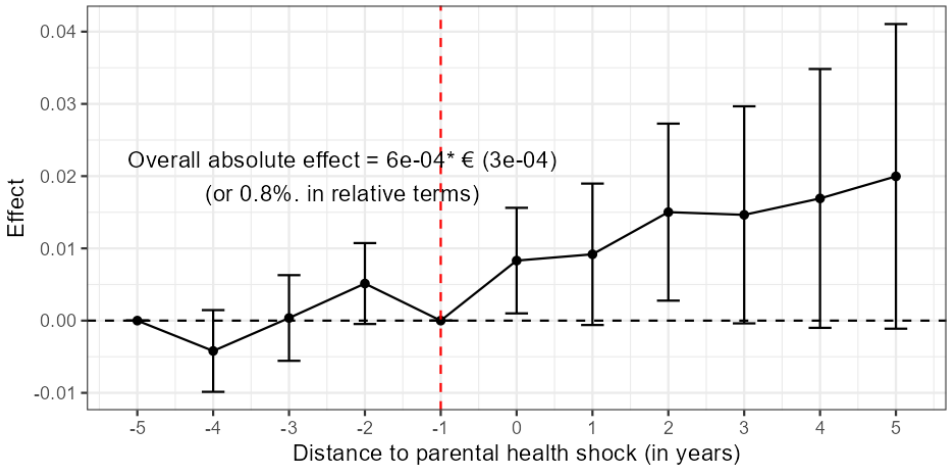
As noted earlier, an increase in disability benefits partly offsets the adverse effects on individual earnings. Figure 5 illustrates this for a group where the phenomenon is particularly pronounced—individuals without sisters. The aggregate effect for the full population is shown in Table 6. Total individual income decreases by €134 (–0.3%) following a parental health shock, which represents a 17% mitigation of the initial drop in earnings. This cushioning effect of social security benefits is observed only for men, whose income loss is reduced from 219 to 155 euros over the five years following the shock.

