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Household donations of time and money in response to a health shock

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ABSTRACT

Donations play a critical role in supporting the provision of public goods, yet how donating behaviour changes in response to health shocks is poorly understood. We investigate how the household's joint decision to donate time (volunteer) and money changes following a health shock. Using data from the United States Panel Study of Income Dynamics, and a within-household design that captures the dynamics of a post-health shock response, we find no overall change in the probability of households donating money but an overall reduction in the probability of donating time following a health shock. This is driven by a significant shift from donating both money and time to donating only money after a health shock. The shift away from donating time occurs for both the individual who experienced the health shock and their spouse, though the reduction is greater for the spouse. We examine the role of labour market responses to health shocks in explaining donating behaviour and find that consistent with the added worker effect, spouses of those who experience a health shock increase their work hours, constraining their time available for volunteering.

1. Introduction

Charitable giving is significant in the US. In 2018, monetary donations totalled $410 billion and donations of time (volunteering) totalled 6.9 billion hours (worth $167 billion) (Giving USA, 2018; United States Bureau of the Census et al., 2019).[1] Households constitute a significant source of these donations, with an estimated 70 per cent of households donating money and 25 per cent of households donating time (Giving USA, 2018; United States Bureau of the Census et al., 2019). These donations of both time and money play a critical role in supporting the provision of public goods such as social and health services. Accordingly, understanding the drivers of household decisions to donate and the potential complementarities or trade-offs between donating money and time is of substantial public importance. One such driver is a health event or shock arising from cancer, heart attack and stroke, which are increasing globally (Institute for Health Metrics and Evaluation, 2020) and lead to major disruptions to household members in terms of health, labour market engagement and time use (Trevisan and Zantomio, 2016; Jeon and Pohl, 2017; Riekhoff and Vaalavuo, 2021). However, little is known about how a health shock can shape donation decisions. Therefore, in this paper, we examine how a household's joint decision to donate money and time changes in response to a health shock. In particular, we investigate how responses differ by the household member experiencing the health shock compared to their spouse, and how labour market responses within the household play a role.

We contribute new evidence on this issue using data from the United States (US) Panel Study of Income Dynamics (PSID), which has the advantage of providing detailed information on monetary donations and volunteering hours of households over time. We employ a within-household fixed effects model and use an event study design to examine changes in donating behaviour of households in the years following a health shock compared to prior to the shock. We follow previous studies in defining an adverse health shock as an unanticipated change in health through a new diagnosis of a potentially life-threatening condition, namely cancer, heart attack or stroke (Smith et al., 2001; Jones et al., 2016; Lindeboom et al., 2016). The unanticipated nature of these health shocks is important for identifying the donating response to health shocks. In this context, unanticipated means that the exact timing of the shock is not known in advance. It does not rule out that individuals may be aware that the risk of experiencing a health shock may be higher in some periods more than others, so we restrict the analysis to consider only the first health shock in order to

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[1] Donations of time or volunteering is defined as work performed without monetary recompense to benefit a charitable organisation in order to create social output that would otherwise require paid resources (Freeman, 1997).

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reduce the anticipation that may occur following this. Identification in these models have been discussed extensively by Abbring and Van Den Berg (2003) and Heckman and Navarro (2007). Our investigation is undertaken at the household level (rather than the individual level), which is important to allow for household donating decisions and family interactions with respect to health shocks and extra-family time constraints, such as work hours and caring responsibilities. Much of the literature considers the individual as the unit of analysis, thus underplaying the role of these interactions.

The key contributions of this paper over the existing literature are threefold. First, few studies have investigated pro-social behaviour following adverse health shocks. Black et al. (2021) find that an adverse health shock leads to an increase in donations to health charities but not an increase in donations overall. However, it is not clear that a similar response would follow for time donations given that there are different requirements and opportunity costs (e.g. volunteering often requires a minimum level of health and time). Our paper extends this literature by considering the joint decision to donate both money and time. Second, we build on the literature which explores the trade-offs between time and money donations more generally (e.g. Brown and Lankford, 1992; Duncan, 1999; Feldman, 2010; Bauer et al., 2013; Brown et al., 2019) by examining these trade-offs in relation to an adverse life event. In addition, much of this literature considers the decisions and trade-offs at the individual level (e.g. Cappellari et al., 2011; Bauer et al., 2013; Brown et al., 2019); our paper joins others in recognising the importance of household interactions (e.g. Brown and Lankford, 1992; Feldman, 2010), by considering the household as the unit of analysis. Third, we contribute to the broader literature on the economic effects of health shocks and household spillover effects. This literature has considered the labour market outcomes of the affected individual and labour supply decisions of the spouse (Jeon and Pohl, 2017; Riekhoff and Vaalavuo, 2021); we uniquely consider how such labour market responses can also have implications for other household decisions such as donations.

