The Career Incentives of Children's Health Shocks[*]

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August 1, 2023

[VERY PRELIMINARY - PLEASE DO NOT CIRCULATE]

Abstract

We study the economic effects of children's health shocks on families. We use a novel dataset on Brazilian families constructed from millions of links between parents and children, spanning several decades and covering a wide range of socioeconomic backgrounds. Combining it with administrative data on formal employment and health, and employing an event study approach that explores variation in the timing of children's hospitalizations and deaths, we find that children's health shocks have persistent impacts on parents' labor supply and earnings. Estimates show that the average probability of employment up to four years after an hospitalization increase in 3% and 4% for male and female parents, respectively, with labor earnings increasing respectively by 6% and 5%. We also show that children's hospitalization cause an increase in enrollment of *private* health insurance plans (for parents and children), and a decrease in children's out-patient visits to *public* primary care centers. When restricting events to severe health shocks, we find that *(i)* long-term hospitalizations decrease female employment, although the effect wanes after four years, and that *(ii)* children's deaths *positively* impact female parents' employment, while reducing that of male parents.

Keywords: health shocks, parents, children, hospitalization, mortality

JEL Codes: I12, J63, J65

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1   Introduction

Illnesses and injuries are among the most common causes of labor supply disruptions and a major source of financial distress to individuals. Many countries today have legislation and public programs hedging workers against earnings losses from health shocks (e.g., disability insurance), but similar institutions covering health shocks of dependent family members are not as widespread. Therefore, many workers may face trade-offs in these situations that can lead to ambiguous average effects on overall employment. On the one hand, they may need to increase financial support to their family through labor earnings due to higher predicted expenditures on health care, while on the other hand, they may work less (or quit their jobs entirely) in order to spend more time at home taking care of a sick relative.

Understanding how individuals react to health shocks on dependent family members can be much aided by studying such events on children – those dependents to whom workers are often most emotionally tied, and towards whom they naturally feel a higher sense of responsibility. Such an investigation, however, can be fraught with challenges. Among the main concerns is data availability, which should be sufficiently comprehensive and include precise, individual-level information on family ties, parental employment, and children's health. While recent studies have overcome this constraint with detailed administrative data from Scandinavian countries, virtually no studies exist for countries outside of Europe with different (or non-existent) government safety nets.

In this paper, we estimate the impacts of children's hospitalizations and/or deaths on parents' employment and labor income in Brazil. We leverage from a unique dataset that records parents-and-children's links from millions of Brazilian families over a period of more than two decades. This data is then combined with several individual-level administrative information on deaths and hospitalizations of children, and also their parents' labor income and employment in the formal sector. Focusing on Brazil is advantageous for studying the aforementioned individual trade-offs. Despite having a public universal health care system, private spending on health care is still higher than the OECD average at 25%, and out-of-pocket expenditures in pharmaceuticals is one of the largest in the world at 91% (OECD, 2021). There also exist private health insurance options in the country that are usually employer-sponsored and provide access to various other medical services outside of the public sector, thus possibly also influencing employment choices by individuals. Finally, studying a large, developing country with limited social insurance institutions may help us better understand how effects operate under more vulnerable socioeconomic realities.

To estimate causal impacts, we use a difference-in-differences approach where we exploit the variation in the timing of children's health shocks (i.e., hospitalization or death) as a

source of identification. We take children between 5 and 12 years old who suffered a shock at any given date to compose the treatment group; and then, for the control group, we pair them with others of the same gender and born in the same year, but who suffered the same shock only some years afterwards. For each pair of children we then compare the trajectories in labor outcomes of their parents (also of the same gender and born in the same year) before and after the child in the treatment group suffers a shock. Exogeneity is supported by the assumption that parents and children in both treatment and control groups are, on average, similar to one another except for the timing of health shocks. We provide evidence in favor of this assumption by showing that there are no differential trends in outcomes between treatment and control groups in the years prior to the shock.

Our findings are manifold. First, we show that labor outcomes for both male and female parents are positively affected by children's hospitalizations. Impacts are quantitatively small but they are visually clear and precisely estimated: we show that employment of male and female parents increase, respectively, by 3% and 4%, and that their labor income also increase by 6% and 5%, on average, following their child's hospitalization. These effects are persistent, lasting up to (and potentially beyond) four years after the shock. We also find that effects appear across most diagnosis groups, including most common causes of infant hospitalizations such as infectious and respiratory diseases. For female parents, effects are also higher in richer areas than they are in poorer areas.

To interpret results we shed light on some of the potential mechanisms linking children's hospitalizations to an upward shift in parental labor supply. We show that, in general, effects do not vary significantly with differences in family/household structure, such as families with single vs. multiple children, or families with cohabiting vs. non-cohabiting parents. We find, however, that female labor supply remains unaffected when there is evidence that one or more of the children's grandparents live in the same household as them. When exploring health care utilization by parents and children before and after a hospitalization, we find that both are *more* likely to enroll in private health insurance after the shock, and that both are also *less* likely to visit a doctor in an public outpatient health care center. These results, contextualized within the structure of private and public health care delivery in Brazil, indicate that parents may also increase their labor supply to provide better access to health care for themselves and their children (e.g., through employer-sponsored health insurance).

Second, we show that effects differ significantly when considering only health shocks that are plausibly more severe, in nature, than an average hospitalization. We find that long-term hospitalizations (i.e., those lasting for at least two weeks) negatively impact female parents' employment, while it exerts no effect on male parents' employment. Estimates

show the probability of employment of female parents decreasing by about 5% on average, but with inconclusive impacts on their labor income. We also show that impacts on female employment are mostly associated with hospitalizations linked to cancer diagnosis. The labor supply of male parents, on the other hand, remain unaffected.

Finally, we investigate the effects of fatal health shocks. These are measured by two different events: *(i)* hospital admissions that result in deaths, and *(ii)* deaths of any kind, i.e., not only those that followed from a hospitalization. Our estimates show that the hospitalization of children, when followed by an eventual death, negatively impact male parents' probability of employment at following years by 12%, and their labor income by 16%. Male parents' estimates for deaths of any kind are qualitatively similar but smaller and statistically insignificant. More striking, however, are the impacts of children's deaths (of any kind) on female parents' labor supply: we find a 17% *increase* in the probability of female employment in years following a child's death. Other estimates for female parents are, again, similar in direction but statistically insignificant.

Our findings on severe health shocks open some avenues for interpretations. The negative impact of children's long-term hospitalization on the employment of female parents suggests that many mothers may quit their jobs to provide extra care for their child at home, following a severe injury or illness. The effects of children's deaths, on the other hand, point to different but complementary mechanisms. The persistent, negative impact on male parents' employment may be linked to a decrease in their willingness to work following the emotional shock of losing a child. That this effect is prevalent for male workers is supported by the fact that male parents, in their majority, are the primary income earners in Brazilian households, with much higher baseline probabilities of employment than female parents prior to the shock. Going on the opposite direction, the positive impact of a child's death on female labor supply suggests that female parents, in general, could be redressing to labor occupations the time and effort previously dedicated to motherhood. A higher willingness to work, in this case, could be serving as an outlet for overcoming the grievance from loosing a child.

This paper contributes to a growing empirical literature on the microeconomic effects of health shocks. Previous work have investigated how fatal and non-fatal health shocks (e.g., hospital admissions) impact individuals' own labor and financial outcomes (e.g., Dobkin et al., 2018), and how they impact labor supply and health care consumption of their family members (e.g., Fadlon and Nielsen, 2019, 2021). Other authors have also recently studied the relationship between children's health shocks and their parents' labor supply. Using data from Finland and Norway, Breivik and Costa-Ramón (2023) show that children's hospitalizations and deaths have persistent negative effects on parental earnings, specially for mothers. Similarly, using data from Denmark, Adhvaryu et al. (2023) also show that parental

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income declines following a child's cancer diagnosis. While our paper parallels these findings for Brazil in the context of severe diagnosis (i.e., cancer) and long-term hospitalizations, it differs entirely from previous studies in showing that parental labor supply and earnings may also increase in reaction to both fatal and non-fatal health shocks on children, thus trailblazing new directions for interpreting that relationship.[1]

Our paper also speaks more broadly to the literature exploring individual incentives for investing in health care. Theoretical contributions to this topic go back to Grossman (1972). Our findings on ex-post health insurance consumption and outpatient visits for parents and children confirm that these are also shaped by inter-generational shocks.[2] Finally, from a policy perspective, our results point to the importance of carefully understanding the interactions between public and private health care options and how these shape individuals' employment decisions. To the extent that severe health shocks are prevalent, our results also points to the potential benefit of designing provisions (i.e., job-protected leaves) allowing individuals to take care of sick family members without risking their own jobs (Anand et al., 2022).

The remainder of the paper is structured as follows. Section 2 provides some background on health care and labor regulations in Brazil and details the data. Section 3 discusses the empirical strategy. Section 4 presents all results, and Section 5 concludes.

2   Institutional Background and Data

2.1   Health Care and Labor Regulations in Brazil

Health care provision in Brazil is primarily administered through a universalized public network of hospitals, clinics, and primary care units. This network, called SUS (an acronym, in Portuguese, for "unified health system") constitutes a major leap in the country's effort towards the goal of providing universal access to health care for its large population, put forward since the writing of the country's current 1988 constitution. It currently provides access to a wide range of medical services to every Brazilian citizen independently of their ability to pay for those services. The system is largely administered by local governments (states and municipalities) and it is financed primarily by intergovernmental grants from the

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[1]Other recent papers have explored the converse relationship between parents' health shocks and children outcomes in Brazil. Koppensteiner and Menezes (2022) show that maternal dengue infections decrease birth weights, and Britto et al. (2023) show that parents' sick leave from work negatively impact children's educational outcomes.