Figure 4: Social security benefits take-up

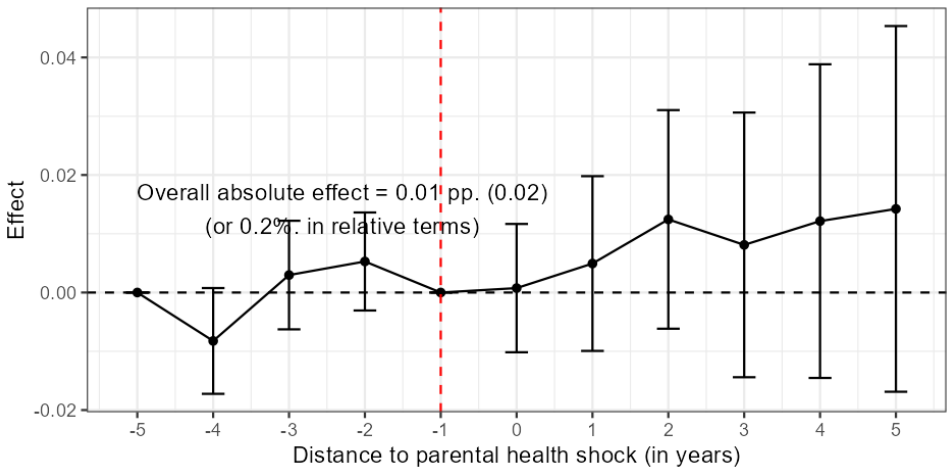
(a) Unemployment insurance



(b) Disability insurance

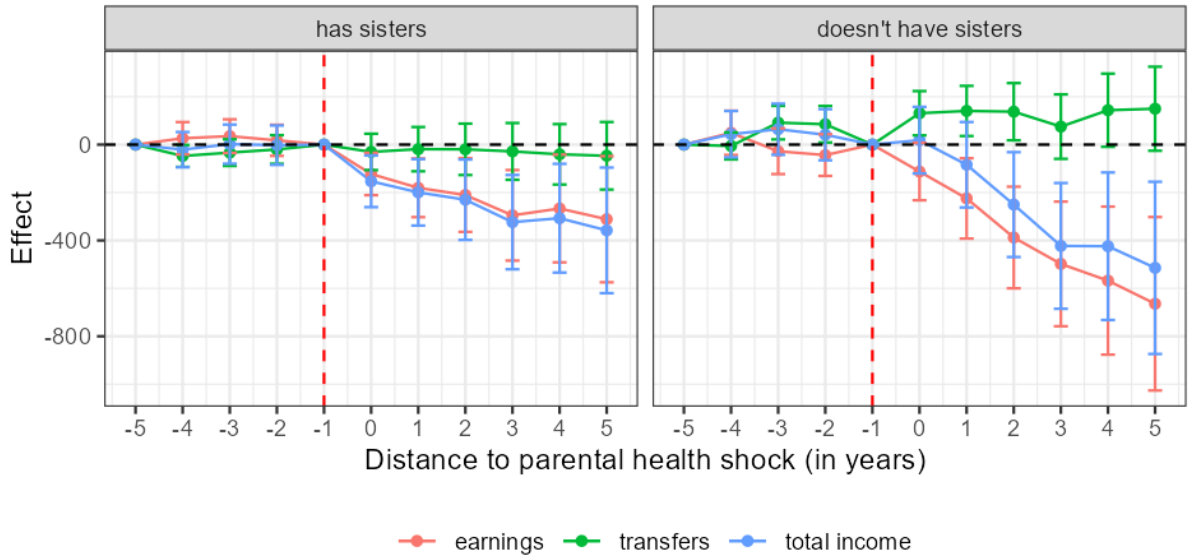


(c) Welfare benefits



NOTE: Unemployment insurance, disability insurance and welfare benefits take-up are dummies equal to 1 if corresponding benefits are strictly positive and 0 otherwise. Confidence intervals are at the 95% level. P-value: *** p<0.01; ** p<0.05; * p<0.1.
SCOPE: Individuals aged 35 to 64 whose parent experienced a heart attack, a stroke or a hip fracture for the first time between 2014 and 2021.
SOURCE: Statistics Netherlands.

Figure 5: Total individual income decomposition around health shock



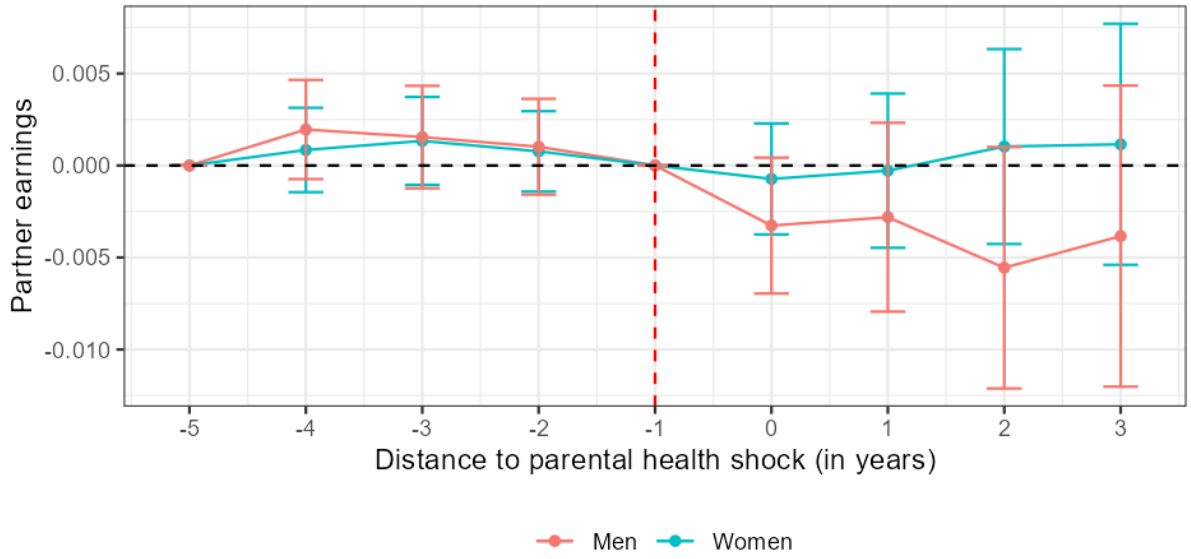
NOTE: Confidence intervals are at the 95% level.
SCOPE: Individuals aged 35 to 64 whose parent experienced a heart attack, a stroke or a hip fracture for the first time between 2014 and 2021.
SOURCE: Statistics Netherlands.