We find there is little overall change in the probability of donating money (3 percentage points increase) and an overall reduction in the probability of donating time (7 percentage points decrease) following a health shock. This is driven by a significant shift from donating both money and time (11 percentage points decrease or 23 percent reduction relative to the pre-shock mean) to donating only money (14 percentage points increase or 39 percent increase relative to the pre-shock mean).

The shift away from time donations occurs regardless of whether the individual or their spouse experienced the health shock; the household member with the health shock and their spouse both reduce their net donations of time, though the reduction is greater for the spouse. Given that a minimum level of health is often required to engage in volunteer activities, it is not surprising that the household member who experiences the health shock reduces their time spent volunteering following a health shock. For the spouse of the household member with the health shock, we find that they significantly increase their work hours by 248 hours (or about 31 days) in the year of the health shock, which likely offsets the significant reduction in work hours by the person who experienced the health shock (266 hours or about 33 days). These changes in work hours are largely sustained in the years following the health shock, and indicate that the capacity of the spouse without the health shock to donate time has substantially decreased.

Our findings shed light on the changes in household donating behaviour in response to health shocks. Given that health shocks such as cancer, heart attack and stroke continue to be the leading causes of disability (Institute for Health Metrics and Evaluation, 2020), this has important implications for the public sector and non-profit organisations which rely on donations of both money and time.

This paper is structured as follows. Section 2 summarises how a health shock might affect giving and the theoretical framework. Section 3 outlines the data. Section 4 outlines the methodology. Section 5 presents the main results. Section 6 presents a discussion of the findings, implications, limitations and concludes.

2. Background

2.1. Conceptual framework for donating time and money

The economics literature has explored how people make decisions between time and money donations more generally, with the debate centred around whether they are substitutes or complements using two key models. The public goods model predicts that donations of time and money are perfect substitutes in equilibrium because the donor only cares about the final public good that is produced (Duncan, 1999). The private consumption model assumes that donors derive private benefits from their charitable contributions, so the total supply of the public good does not affect individual utility, relaxing the result that donations of time and money are perfect substitutes (e.g. Menchik and Weisbrod, 1987; Brown and Lankford, 1992; Bauer et al., 2013).

Duncan (1999) demonstrates empirical support for the public goods model; however, in an experimental study testing its assumptions, Brown et al. (2019) find stronger preferences for time donations compared to money donations, which they attribute to a differential warm glow (utility) for the giver between the two forms of donations. The private consumption model allows time and money to be donated for different reasons, so it makes no clear prediction about the relationship. For example, individuals may benefit more from donating time than spending the equivalent amount of money because they enjoy the prestige associated with volunteering, the interaction with others, or if they expect external benefits such as making valuable social contacts (Cappellari et al., 2011; Ellingsen and Johannesson, 2011).

Most of the literature is based on the private consumption model, which we also adopt in this paper. However, there is little empirical consensus on whether donations of time and money are substitutes or complements in this literature. Bauer et al. (2013) find that time and money donations are substitutes due to the opportunity cost of time. Brown and Lankford (1992) provide evidence that volunteer time is a gross complement to money donations. Similar to Freeman (1997), this finding is attributed to some individuals having a 'taste' for giving in general, particularly given a tendency for the same people to donate both money and time. Feldman (2010) finds evidence that donations of time and money are substitutes following a decrease in the tax price of monetary donations. However, Feldman (2010) finds that monetary donations have a positive effect on the donations of time that act outside the change in relative prices. This is attributed to greater intrinsic motivation through increased information and identification with the goals of the organisation; households that donate money are more likely to be asked to donate time and respond affirmatively.