[2]Conversely, Grossman et al. (2022) show that children's access to health insurance drive better health outcomes for mothers.

federal government.[3]

Complementary to the SUS, a private (or "supplementary") health care sector also exists in the country. It is primarily constituted by a market of private health insurance plans (mostly employer-sponsored) that give access to specific services in privately-owned hospitals and clinics. In contrast with the public sector, however, the majority health care establishments in the private sector (about three-fours of the total) concentrate in providing out-patient care services. This fact limits potential concerns about hospitalizations in the public sector – the main observable source of health shocks in our identification strategy – being confounded by interactions with the private sector. Similarly to Amorim et al. (2023), we also explore this point further in our analysis. In particular, we use complementary data on private-sector health insurance enrollment to explore this interaction.

There are no comprehensive social insurance policies in the country that would protect individuals against employment or earnings losses in the case of health shocks of family members. The closest institution of the kind is a selection of labor regulatory marks that give employees the right to miss work for a number of days in specific situations involving health care for themselves or their family members. In many instances, however, such regulations may be insufficient to protect individuals against such shocks and still leave them susceptible to negative impacts on employment. For example, parents are allowed to miss just *one* working day *a year* to accompany their children in medical consultations, provided that the employee is also able to present proper documentation to their employer as proof.[4] Therefore, in case of long-term hospitalizations, or if sustained at-home care for children is needed in case of severe illnesses, there are no legal guarantees on parental job protection.

2.2   Data Sources

We use several data sources to construct a matched sample of children and their parents, merged with information on parental employment and health outcomes for both parents and children. We describe each separate dataset in what follows.

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[3]See Amorim (2020) for more details about the role of intergovernmental grants in the total share of revenues invested in the SUS.

[4]Item XI from Article 473 in Ordinance #5,452 reads: "The employee may not show up to work for 1 (one) day per year to accompany a child up to 6 (six) years old in a medical consultation, without any loss in their salary."

2.2.1 Health Care

We use a variety of data sources in health care and mortality, which we use to construct health outcomes for children and their parents. All health datasets are acquired through the National Health Database (*Base de Informações de Saúde* – DATASUS), the government's official registry of the country's network of public hospitals and healthcare services, the SUS. Records on hospital discharges from in-patient admissions in public hospital come from the Hospital Information System (*Sistema de Informações Hospitalares* – SIH-SUS). It includes information for each hospital admission at the individual level such as diagnostic, date of admission, and length of stay. Records on out-patient visits to public hospital come from the Ambulatory Information System (*Sistema de Informação Ambulatorial* – SIH-SUS). Finally, we also use enrollment data on private health insurance plans from the National Health Agency (*Agência Nacional de Saúde* – ANS). This dataset contains information at the level of individual enrollment for every insurance plan sold in the private (i.e., supplementary) healthcare market, including plan characteristics (e.g., whether employer-sponsored or purchased through the individual market) and duration of enrollment.

Figure 1 shows descriptive information on hospitalizations of minors aged between 1 and 17 years old for our sample of identified children merged with at least one of their parents. A few patterns can be discerned from the graphs. Children seem more at risk of hospitalization in earlier ages, decreasing monotonically until 13 years old when it starts increasing again. The main causes of hospitalizations are qualified under infectious/parasitic diseases and diseases of the respiratory system. Other important causes are diseases of the digestive and genitourinary systems, and external causes of morbidity. Also, after being admitted to a hospital for the first time, about one-third of children is re-admitted to a hospital for at least a second time. Once admitted, the median length of stay in a hospital is between two to three days.

Figure 1: Summary Statistics on Children's Hospitalizations
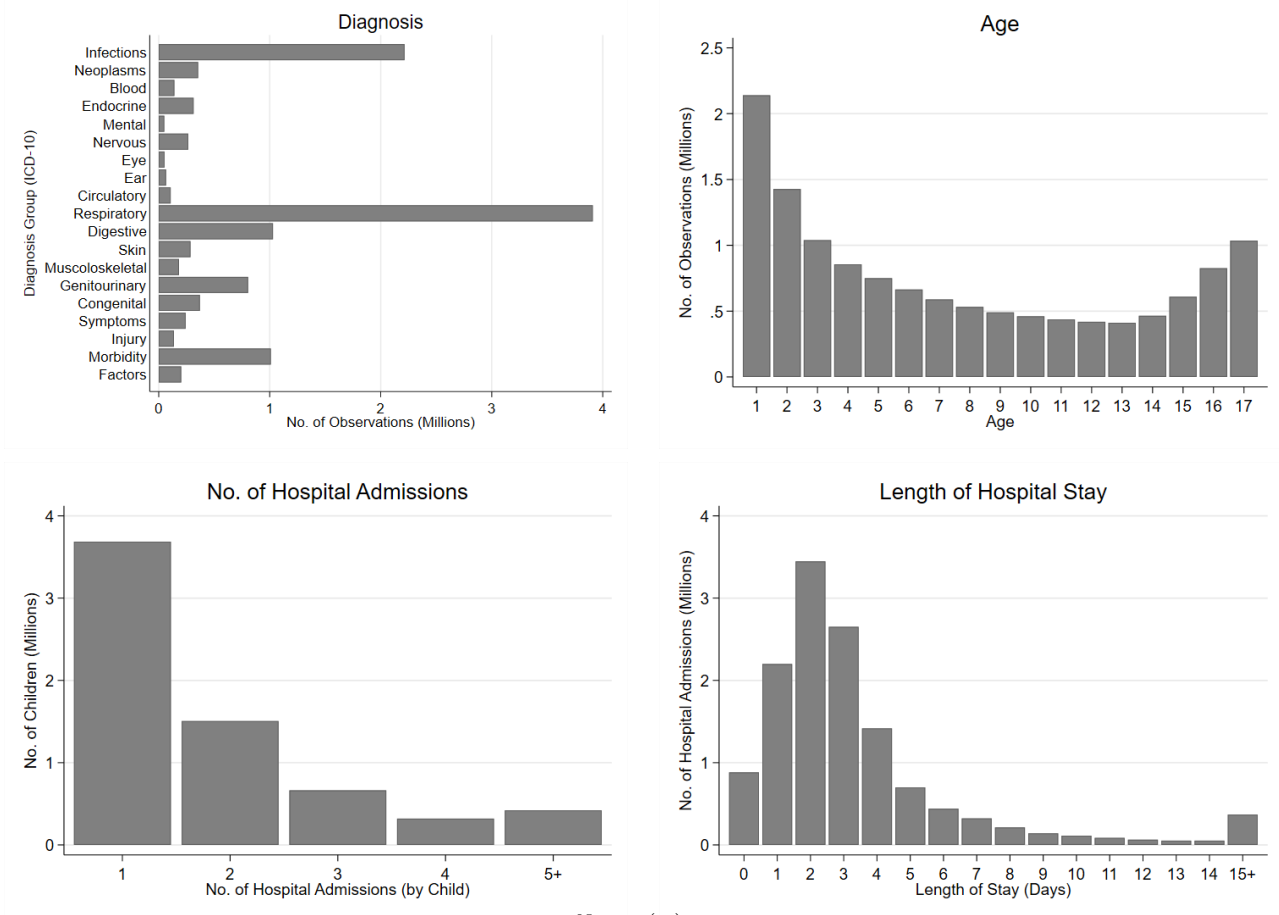
Notes: (...)

2.2.2 Formal Employment

Information on parental employment comes from the Annual Social Information Report (*Relação Anual de Informações Sociais* – RAIS). This well-known dataset is a nationally comprehensive registry of all labor relations in the country, containing matched employer-employee records on all formal-sector jobs in both the public and private spheres. It includes annual records on worker-level information such as the start and end dates of contracts, job locations, standardized codes for occupation and industry sectors, and workers' education level and total earnings. It also includes individual identifiers that allow us, for example, to track job switches for a same worker across different years.

2.2.3 Individual Registry and Parent-Child Links

As mentioned, all observations in the previous datasets are at the individual-level, but while the data on formal employment contains individual identifiers to every worker (i.e., the *Cadastro Pessoa Física* – CPF, an analogue to the Social Security Number in the US), the health care and mortality data sets do not, in order to preserve privacy over individuals' sensitive information. We circumvent this limitation on the latter with the individual registry database from the Federal Revenue of Brazil (*Receita Federal do Brasil* – RFB), the Brazilian federal tax administration. This dataset dates back to 1965 and contains the registry numbers (CPF) of the entire Brazilian population, together with full names, gender, date of births, and full residential address for every individual (including their history of all previous home addresses). Leveraging from its comprehensiveness, we perform a merging exercise between this data and the health care datasets that allows us to recover individual identifiers for ...% of all observations in the hospitalization data, ...% of observations in the out-patient care data, and ...% of observations in the health insurance data.[5]

A second important information to recover are the links between parents and children in our sample. This will allows us, for example, to link the variation employment records of parents across time with the hospitalization records of their children. To that end we combine two different resources. One is the individual information from income tax declarations in the RFB dataset, which includes all children listed as dependents for tax deduction purposes. The second resource is the full registry of participants in government financial assistanship programs in the country, called the Single Registry (*Cadastro Único* – CU), which also contains information on dependent children. The later dataset is an important complement to the former, since it estimated that only around ...% of the Brazilian population formally declare taxes (likely the highest-earning share of the population). Both datasets combined thus provides a more representative picture of Brazilian families across every level of income, from high- to low-income families. To visually assess this, Figure 2 shows the histogram of parent-child links over the observable distribution of age- and gender-specific (formal) labor income levels of all parents our the sample. The figure clearly shows how both samples from the RFB income declaration datastes and the CU dataset (which we will henceforth refer to as high- and low-income samples, respectively) span across the full distribution of parental income.