4.4 Effect on partners

Parental health shocks might also affect employment and earnings of the partner. The effect on the partner is ambiguous. On the one hand, the partner could substitute the earnings loss via an added worker effect as documented in the case of spousal job loss (e.g. Halla et al. 2020). On the other hand, employment and earnings of the partner might also be negatively affected when contributing to informal care provision or substituting other care work in the household. To study the effects of the employment and earnings of the partner we only focus on couple households. As shown in Figure 6 and Table 5, we find evidence of a negative earnings effect only for wives. The magnitude is comparable to the average earnings reduction observed among female children: over the five years following a parental health shock, daughters-in-law experience an average annual earnings loss of €124 (–0.5%). This effect is even bigger when wives have sisters-in-law (-0.6%) and when the mother-in-law experienced the health shock (-0.9%).

Overall, as illustrated in Figure 7, since both partners' earnings are negatively affected and public transfers only partly compensate, the household-level income losses are larger in absolute terms than the individual effects previously documented in the literature. As summarized in Table 6, household income falls by €195 (–0.3%) over five years. The decline is even more pronounced in households where men's parents experienced a health shock, with a drop of €278, corresponding to a 0.4% decrease in total household income.

Figure 6: Effects of the health shock on partner's earnings



NOTE: Earnings include income from wages, self-employment, and other activities. Confidence intervals are at the 95% level. P-value: *** p<0.01; ** p<0.05; * p<0.1.
SCOPE: Individuals aged 35 to 64 whose parent experienced a heart attack, a stroke or a hip fracture for the first time between 2014 and 2021.
SOURCE: Statistics Netherlands.

Figure 7: Total household income decomposition around health shock



NOTE: Confidence intervals are at the 95% level.
SCOPE: Individuals aged 35 to 64 whose parent experienced a heart attack, a stroke or a hip fracture for the first time between 2014 and 2021.
SOURCE: Statistics Netherlands.

Table 5: Heterogeneity estimates for partner earnings (couples only)

	Partner earnings			
Group	Abs. (€)	std.	Rel. (%)	N
		— Sex —		
women	-49.42	(98.99)	-0.09	1,429,847
men	-123.85**	(58.19)	-0.46	1,428,358
		— Age at health shock (men) —		
below 52	-113.58	(95.16)	-0.40	593,750
52 or older	-140.86*	(77.40)	-0.53	760,823
		— Has sisters? (men) —		
has sisters	-149.66**	(71.45)	-0.56	937,084
doesn't have sisters	-79.16	(100.29)	-0.28	491,274
		— Parent gender (men) —		
mother	-237.11***	(77.20)	-0.88	767,614
father	-6.17	(91.67)	-0.02	586,959

NOTE: Earnings include income from wages, self-employment, and other activities. An individual is in a single-household if remained a one-adult household throughout the period of the study and is in a couple-household if remain in a two-adult household throughout the period of the study. P-value: *** p<0.01; ** p<0.05; * p<0.1.
SCOPE: Individuals in a couple, aged 35 to 64 whose parent experienced a heart attack, a stroke or a hip fracture for the first time between 2014 and 2021.
SOURCE: Statistics Netherlands.

Table 6: Main estimates for social security and household incomes

	Full sample	Women	Men
— Individual earnings —			
Absolute effect (euros)	-162.51***	-104.11**	-219.58***
	(41.19)	(41.97)	(69.7)
Relative effect (%)	-0.41	-0.39	-0.42
— Individual total income —			
Absolute effect (euros)	-134.42***	-109.43***	-155.11**
	(43.35)	(42.12)	(74.61)
Relative effect (%)	-0.31	-0.36	-0.27
— Partners' earnings —			
Absolute effect (euros)	-74.38	-28.66	-110.24**
	(45.98)	(79.87)	(45.94)
Relative effect (%)	-0.25	-0.07	-0.56
— Household total income —			
Absolute effect (euros)	-195.08***	-96.98	-277.97***
	(66.58)	(97.84)	(90.23)
Relative effect (%)	-0.26	-0.13	-0.36
Observations	5,099,994	2,499,280	2,600,714