We treat charitable giving as a private consumption choice, which recognises that individuals derive warm glow from their donations (it directly enters their utility function) and that time and money may be donated for different reasons (Brown and Lankford, 1992; Feldman, 2010; Bauer et al., 2013). These models capture the utility maximisation problem at the individual level, but in the context of a health shock, decisions to donate time and money are likely to be determined at the household level – much of the literature ignores the household as the unit of analysis, thus underplaying the role of family interactions and the interplay of these interactions with extra-family constraints such as work and caring responsibilities (Wilson, 2000). We therefore consider this model at the household level to capture the dynamics and joint decisions by household members, where households maximise their utility dependent on aggregate household private consumption, leisure and charitable contributions of time and money. This is subject to the aggregate monetary and time resources of the household, where each individual in the household has a total endowment of time comprising work time, leisure time (which includes self-care or caregiving) and charitable donations of time. This allows us to consider the possible response when one member of the household experiences a health shock.

2.2. Health shocks and donating decisions

There is limited empirical evidence on how a health shock impacts the joint decision to donate time and money at the household level. Following a health shock, individuals may become particularly motivated to help others as public services (e.g. health services) and their benefits become more salient and trigger altruistic or warm glow giving. This is known as 'altruism born of suffering'.[2] But the ability to give may be limited. There are often household financial pressures following a health shock due to a reduction in employment and income by the person experiencing the health shock, an increase in healthcare expenditure, and a need to finance formal care arrangements, all of which may increase the opportunity cost of donating money (Black et al., 2021).

When it comes to donating time, there are further considerations. For the household member with the health shock, there may be an associated increase in the value of time for self-care causing 'leisure' time to increase at the expense of time devoted to volunteering or working. Volunteer activity can also vary significantly and require different skills (Wilson, 2000), with the most common activities consisting of preparing and distributing food (11%); fundraising (9%); teaching (9%); and general labour (9%) (United States Bureau of the Census et al., 2019). These activities indicate that donations of time often require the individual to physically attend a designated facility to participate and require a minimum level of health and time. A health shock will therefore typically reduce the capacity of affected individuals to engage in volunteer activities. Given these additional requirements, the ability to donate time following a health shock may be more constrained than money donations, which may lead to a preference for the latter.

Another important consideration is that a health shock may trigger changes to the allocation of time of the spouse without the health shock, which in turn influences the opportunity cost of donating time and money. Assuming the spouse of the household member with the health shock is engaged in the labour market, they face a number of potential response options when a health shock occurs: they could maintain their current labour supply and rely on paid formal or alternative caregiving, which would result in an overall reduction in money available for donations; or they could increase their labour supply (by reducing their leisure time) to compensate for the loss of spousal income and higher health care expenses (known as the *added-worker effect*) (Coile, 2004; Acuña et al., 2019), which would result in a reduction in available time for donating. Another response option is they could decrease their labour supply to provide care for the affected spouse (*caregiver effect*) (Braakmann, 2014; Jeon and Pohl, 2017) or if caregiving needs are less acute, to spend more leisure time with their spouse, which would result in a reduction in both available time and money (*joint leisure effect*) (Jeon and Pohl, 2017). For the caregiver and joint leisure effects, work time decreases, leisure time increases and volunteering time likely decreases. The most likely spousal response is a priori unclear, and existing evidence from a limited number of empirical studies suggest that it depends on the context (Coile, 2004; Siegel, 2006; García-Gómez et al., 2013; Jeon and Pohl, 2017; Acuña et al., 2019; Anand et al., 2022).

Overall, given the lack of consensus in the theoretical literature and limited empirical evidence, the dynamics of household donations of money and time following a health shock are ambiguous and need to be investigated empirically.

3. Data

3.1. Panel Study of Income Dynamics (PSID)

The PSID is a nationally representative panel of households in the United States, which began in 1968, containing detailed information on economic, health and social issues (Panel Study of Income Dynamics, 2019). From 2001 to 2015 biennially, the PSID contains a philanthropy module comprising a series of detailed questions relating to charitable giving. It contains information on whether or not volunteering is undertaken for both the household head and spouse in 2003, 2005 and 2011, and therefore we focus our analysis on these survey waves.

We follow previous studies in defining an adverse health shock as an unanticipated change in health through a new diagnosis of a potentially life-threatening condition, namely cancer, heart attack or stroke (Smith et al., 2001; Jones et al., 2016; Lindeboom et al., 2016).[3] The unanticipated nature of these health shocks is important for the identification of the model, which in this context, means that the exact timing of the shock is not known in advance. Identification in these models have been discussed extensively by Abbring and Van Den Berg (2003) and Heckman and Navarro (2007).