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[5]More specifically, we construct samples from the RFB data based on individuals who are uniquely identifies by the smallest cluster os individual-level information contained in the health and mortality databases. For example, to recover identifiers in the health care data, we first restrict the RFB data to include only individuals who are unique at their specific gender/date-of-birth/zip-code cluster, then we merge them with information in the health care data using these same characteristics as identifiers. A more detailed description of this process is available at Amorim et al. (2023).

Figure 2: Income Percentile of Parents of Hospitalized Children, by Data Source


Histogram: Parent-Child Links
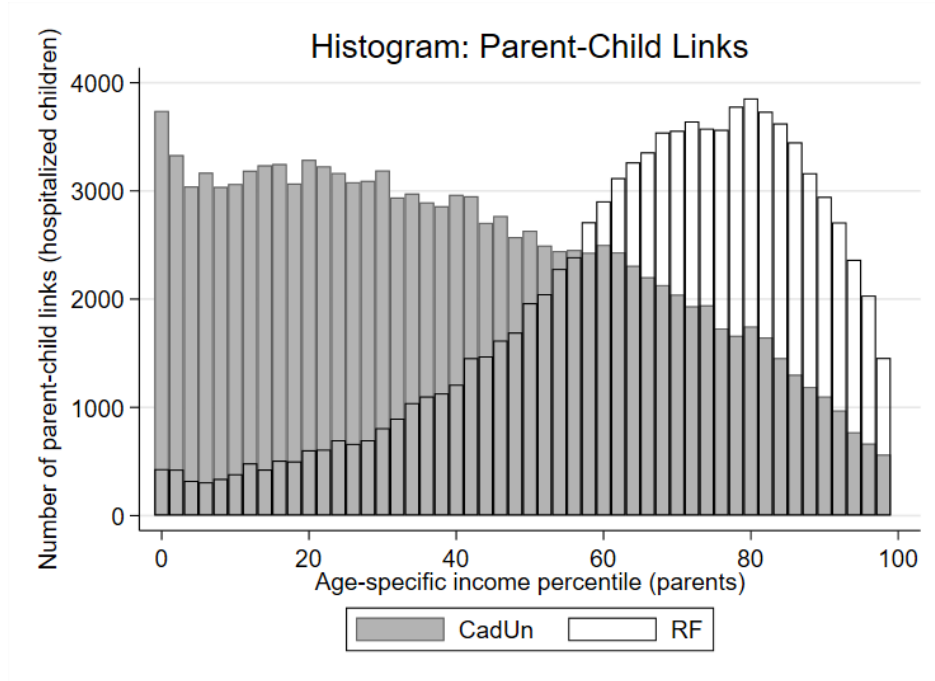
Notes: (...)

2.3   Data Illustration

We now proceed to illustrate the main effect of children's hospitalization on parental employment with a simple example using the raw sample constructed from the data sources above. This example also gives support to the identification strategy we will formalize in the next section. Figure 3 plots the employment survival rate for different groups of parents between the years 2004 and 2015. We define employment survival as the probability of having a job at the end of year t, given that the person held a job at the beginning of that same year (or, conversely, at the end of year $t - 1$). This is mathematically represented as $P(Emp_t = 1|Emp_{t-1} = 1)$. The figure shows this for five groups of parents, each differing from the other only by the year in which their child were hospitalized. We include only those cases in which the recorded hospitalization was a first-time event for both the parent and the child. Parents represented by the red, green, and yellow lines had their children hospitalized, respectively, in the years 2006, 2010 and 2014. Parents represented by the blue line had their children hospitalized before 2004, and we thus label this group "always-treated". Conversely, those parents represented by the gray line had their children hospitalized after 2016, and we thus label this group "never-treated".

A distinct pattern can be seen from the picture. First, we notice that the survival rate

Figure 3: Effect of Children's Hospitalization on Parent's Employment Survival Rate
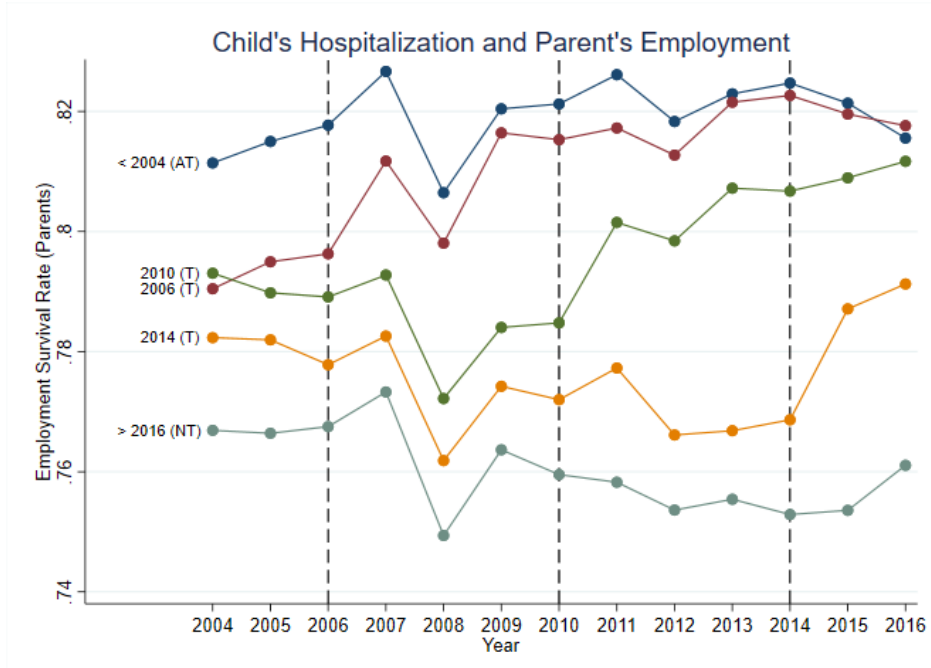
Notes: This figure shows the average employment survival rate of parents whose children were hospitalized at different years. Employment survival rate is calculated as the probability of individuals remaining employed at a given year, given that they were employed at the end of the previous year, or $P(Emp_t = 1|Emp_{t-1} = 1)$. Individuals in the red, green and blue groups were treated (T) at years 2006, 2010 and 2014, respectively. Individuals in the blue are "always-treated" (AT), i.e., were treated before earliest year in this sample (2004), and those the gray groups are "never-treated" (NT), i.e., were treated after the latest year in this sample (2016).

at year 2008 suffers a marked dip for all groups – an event that coincides in timing with the Great Recession. Most notably, however, are the is the pattern perceived in comparisons made between groups of parents before and after their children are hospitalized. The event of a child's hospitalization seems to place parents at a higher trajectory of employment survival when comparing them with parents whose children have not yet suffered the same shock, or with parents whose children have already been through the shock. For example, parents whose children were hospitalized at 2010 sharply increase their employment survival rate compared to those parents whose children are hospitalized in 2014 or after 2016. After a few years this same group also seems to "catch-up" with those parents whose children were hospitalized in 2006 or before 2004. This phenomenon and its causes will be the main focus of our investigation in the following sections.

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3 Empirical Strategy

In our analysis we are interested in estimating the economic impacts of children's health shocks on families. For that purpose we aim to construct the counterfactual economic trajectories of families whose child has suffered some type of health shock (e.g., hospitalization or death). However, finding the right counterfactuals for these families is challenging, since health shocks are seldom random events. For example, if we compare two different families with children, where the child in one family suffered a health shock while the child in the other family did not, we could be comparing an unhealthy child from a poor family, who could thus be more likely to become hospitalized, with a healthier child from a richer family, who might have access to better preventive care, better sources of nutrition, etc. We thus overcome this potential source of endogeneity by making pairwise comparisons between similar family units whose children have suffered similar health shocks but in different points in time. More specifically, following an approach similar to Fadlon and Nielsen (2021), we compare parent-child pairs with same gender compositions, age cohorts, and income levels, while leveraging from the different timings of health shocks as a source of exogenous variation.[6]

We start by including in the treatment group all parent-child pairs in which the child suffers a health shock at some date τ. For each parent-child pair in the treatment group we then select for the control group a single parent-child pair whose child has suffered a shock at some point during the one-year period after the exact date of between dates $\tau + \Delta$ and $\tau + \Delta + 1$. In these expressions, Δ represents a specific number of years, which we set to 4 years in our baseline specification. As an illustration, when a child is hospitalized at date April 1st, 2010, the child from the control pair will have been hospitalized between April 1st, 2014 and March 31st, 2015. Observations in the control group are chosen using a one-to-one matching approach where we randomly select out of the potential control pairs one from the same data source (i.e., high-income or low-income), with the same gender composition (e.g., father-and-son, mother-and-daughter), and with same birth years in date τ as both the parent and the child in the treated pair.