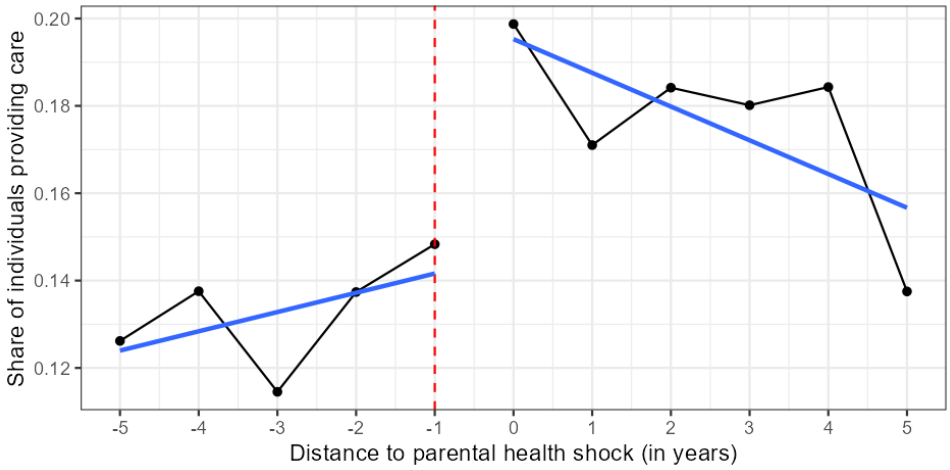
NOTE: Earnings include income from wages, self-employment, and other activities. P-value: *** p<0.01; ** p<0.05; * p<0.1.
SCOPE: Individuals aged 35 to 64 whose parent experienced a heart attack, a stroke or a hip fracture for the first time between 2014 and 2021.
SOURCE: Statistics Netherlands.

4.5 Mechanism: informal care provision

In the final section we leverage the unique combination of the survey data with the admin data to provide novel evidence about the mechanism of the effects induced by the parental health shocks. In more detail, for a subsample of 6,489 individuals we can link survey data with information about informal care provision to the inter-generational administrative data. Based on survey data we classify adult children as care providers if they state that they provide more than three hours per weeks of informal care. Note, the data do not directly include information for which person care is provided.

As a first step, we examine the correlation between parental health shocks and care provision. Specifically, we plot the average share of individuals who report providing care at various time distances from the parental health shock. Figure 9 shows a clear increase in informal care provision by about 5 percentage points when the sudden health shock occurs.

Figure 8: Care provision around health shock

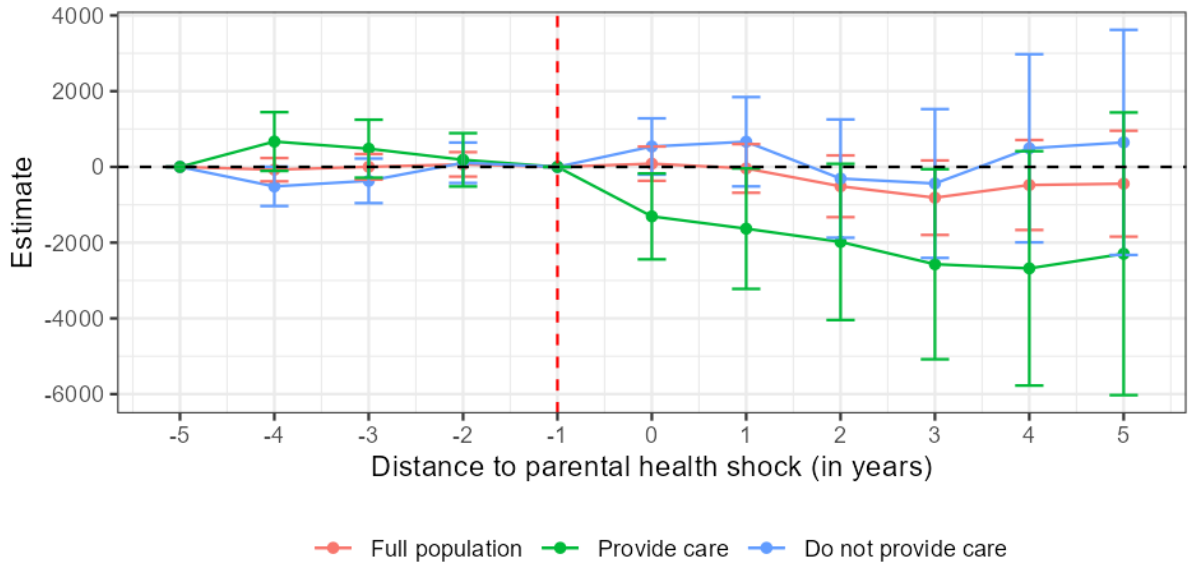


NOTE: Care provision is a dummy equal to 1 if an individual declared that they provided care for more than 3 hours a week within the past 12 months and 0 if they declared that they did not.
SCOPE: Individuals aged 35 to 64 whose parent experienced a heart attack, a stroke or a hip fracture for the first time between 2014 and 2021.
SOURCE: Statistics Netherlands and GGDs.

In a second step we then split the children's sample between those who provide care and those who don't and test for differences in the career and earnings effects of the parental health shock (Table 7).[11] We find a clear and sizable differences between children who provide care and those who don't provide care. As expected we find no significant effect for children who do not provide informal care. In contrast the effect for children who provide care is sizable.

[11] This analysis is restricted to individuals for whom care provision information is available. Unfortunately, this

Figure 9: Care provision around health shock



NOTE: Earnings include income from wages, self-employment, and other activities. Care provision is a dummy equal to 1 if an individual declared that they provided care for more than 3 hours a week within the past 12 months and 0 if they declared that they did not.
SCOPE: Individuals aged 35 to 64 whose parent experienced a heart attack, a stroke or a hip fracture for the first time between 2014 and 2021.
SOURCE: Statistics Netherlands and GGDs.

Table 7: Individual earnings effects by care status

	Full sample	Providing care	Not providing care
	— Full sample —		
Absolute effect	-100.59	-1799.18***	494.3
Standard error	270.4	678.63	455.8
Relative effect (%)	-0.25	-5.2	0.12
	— Women —		
Absolute effect	-173.38	-1396.93***	-88.13
Standard error	275.02	618.39	478.74
Relative effect (%)	-0.67	-5.63	-0.37
	— Men —		
Absolute effect	-5.95	2618.70	737.71
Standard error	482.29	1770.95	714.46
Relative effect (%)	0.01	-4.87	0.13
Observations	127,334	18,728	44,669

NOTE: Earnings include income from wages, self-employment, and other activities. P-value: *** p<0.01; ** p<0.05; * p<0.1.
SCOPE: Individuals aged 35 to 64 whose parent experienced a heart attack, a stroke or a hip fracture for the first time between 2014 and 2021.
SOURCE: Statistics Netherlands and GGDs.

data is missing for approximately one-fourth of the overall sample.

5 Conclusion

In the Netherlands, an aging population and rising pension age (to 67 by 2024) increase the demand for long-term care (LTC), supported by universal social health insurance and public LTC insurance covering home care, rehabilitation, and nursing home admissions (Bakx et al. 2023). Informal caregiving by adult children, with 13% of the population (mostly women aged 40–69) providing such care, plays a critical role but impacts caregivers' labor market outcomes and well-being. Against this backdrop, we examine the effects of sudden parental health shocks on adult children's employment and earnings in the Netherlands.

Our event-study analysis reveals long-lasting negative effects, with no pre-treatment impacts. Five years after a parental health shock, employment decreases by 0.23 percentage points (0.3%) and earnings by approximately €431 (1.1%) (Figure 2). On average, over a 5-year period following the shock, employment falls by 0.14 percentage points and earnings by €163, corresponding to relative declines of 0.18% and 0.41%, respectively. These findings are robust to sample restrictions (e.g., acute hospitalizations or parents returning home) and alternative specifications, including estimators by Sun & Abraham (2021) and Callaway & Sant'Anna (2021) for heterogeneous treatment effects. Analysis using monthly data and a placebo test with random events further confirm the robustness and causal nature of these effects.