The dynamic effects of children's health shocks are then estimated using the following equation:

$$Y_{it} = \alpha + \delta\, Treat_i + \sum_{t=-P}^{T} \beta_t\, Treat_i \cdot Time_t + \sum_{t=-P}^{T} \lambda_t\, Time_t + \epsilon_{it}, \qquad (1)$$

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[6]Our baseline definition of a family unit consists of a pair of one child and one of their male or female parents. We do this in order to preserve the highest number of parent-child links as possible given that only observe both parents of a same child in a subset of our sample. We replicate and compare all results using samples where both parents are observed, and ones where we are able to identify both parents living in the same address.

where Y_{it} is the outcome of interest for family unit i at period t (measured in years after/since the shock), $Treat_i$ is a dummy indicating that parent i belongs to the treatment group, and $Time_t$ is a dummy indicating the number of years since or before the child's health shock. All estimates are normalized as differences to the baseline omitted period $t = -1$. The coefficients $\{\beta_0, ..., \beta_T\}$ identify the dynamic treatment effects, while $\{\beta_{-P}, ..., \beta_{-2}\}$ identify any potential anticipatory effects. Average treatment effects are estimated using the following equation:

$$Y_{it} = \alpha + \delta\, Treat_i + \beta\, Treat_i \cdot Post_t + \lambda\, Post_t + \epsilon_{it}, \tag{2}$$

where the dummy $Post_t$ represents all time periods after the date of health shock (i.e., $Post_t = 1$ for $t > 0$), and the remaining variables are defined as in (1). Standard errors in both equations are clustered at the level of family units.

Table 1: Summary Statistics, Treated vs. Non-Treated Observations

	(1)	(2)	(3)	(4)	(5)	(6)
		Male Parent			Female Parent	
	Treated	Non-Treated	Std. Diff.	Treated	Non-Treated	Std. Diff.
Individual Characteristics						
Age	36.91	36.91	0.00	33.55	33.55	-0.00
Tenure (Months) $(t = -1)$	43.85	42.28	0.03	31.89	30.58	0.03
Educational Level (Years) $(t = -1)$	10.02	9.88	0.05	10.93	10.84	0.04
Income $(t = -1)$	1,644.62	1,527.24	0.07	982.13	927.72	0.05
Municipality Characteristics						
Population	1,283,688	1,200,029	0.03	1,252,530	1,157,854	0.03
GDP	21.49	20.34	0.06	20.29	19.09	0.07
Gini Index	0.61	0.61	0.05	0.62	0.61	0.06
Informality Rate	0.42	0.43	-0.08	0.43	0.44	-0.08
Homicide Rate	25.47	25.42	0.00	25.94	25.79	0.01
Hospitals per 100,000 Resid.	120.73	118.34	0.03	117.33	114.59	0.04
Prop. Public Hospitals	0.47	0.50	-0.09	0.50	0.53	-0.10
Private HI Plans p.c.	0.28	0.26	0.08	0.26	0.24	0.08

Notes: (...) Tenure, Educ. and Income observed only if employed

The main identification assumption is that economic outcomes for both the treatment and control groups would have followed similar trajectories in the absence of treatment. More precisely, since observations in the control group suffer a similar health shock Δ years after their matched counterparts in the treatment group, we would expect to observe any breaks in such trajectories only during the periods separating one shock from another. We check for check the validity of this assumption by comparing observations in the treatment and

control groups in terms of their observable characteristics, or whether treatment assignment predicts any differential patterns between them. Table 1 shows baseline averages for a range of individual- and regional-level observable characteristics for the treatment and control groups separately, together with their standardized differences. Reassuringly, results in the table show that all characteristics are similar across both treatment and control groups. Finally, the absence of anticipation effects (pre-trends) in all dynamic estimates for our main outcomes give further support to the validity of our choice of counterfactuals.

4 Results

In this section, we present our main set of results on the effects of children's health shocks on parental labor market outcomes. In the first subsection we show that the event of a child's hospitalization have positive and persistent effects on parental labor supply and income, for both male and female parents. We use a general definition of hospitalization and we show that effects hold across most types of diagnostics. In the following subsection we restrict cases to include only those that characterize a severe health shock, i.e. long-term in-patient hospitalizations, and hospitalizations followed by deaths. In the last subsection we perform a series of empirical exercises aimed at uncovering possible mechanisms behind the estimated effects.

4.1 General Health Shock: Hospitalization

Figure 4 shows how parents respond to their children being hospitalized. The top panel shows impacts on (the probability of) employment and the bottom panel shows impacts on total labor income. Within each panel, the graph on the left reports simple averages for that outcome across treatment and control groups, which are also separated by parents' gender. The graph on the right reports point estimates along with 95% confidence intervals for the difference-in-differences estimates, also separated by parents' gender In every graph, years are measured with reference from the exact date of hospitalization for children in the control group. As discussed in Section 3, this shock represents a placebo effect for parents in the control group, whose children are hospitalized exactly 4 years after their counterparts in the treatment group.

Results in Figure 4 show that the event of a child's hospitalization causes a positive effect on parental employment and income, for both mothers and fathers. Although quantitatively small, effects are persistent and seem to push parental employment and income to an upward trajectory that could last beyond the observed window of 4 years after the shock. These

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Figure 4: Effect of Children's Hospitalization on Parent's Labor Outcomes
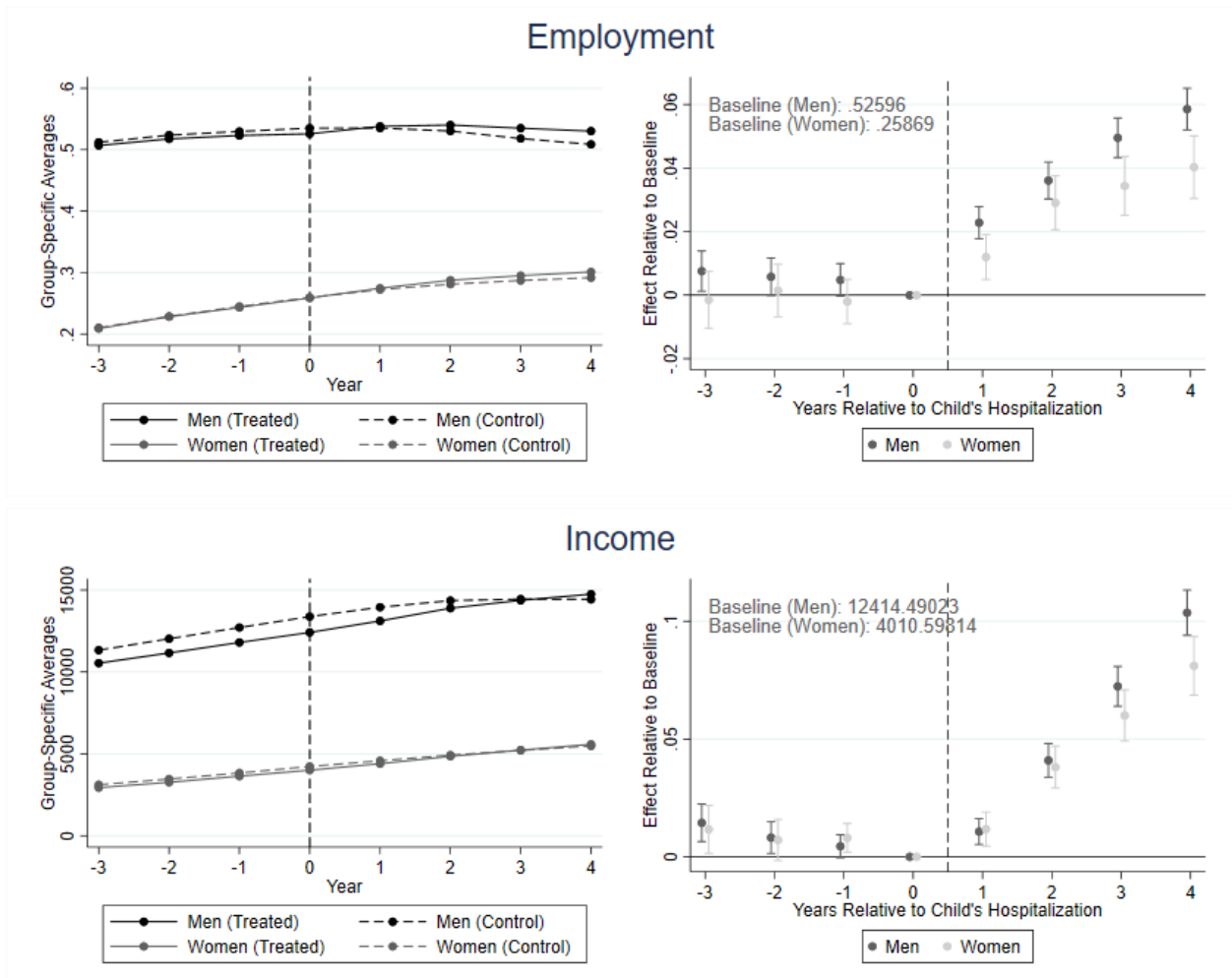
Notes: This figure shows the impact of children's in-patient hospitalization on parental employment (Panel (a)) and labor income (Panel (b)). At each panel, the graphs on the left side display raw averages for men and women in the treated and control groups, while the graphs on the right side side show their respective event-study plots. The event at time zero is the hospitalization of a child from an individual in the treatment group. Individuals in the treatment group are exactly matched with individuals in the control group by age and gender, and their children's age and gender, at the time of the event. Children of individuals in the control group are hospitalized 4 years after children of individuals in the treatment group. 95% confidence intervals are also reported. Income is measured in Brazilian Reais.