The negative labor market effects likely stem from informal caregiving responsibilities, which are prevalent in the Netherlands due to limited private LTC funding (Bakx et al. 2023). Our results align with findings from Norway, where similar institutional support exists, with earnings dropping by 0.5% post-shock (Lizardi et al. 2024). However, they contrast with Rellstab et al. (2020), who found no effects in the Netherlands using a broader health shock definition, suggesting that specific shocks (e.g., hospitalizations) drive caregiving demands. Compared to Austria, where formal care is less widespread, our effects are smaller than the 3.5% employment and 5.7% earnings reductions reported by Frimmel et al. (2025), reflecting the Netherlands' robust LTC system.

Long tables

Table 8: Heterogeneity estimates for transfers

	Disability benefits			**Unemployment benefits**			**Welfare benefits**			
Group	Abs. (€)	std.	Rel. (%)	Abs. (€)	std.	Rel. (%)	Abs. (€)	std.	Rel. (%)	N
					— Sex —					
women	1.25	(10.00)	0.09	11.92	(16.01)	1.43	1.47	(4.63)	0.31	2,499,280
men	23.31*	(13.45)	1.42	17.46	(28.68)	1.32	2.35	(4.18)	0.60	2,600,714
					— Disease type —					
heart attack	-2.11	(13.93)	-0.15	56.76**	(25.24)	5.96	-6.77	(5.91)	-1.43	1,528,831
hip fracture	9.83	(15.69)	0.58	-53.11	(33.59)	-4.25	8.07	(5.11)	2.17	1,650,932
stroke	23.70*	(14.04)	1.57	41.36	(26.41)	3.91	4.14	(5.19)	0.92	1,920,231
					— Age at health shock —					
below 52	0.92	(9.94)	0.09	-1.99	(16.91)	-0.24	4.78	(5.08)	1.00	2,275,953
52 or older	22.56	(14.04)	1.16	22.77	(31.48)	1.75	-2.39	(3.92)	-0.61	2,590,777
					— Civil status —					
single	37.30	(23.21)	1.64	14.36	(34.05)	1.40	3.96	(13.38)	0.25	752,754
couple	10.23	(10.48)	0.85	7.84	(22.54)	0.74	-1.90	(1.17)	-3.24	2,858,205
					— Parent household type —					
parent in a couple	15.94	(10.75)	1.30	10.29	(20.55)	1.06	5.60	(4.03)	1.52	2,506,314
single parent	18.00	(12.89)	0.99	5.72	(27.18)	0.48	-2.35	(4.95)	-0.47	2,360,416
					— Has sisters? —					
has sisters	4.19	(10.85)	0.26	-0.59	(20.27)	-0.05	2.19	(3.94)	0.49	3,291,960
doesn't have sisters	27.11**	(13.24)	1.88	40.25	(28.92)	3.79	1.76	(5.06)	0.44	1,808,034
					— Parent gender —					
mother	7.66	(11.54)	0.46	-0.12	(23.98)	-0.01	1.55	(4.26)	0.35	2,739,507
father	25.78**	(11.98)	1.94	20.34	(23.21)	2.05	1.31	(4.73)	0.31	2,127,223

NOTE: Earnings include income from wages, self-employment, and other activities. Social security benefits refer to unemployment benefits, disability benefits, pension benefits and welfare benefits. An individual is single if remained a one-adult household throughout the period of the study and is in a couple if remain in a two-adult household throughout the period of the study. P-value: *** p<0.01; ** p<0.05; * p<0.1.
SCOPE: Individuals aged 35 to 64 whose parent experienced a heart attack, a stroke or a hip fracture for the first time between 2014 and 2021.
SOURCE: Statistics Netherlands.