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effects are clearly visualized when comparing raw averages of each outcome across treatment and control groups both before and after the shock, as seen in the left-hand side graphs, as when plotting the difference-in-difference estimates in the right-hand side graphs. Table 2 reports average treatment effects for both male and female parents. Column (1), Panel A shows that the total effect on male employment over 4 years is estimated as 2 p.p. over a baseline employment probability of 51%. Column (1), Panel A shows that the effect on female employment is estimated 1 p.p. over a baseline probability of 23%. Relative to their respective baseline values, total effects are quantified as a 3% increase for male parents, and a 4% increase for female parents. A similar exercise to quantify the effect of the shock on male and female labor income (Column 2) yields estimated positive impacts of 6% and 5%, respectively, for male and female parents.

Table 2: Effect of Child's Hospitalization on Parents' Labor Outcomes

	(1)	(2)	(3)	(4)	(5)	(6)
	Full Sample		High-Income Sample (RFB)		Low-Income Sample (CadUn)	
	Employment	Income	Employment	Income	Employment	Income
	Panel A: Male Parents					
$Treat_i \times Post_i$	0.019876***	689.21***	0.028658***	1,223.27***	0.012712***	272.50***
	(0.001346)	(49.21)	(0.001907)	(90.35)	(0.001761)	(37.94)
Mean Outcome (Treated at $t = 0$)	.51	11078.34	.68	17841.51	.38	5582.87
Effect Relative to the Mean	3%	6%	4%	6%	3%	4%
Observations	2,934,640	2,934,640	1,510,208	1,510,208	1,715,888	1,715,888
	Panel B: Female Parents					
$Treat_i \times Post_i$	0.009417***	171.34***	0.018308***	386.52***	0.004353***	56.80***
	(0.000996)	(20.44)	(0.001793)	(46.62)	(0.001127)	(13.59)
Mean Outcome (Treated at $t < 0$)	.23	3318.55	.38	6610.48	.14	1368.02
Effect Relative to the Mean	4%	5%	4%	5%	2%	4%
Observations	4,108,544	4,108,544	1,652,208	1,652,208	2,754,176	2,754,176

Notes: Standard errors clustered at the firm level are indicated in parenthesis. ***, ** and * represent $p < 0.01$, $p < 0.05$ and $p < 0.1$ respectively.

Table 2 also reports estimates separately for both high- and low-income individuals. Following the exposition in Section 2, we define our sample of high-income individuals as those parents whose link with their child are observed in the RFB database, which is thus formed by individuals who formally declared taxes at some given year, listing their child as a dependent. Conversely, our low-income sample is composed of parents whose link with their child are observed in the CADUn database, having thus participated in some governmental means-tested social insurance program. As shown in Figure 2, the resulting observed labor income distribution at each of these samples are skewed, respectively, to the bottom and upper percentiles of that distribution.

Results show that the estimated impacts are higher on the high-income sample than on

the low-income sample, however, it should be noted that baseline values are also higher in the former than in the latter. It also follows that estimated impacts relative to baseline values are quite similar between both samples. We find that positive impacts on employment remain between 2% and 4% across income and parental gender groups, while impacts on labor income remain between 4% and 6%.

In order to explore if results vary with the nature of the health shock being observed, in Figure 5 we report separate estimates for different types of hospitalization. More specifically, we define 10 diagnostic groups for which we observe the highest number of cases and we run separate regressions including only observations in the treatment group that received that specific diagnostic, along with their matched counterparts in the control group.[7] Interestingly, impacts remain similar across most groups for both parental genders. Exceptions are noted for hospitalizations due to external causes (not including injuries), neoplasms and infectious/parasitic diseases (not including intestinal), all three of which have statistically insignificant effects on mothers' employment.

Figure 5: Effect of Children's Hospitalization on Parent's Employment, by Diagnosis Group
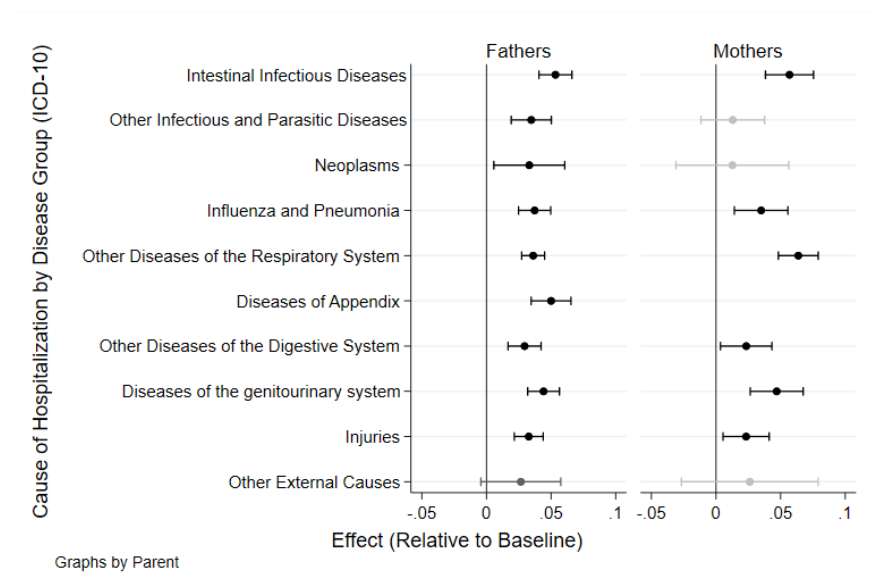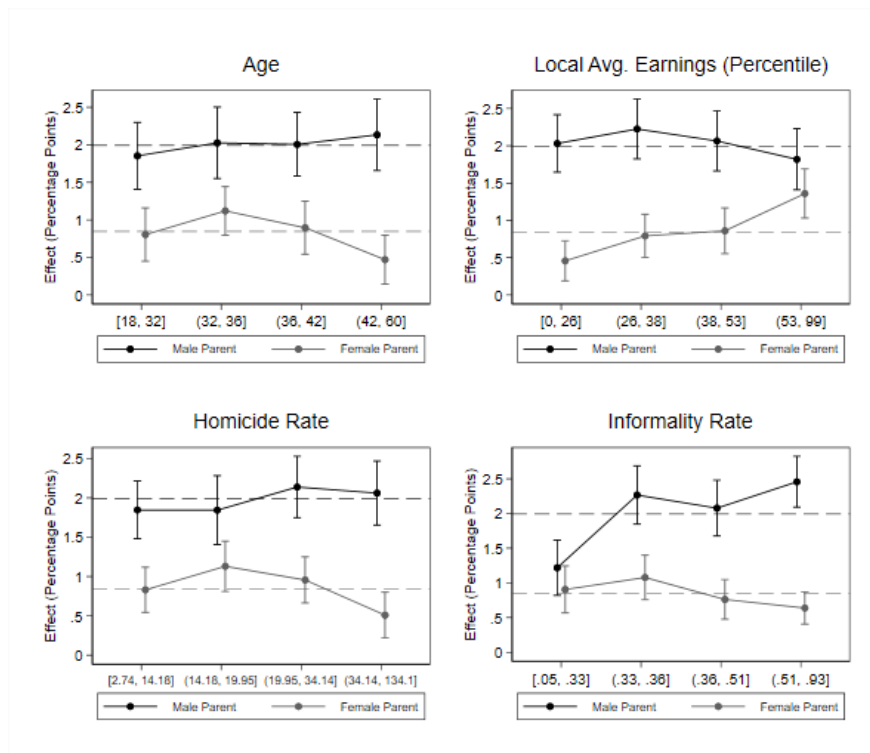

Notes: (...)

Figure 6 shows the results of a heterogeneity analysis on different individual- and local-level characteristics; namely parental age, average labor earnings on parents' zip code of residence, and local (i.e., municipality) rates of homicide and labor informality. As in Figure

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[7]An alternative (and possibly more precise) exercise is to also match observations in the treatment and control groups by their diagnostic, besides the baseline matching variables of parent's and children's age and gender. The original matching strategy, however, helps retain a larger number of observations and thus preserve statistical power. Nevertheless, results remain very similar using either strategy.

5, we focus on the probability of employment as our main outcome. We divide the sample of treated parents (and their control-group matched counterpart) according to values defined by quartiles of these characteristics in the full sample. If we were to uncover large disparities between these estimates, this would further help us understand the nature of the effects. We find, however, no sharp variation between estimates. The noted exceptions are the smaller estimated effect on the lowest quartile of local labor informality and the monotonically positive pattern between estimates from the lower to upper quartiles of local average labor earnings. This latter result point to the direction that parental income levels (especially of mothers) may be a relevant factor explaining the effects of health shocks.

Figure 6: Heterogeneity Analysis on the Effect of Children's Hospitalization on Parent's Employment

Notes: (...)

All in all, the similarity between estimates both in Figure 5 and Figure reffigc2 suggest that impacts on parental labor market outcomes are not necessarily driven by the nature of the health shock associated with the child's hospitalization, nor with other characteristics such as parental age or local indicators such as informality and homicide rates. If they were fully explained by the type of diagnostic, for example, we would expect to see different effects for different types of diagnostics. Instead, Figure 5 shows that hospitalizations that

are potentially associated to non-random events, such as appendicitis (which form most cases that are included under the category "Diseases of the Appendix"), are on par with those that are more likley to be associated with random events, such as injuries, influenza, and infectious diseases. In the next subsection we further explore competing mechanisms that might explain these results. In Subsection 4.2 we explore whether severe and/or fatal health shocks have different impacts on parental labor outcomes.

4.2   Potential Mechanisms

Many possible mechanisms may explain the effects presented in the previous section. The positive impacts on both male and female labor supply and earnings may indicate that parents increase their labor supply in anticipation of higher health care expenditures for their children in the future. This could include, for example, visits to specialized doctors and the purchase of pharmaceuticals. Some hospitalizations may also be associated with the need of subsequent care for the sick child, so the effects could also be affected by parents' need to trade off time spent at work versus time taking care of their child. We explore some of these possibilities in the present section.

4.2.1   Family Structure and Household Composition

We first check whether effects change depending on family structure. Table 3 presents several estimates on the effects of children's hospitalization on parental employment for both male (Panel A) and female parents (Panel B), but in each column we limit observations depending on household-level characteristics. Column (1) includes all families for which we observe both male and female parents – a restriction we maintain for the remaining estimates in this table.[8] As expected, estimates in this column are very similar to those in Table 2, column (1).

Columns (2) through (4) introduce limitations on the number of children in each family. Column (2) includes families with only one child. Column (3) includes families with at least two children in which the youngest one was hospitalized, while column (4) also includes families with at least two children but in which the oldest one was hospitalized. All estimates are statistically indistinguishable from those in column (1). We notice that some effects in column (3) and (4) are statistically insignificant, but this is possibly due to lower statistical power associated to smaller samples used to calculate these estimates. These results indicate that impacts on parental labor supply do not change depending on the number of children, or on which child suffered the health shock.

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[8]For all estimates in this table we also cluster standard errors at the household level.

Table 3: Effect of Child's Hospitalization on Parents' Labor Employment, by Family Structure

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dependent Variable:			Children			Parents		Grandparents	
Employment	All Families	Single	2+ Children		Non-	Cohabiting		Some	None
		Child	Youngest	Oldest	Cohabiting	Male B.W.	Female B.W.	Cohabiting	Cohabiting
					Panel A: Male Parents				
$Treat_i \times Post_i$	0.018545***	0.020086***	0.011553	0.022329***	0.018454***	0.023985***	0.011349	0.016787***	0.018013***
	(0.001643)	(0.002426)	(0.008374)	(0.007371)	(0.001910)	(0.002868)	(0.007351)	(0.003761)	(0.001926)
Mean Outcome (Treated at $t = 0$)	.49	.5	.42	.44	.51	.55	.24	.44	.51
Effect Relative to the Mean	3	3	2	5	3	4	4	3	3
Observations	1,756,176	614,752	43,280	55,712	1,177,200	441,776	66,400	239,712	1,122,304
					Panel B: Female Parents				
$Treat_i \times Post_i$	0.008343***	0.013222***	0.007301	0.010339	0.008505***	0.007597***	0.022879***	0.001502	0.010122***
	(0.001527)	(0.002275)	(0.007390)	(0.006579)	(0.001769)	(0.002667)	(0.008235)	(0.003430)	(0.001797)
Mean Outcome (Treated at $t < 0$)	.21	.2	.12	.15	.21	.22	.66	.2	.22
Effect Relative to the Mean	3	6	5	6	3	3	3	0	4
Observations	1,756,176	614,752	43,280	55,712	1,177,200	441,776	66,400	239,712	1,122,304

Notes: Standard errors clustered at the firm level are indicated in parenthesis. ***, ** and * represent $p < 0.01$, $p < 0.05$ and $p < 0.1$ respectively.

The next three columns preserve observations based on whether both parents live in different addresses (column 5) or in the same address (columns 6 and 7). The latter two columns include only observations for which we observe wether the male or female parent, respectively, is likely to be the breadwinner in the household. We define a "breadwinner" as the parent whose total labor income in the previous three years prior to the child's hospitalization is higher than that of their partners. We find that implied magnitudes relative to baseline means are similar to those in column (1), suggesting that such differences do not meaningfully change our interpretations. We do find, however, that employment estimates for both male and female breadwinners are higher and statistically different (at the 10% level) from those in column (1).

Finally, the last two columns include observations for which we observe at least one grandparent of the hospitalized child living in the same address as parents (column 8) and those for which we do not observe cohabiting grandparents (column 9). We find that female employment does not change in households with some cohabiting grandparent. For this sample, the point estimate on female employment is close to zero (as is the relative effect over the sample baseline) and are statistically different from from the corresponding estimate in column (1), at the 95% level. This suggests that cohabiting grandparents may provide safeguards to female parents; for example, in the form of financial support on future health care expenditures incurred by hospitalized children. As a result, female parents would be less pressured as the average parent to increase their labor supply following their child's hospitalization.

4.2.2 Private vs. Public Health Care Consumption

Another way to evaluate whether labor market effects are driven by financial incentives is to understand how health care consumption of both parents and children are impacted by children's health shocks. Figure 7, Panel (a) shows the impact of a child's hospitalization on private health insurance enrollment for both parents (left graph) and children (right graph) in the years following the hospitalization.[9] As discussed in Section 2.1, these are insurance options that give enrolees access to private-sector networks of hospitals and clinics not related with the SUS. We find large positive effects on subsequent enrollment in private health insurance. Table 4, column (1) show that relative effects for parents and children are respectively quantified in 17% and 42%, albeit over a small baseline of 2 percentage points for both groups. This suggests that the increase in parental labor supply could be partially driven by parents wishing to provide better access to health care services for their children following their hospitalization in a public-sector hospital.

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[9]Accessibility to private options of health care are likely to be influenced by individuals' total earnings and their place of residence. To account for this, in this exercise we also match individuals between treated and control groups by the measure of average local earnings introduced in Figure 6, i.e., the national percentile of average labor earnings in individuals' zip code of residence.

Figure 7: Effect of Child's Hospitalization on Health Care Utilization

(a) Private Health Insurance Enrollment
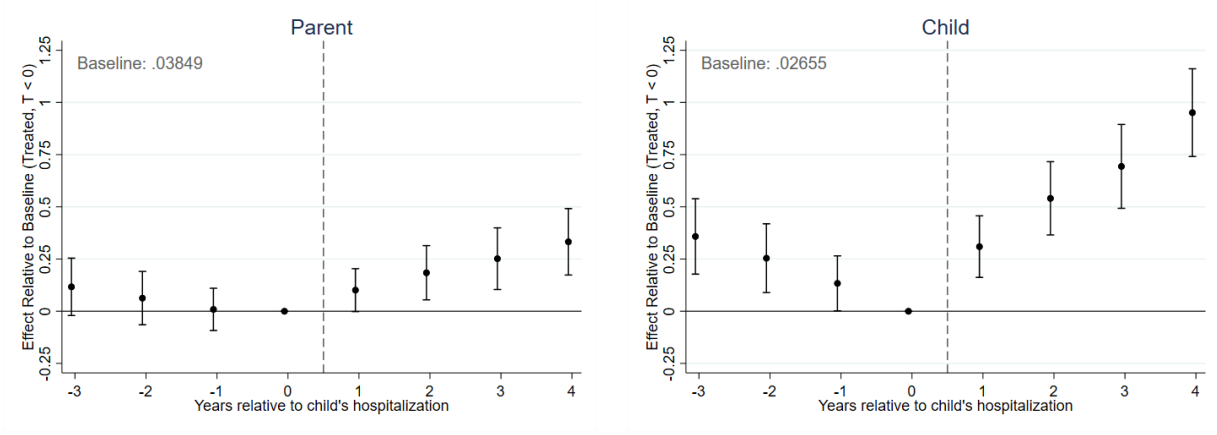
(b) Out-Patient Visits in Public Hospitals
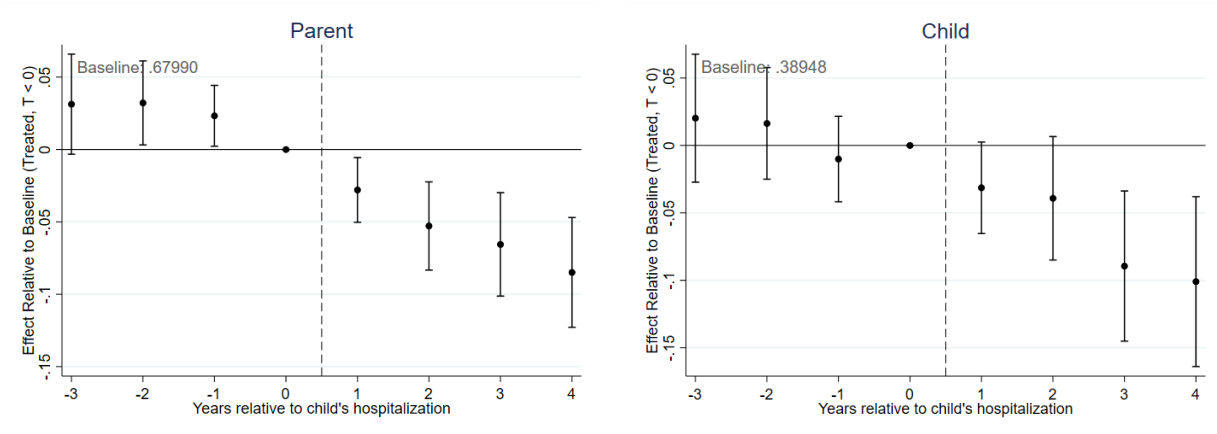
Notes: (...)