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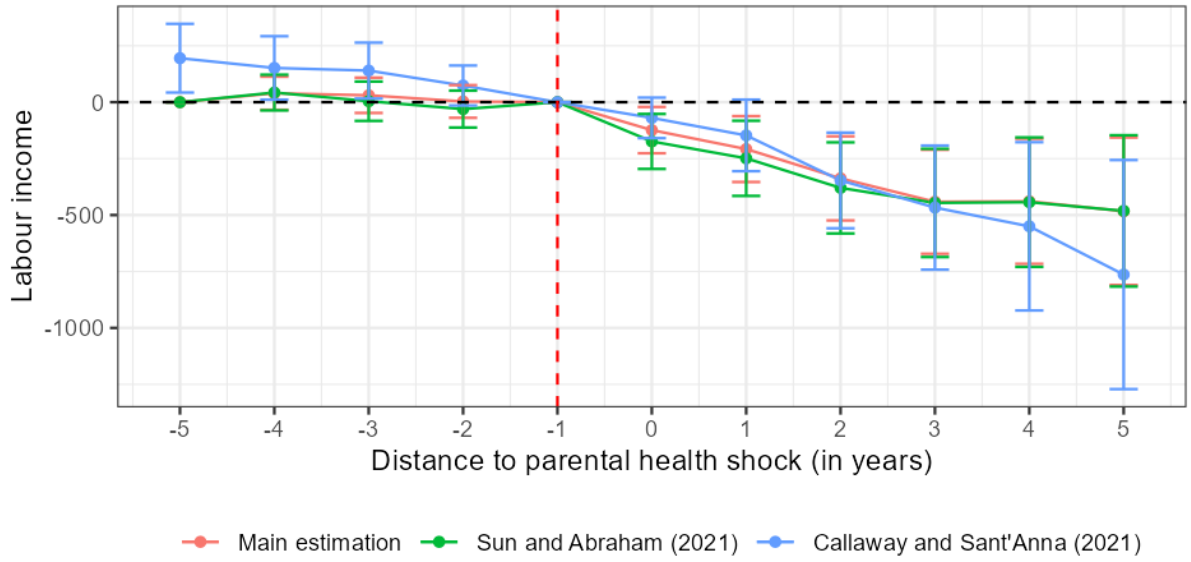
A Additional Tables and Figures

Table A.1: Datasets used in the study

Content	Name of dataset	Years
Date of birth and gender	GBAPERSOONTAB	2024
Death	GBAOVERLIJDENTABTAB	2024
Linkage parent-child	KINDOUDERTAB	2024
Households characteristics	GBAHUISHOUDENSBUS	1995–2024
Individual income		
Wage income	SECMWERKNDGAMNBEDRABUS	1999–2023
Profits from self-employment	SECMZLFMNDBEDRAGBUS	1999–2023
Income from other activity	SECMOVACTMNDBEDRAGBUS	1999–2023
Welfare benefits	SECMBIJSTMNDBEDRAGBUS	1999–2023
Unemployment benefits	SECMWERKLMNDBEDRAGBUS	1999–2023
Disability and sickness benefits	SECMZIEKTAOMNDBEDRAGBUS	1999–2023
Other social security benefits	SECMSOCVOORZOVMNDBEDRAGBUS	1999–2023
Pension income	SECMPENSIOENMNDBEDRAGBUS	1999–2023
Hospitalisations	LBZ	2013–2021
Health Monitor Survey	GEZONDHEIDSMONITOR	2016; 2020

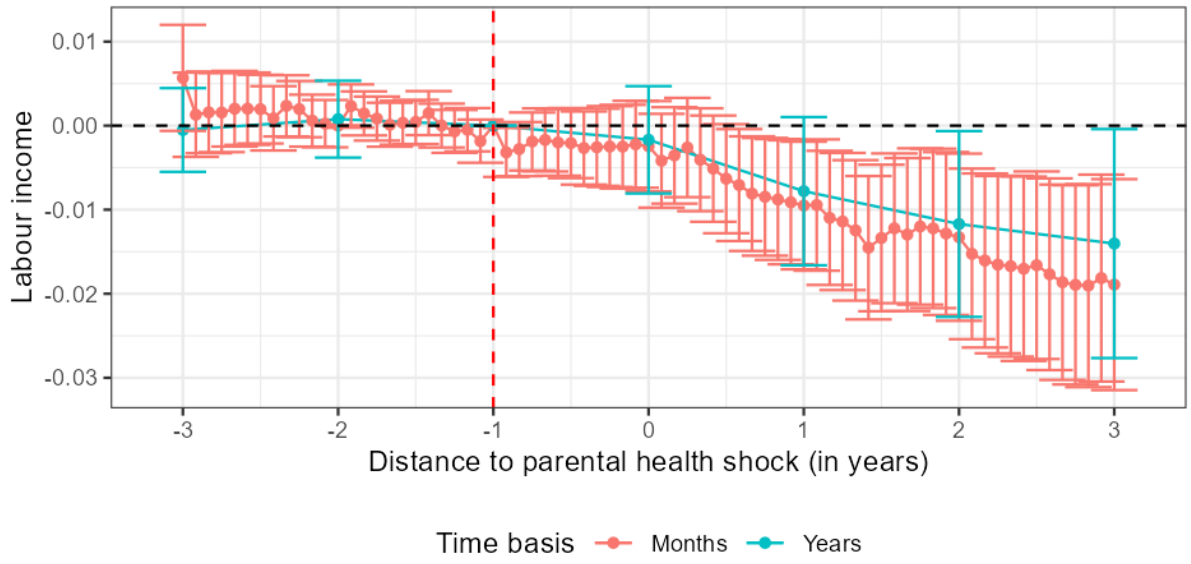
SOURCE: Statistics Netherlands microdata catalogue.