Figure 7, Panel (b) shows the impact of a child's hospitalization on out-patient visits in public hospitals for both parents and children. Contrary to the effects on private health insurance, we find a decrease in the average number of out-patient visits for both groups. Relative effects in Table 4, column (2) suggest a decrease of 10% in the number of visits relative to respective baseline values. These apparent counter-intuitive results are in line with our findings on health insurance enrollment – an increase in enrollment on *private* health insurance plans, in this case, would crowd-out subsequent utilization of *public* health care services. Such proposition is supported by the fact that around 73% of the total number of supplemental/private health care establishments in Brazil are for out-patient services (ANS, 2019).

Table 4: Effect of Child's Hospitalization on Health Care Utilization

	(1)	(2)
	H.I. Enrollment (Private)	Out-Patient Visit (Public)
	Panel A: Child	
$Treat_i \times Post_i$	0.009039*** (0.000923)	-0.027987*** (0.009557)
Mean Outcome (Treated at $t = 0$)	.02	.27
Effect Relative to the Mean	42	-10
Observations	690,752	690,752
	Panel B: Parent	
$Treat_i \times Post_i$	0.004436*** (0.000988)	-0.054063*** (0.011366)
Mean Outcome (Treated at $t = 0$)	.02	.49
Effect Relative to the Mean	17	-10
Observations	690,752	690,752

Notes: Standard errors clustered at the firm level are indicated in parenthesis. ***, ** and * represent $p < 0.01$, $p < 0.05$ and $p < 0.1$ respectively.

4.3 Severe Health Shock: Long-Term Hospitalization and Death

In this section, we estimate the effect of children's severe health shocks on parents' labor market outcomes. We focus on three types of events that are plausibly associated to extreme circumstances involving children's health, and thus may lead to very different reactions on the part of parents. These are: *(i)* long-term hospitalizations, *(ii)* hospitalizations that are followed by an in-hospital death, and *(iii)* deaths of any kind. Event study graphs are shown in Figure 8. Table 5 reports average treatment effects and baseline values for each outcome.

Panel (a) of Figure 8 shows that a long-term hospitalization[10] exert no quantifiable impact on male parents' employment or income. On the other hand, we find that female employment is affected by these types of hospitalization and decreases by about 5%, as shown in Column (1) of Table 5, Panel B. Effects are more pronounced in the first years right after the hospitalization but fall back to baseline values by the third year. Impacts on female labor income, however, are inconclusive, and average effects are statistically insignificant.

These results on both male and female employment are similar to those found elsewhere in the literature (e.g., **?**). They indicate that long term-hospitalizations of children in the Brazilian public health care sector are more akin, in nature, to those hospitalizations that are documented in other countries, thus bearing similar consequences to parents as well. For instance, the negative impact on female labor supply is likely due to the need of providing extra care to their child at home following their hospitalization. In the absence of formal job safety provisions (such as providing workers with options for parental leave when their
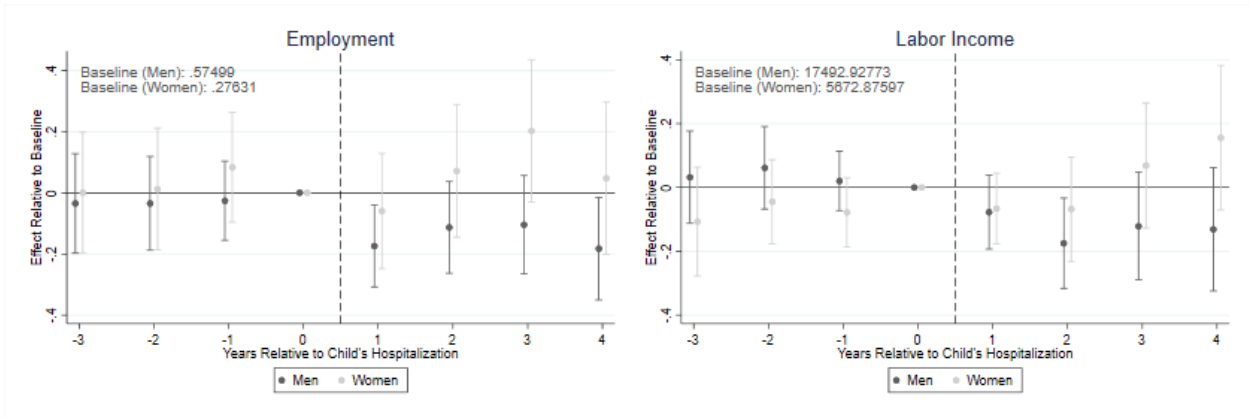
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[10]We define long-term hospitalization as those in which the length of stay in the hospital was at least two weeks. These encompass ...% of our sample, as can be visualized in Figure 1.

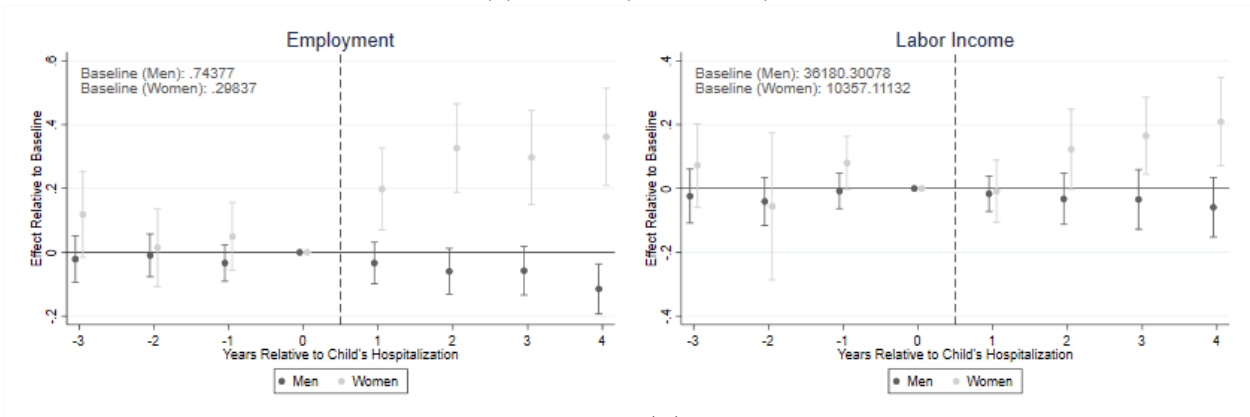**Figure 8:** Effect of Children's Severe Health Shocks on Parent's Labor Outcomes

(a) Long-Term Hospitalization (2+ Weeks)
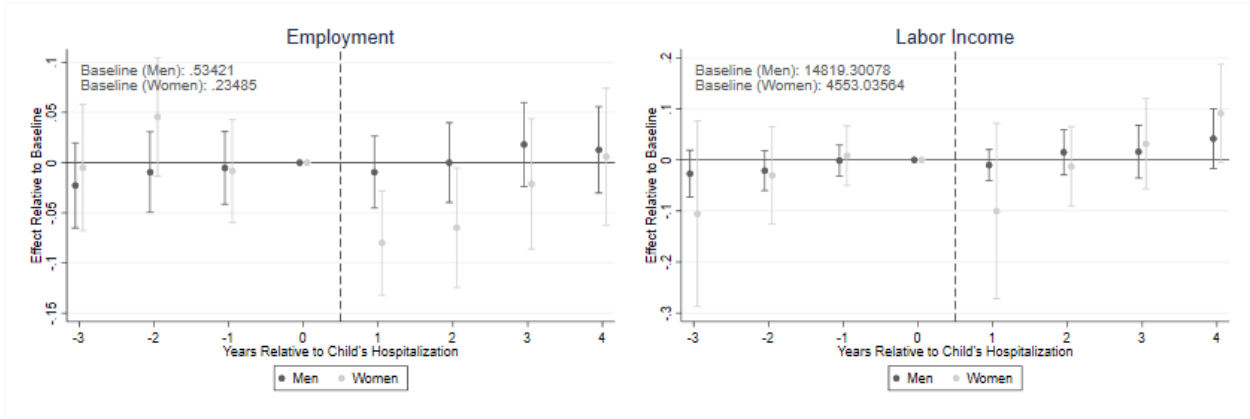
(b) Hospitalization Followed by Death

(c) Death (Any Kind)

Notes: (...)

children get sick or suffer any other type of severe health shock) many mothers may then quit their jobs entirely in order to fulfill this task. Results do indicate, however, that this effect is reversed after a few years.

The death of a child, on the other hand, seems carry very different implications to parental labor supply. Panel (b) of Figure 8 shows that male employment and income decrease significantly following a child's hospitalization that results in death, and that this effect persists in following years. This finding is consistent with the notion that the death of a child should provoke an emotional shock to parents, and that in the case of male parents this translates into a smaller willingness to work in subsequent years. The fact this is evident for male parents could be associated with their common role of main income earners in a household.[11] These effects are also discernible in Panel (c) of Figure 8, which measures impacts from children's dates of death and include all deaths (not only those that followed from a hospitalization), but they are overall statistically insignificant.