Figure A.1: Robustness to alternative specifications



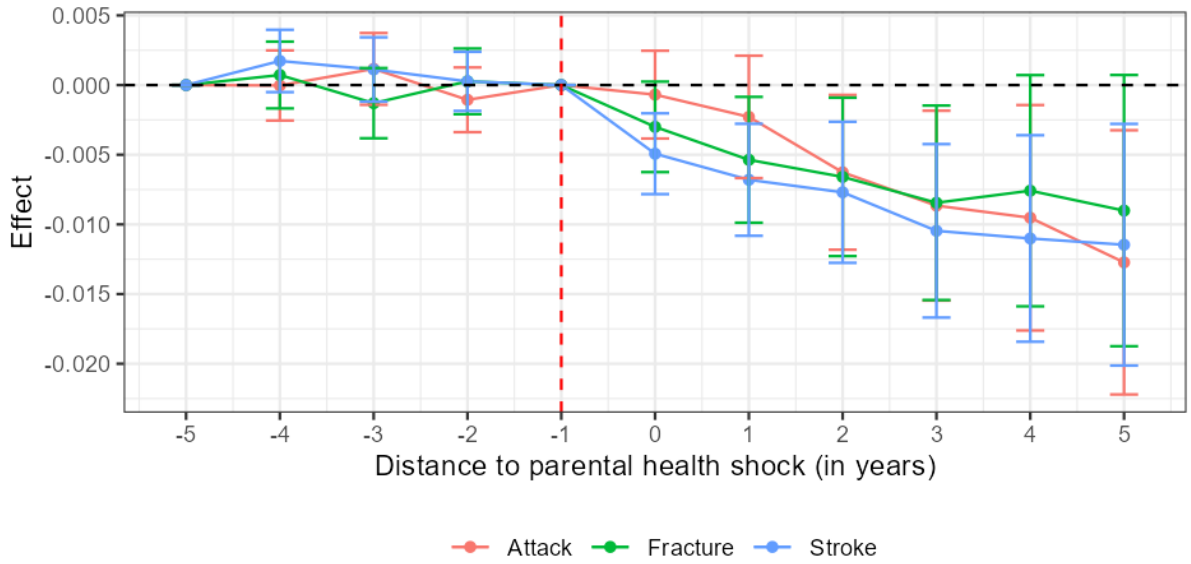
NOTE: Earnings include income from wages, self-employment, and other activities. Confidence intervals are at the 95% level. P-value: *** p<0.01; ** p<0.05; * p<0.1.
SCOPE: Individuals aged 35 to 64 whose parent experienced a heart attack, a stroke or a hip fracture for the first time between 2014 and 2021.
SOURCE: Statistics Netherlands.

Figure A.2: Robustness to time basis specifications



NOTE: Earnings include income from wages, self-employment, and other activities. Confidence intervals are at the 95% level. P-value: *** p<0.01; ** p<0.05; * p<0.1.
SCOPE: Individuals aged 35 to 64 whose parent experienced a heart attack, a stroke or a hip fracture for the first time between 2014 and 2021.
SOURCE: Statistics Netherlands.

Figure A.3: Heterogeneity effects on earnings by disease type



NOTE: Earnings include income from wages, self-employment, and other activities. Confidence intervals are at the 95% level. P-value: *** p<0.01; ** p<0.05; * p<0.1.
SCOPE: Individuals aged 35 to 64 whose parent experienced a heart attack, a stroke or a hip fracture for the first time between 2014 and 2021.
SOURCE: Statistics Netherlands.