More striking, however, are the impacts of children's deaths on female employment. Results for hospitalizations followed by deaths (Figure 8, Panel (b)) show impacts that are indistinguishable from zero, but results for deaths on any kind (Figure 8, Panel (c)) show a substantial increase in female employment after children's deaths, in the opposite direction from both findings on female employment after long-term hospitalizations and male employment after hospitalizations followed by deaths. This finding supports the hypothesis — to adapt from the expression commonly used in the literature — of a "reversed child penalty" for female workers; i.e., an increase in labor force participation that is likely associated to female parents shifting time away from their previous roles as mothers. This effect may also be more relevant in the case of children that were affected by long-term health issues and thus placed higher demands on parents' times, and specially female parents'. Such effects, to our knowledge, have not been extensively documented by the empirical literature.

Columns (3) to (6) in Table 5 quantify the average post-treatment values of the effects documented above. Hospitalizations followed by deaths cause male parents' employment to decrease by 12%, and income to decrese by 16% (p-value: ...). The death of a child causes a 17% increase in female employment, but the effects on income (around a 10% increase) is statistically indistinguishable from zero.[12]

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[11]It is worth noticing that in only 12% of couples from our sample of identified cohabiting partners the female partner was the main income earner (i.e., the "breadwinner") of the household. See Subsection 4.2.1 and, more specifically, Table 3.

[12]One can be puzzled by the similar number of observations between in-hospital deaths (columns 3 and 4) and all kinds of deaths (columns 5 and 6). While we should expect having more observation in the latter case, the coarser clusters of observable characteristics used to identify individual registries in the mortality sample results in a larger loss of observations compared to the sample of hospitalizations. More details are described in Amorim et al. (2023). Also, we find no evidence of selection in observable characteristics between identified individuals in each sample.

**Table 5:** Effects of Child's Severe Health Shocks on Parents' Labor Supply

	(1)	(2)	(3)	(4)	(5)	(6)
	Long-Term Hosp. (2+ Weeks)		Hosp. Followed by Death		Death (Any Kind)	
	Employment	Income	Employment	Income	Employment	Income
	Panel A: Male Parents					
$Treat_i \times Post_i$	0.007848	413.242734	-0.068750**	-2704.842748*	-0.017073	-832.781862
	(0.007485)	(321.868471)	(0.031212)	(1,387.698498)	(0.034685)	(2,975.112474)
Mean Outcome (Treated at $t=0$)	.52	13550.63	.56	16589.99	.75	31866.07
Effect Relative to the Mean	1	3	-12	-16	-2	-2
Observations	56,576	56,576	3,200	3,200	3,280	3,280
	Panel B: Female Parents					
$Treat_i \times Post_i$	-0.011287**	156.428866	0.011513	452.850323	0.057692**	1,152.601600
	(0.005302)	(188.473861)	(0.023060)	(464.134547)	(0.026178)	(1,001.147945)
Mean Outcome (Treated at $t=0$)	.21	3903.25	.25	5073.74	.33	10961.32
Effect Relative to the Mean	-5	4	4	8	17	10
Observations	80,800	80,800	4,864	4,864	4,368	4,368

Notes: Standard errors clustered at the firm level are indicated in parenthesis. ***, ** and * represent $p < 0.01$, $p < 0.05$ and $p < 0.1$ respectively.

Figure 9 shows how the effects discussed above are driven by the different diagnosis associated with hospitalizations/deaths. It is an exercise analogous to the one shown in Figure 5. The upper panel on long-term hospitalizations show that the negative effect associated to female workers is most evident for hospitalizations due to neoplasms. This is in line with recent findings showing that children's cancer diagnosis have short- and long-run negative impacts on parental income – and specially female parents' income – in northern European countries (e.g., Adhvaryu et al., 2023, Vaalavuo et al., 2023). While some effects are also statistically significant (at 10% level) for male parents, they are overall inconclusive and sum up to a null effect, on average.

The middle panel shows that the effect of hospitalizations followed by deaths on male parents' employment is primarily driven by external causes, including injuries. This aligns with the interpretation that these negative effects are driven by unpredicted hospitalizations/deaths, and are thus plausibly associated with consequences of an emotional shock to (male) parents. Finally, the estimated effect of overall deaths on female employment, shown at the bottom panel, are driven by the main causes of health shocks to children, as seen in Figure 1 – namely, those associated with influenza, pneumonia, and other types of respiratory diseases.

Figure 9: Effect of Children's Hospitalization on Parent's Employment, by Diagnosis Group
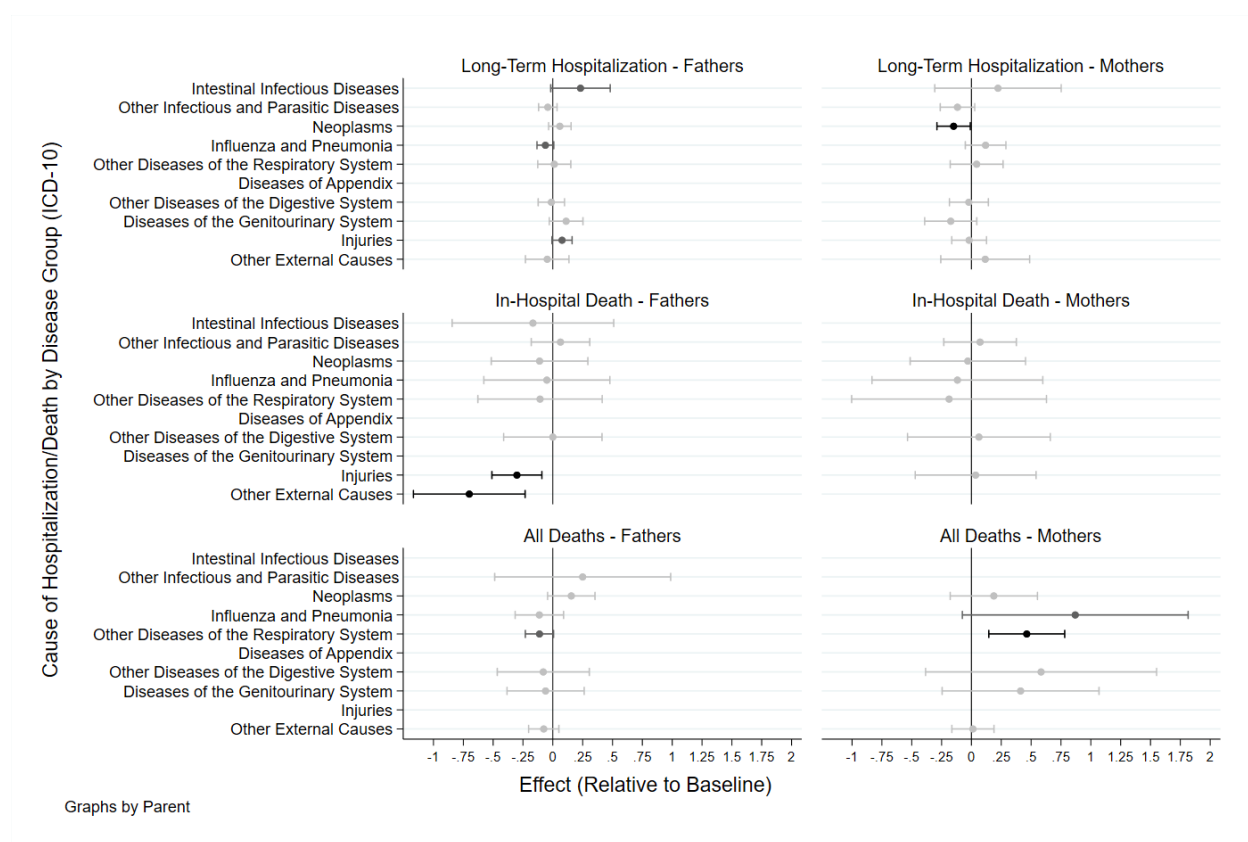
Notes: (...)

5   Discussion and Concluding Remarks

This paper explores the economic impacts of children's health shocks on Brazilian families. Our findings show that that children's hospitalizations increase both male and female parents' labor supply and earnings, on average. Effects differ when restricting events to long-term hospitalizations: while male labor supply does not change, female employment probability is negatively impacted but rise back to baseline values after three years. Deaths, on the other hand, negatively impact male parent's employment and income, but exert a positive and persistent impact on female employment and income. We also find evidence of shifts from public to private consumption of health care following a health shock. More precisely, we show that children's hospitalization cause an increase in enrollment of private health insurance plans (for parents and children), and a decrease in children's out-patient visits to public primary care centers.

Our results point to several directions for future research. We show that parents react to children's health shocks depending on the nature of such shocks – whether their are

mild or severe, predictable or unpredictable, or should require extra investments in time or financial resources from parents. Our results should thus guide future efforts to understand how individuals decide between working and providing support for sick or injured family members, particularly in places with low socioeconomic status and limited access to varied options for health and/or social insurance. Also from a policy perspective, our results point to the importance of carefully understanding the interactions between public and private health care options and how these shape individuals' employment decisions.

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