Our sample consists of households of 'couples' (with or without other household members) who remain together over the observed time horizon, where one member of the couple experienced a health shock from 2001 onwards.[4] Because we estimate a within-household analysis and compare households' donations after they experience a health shock with their behaviour prior to a health shock, we only include households following a first health shock. This is based on two key reasons. First, there is random-like variation in the timing of health shocks and our estimation strategy captures the dynamics of a post-shock response. Second, households that do not experience a health shock are significantly different across a number of key sociodemographic characteristics (age, education, race, household size) compared with households who experience a health shock (refer to Appendix A, Table A1), and therefore may provide an inappropriate control group.

We consider the household couple to be jointly responsible for determining household donations given that 77 per cent of households in the PSID report this is the case,[5] so households are excluded if there were changes in the household head or spouse (e.g. due to death) to ensure that the household head and spouse composition remains constant. Households are also excluded if the health shock was not their first health shock to capture changes in donations following an initial adverse health event.[6] Changes in household composition and multiple health shocks are later included in the sample when robustness checks are undertaken (see Section 5.1). The final sample comprises 1245 observations on 452 households.

Table 1 outlines the summary statistics of the key variables used as time-varying controls in the analysis. The mean age of the household head and spouse is 55 and 53 respectively, with a mean household size of 3.1. We also control for other significant events, specifically, the birth or death of a child (a relatively uncommon occurrence), and the presence

[2] Refer to Black et al. (2021) for a more detailed description of altruism born of suffering in this context.

[3] These studies focus on these conditions because they occur suddenly and largely unexpectedly, and are regarded as 'unanticipated' because the exact timing of onset is unknown. So, while risk factors may inform an individual about their health risks, it remains largely uninformative with respect to the timing of the event.

[4] Charitable giving is typically a household decision between the household head and spouse. A majority (67%) of households in the PSID are 'couples' and these households are generally more stable over time, which is important for minimising confounding due to changes in household head and spouse composition, which may affect charitable giving decisions.

[5] In the PSID, households are asked: "when you and your spouse made decisions about supporting charities, did one of you make most of the decisions about how much to give to each charity, did you mostly decide together, or did you make your own separate decisions?"

[6] We can only observe health shocks between 1999 and 2015. If any individual in the household experiences at least one health shock during this period, we record the one that occurred first as the health shock, and exclude any other future health shocks observed for that household. We then consolidate this information and align this to the survey waves 2003, 2005 and 2011 in which we undertake the analysis.

Table 1
Summary statistics of time varying control variables (2003, 2005, 2011).

	Mean	SD
Demographics		
Age – head	54.9	11.1
Age – spouse	52.5	10.9
Household characteristics		
Household size	3.1	1.3
Death of child (=1 if death of child occurred %)	0.2	4.0
Birth of child (=1 if birth of child occurred %)	3.0	17.0
Other unrelated health condition (=1 if at least one household member has an unrelated health condition %)[a]	65.0	47.0
Observations	1245	

[a] Other unrelated health conditions include asthma, arthritis and other (e.g. seizures, allergies, fibromyalgia, migraines, eye/ear infection etc) and were selected based on data availability.

of an unrelated health condition (65%) which may influence salience of need towards the health sector.

3.2. Donations of money and time

Households were asked about donations in the previous calendar year. For example, in 2003, they were asked: "During the year 2002, did you [or anyone in your family] donate money, assets, or property/goods, with a combined value of more than $25 to religious or charitable organisations?". If they answered 'yes', they were asked further questions about the dollar value and sector that they donated to. In 2003, 2005 and 2011, respondents were asked about volunteering immediately after the questions about donating. It is made clear to respondents that volunteering means 'doing unpaid work' and not just belonging to an organisation. Respondents were asked, "In the last year, did either you or [spouse's name] do any volunteer activity through organisations?". Respondents were asked to specify who undertook the volunteering (household head, spouse or both). Further questions about volunteering hours and type of sector were asked, but only in two waves (2003 and 2005). Given our use of a within-household fixed effects approach (detailed below) and the limited statistical power to investigate donations at a more disaggregated level, we use all three available waves with any information on both volunteering and donations and focus on the overall donations of time and money at the extensive margin. While there is potential for measurement error given the self-reported nature of this variable, our focus on the extensive margin may minimise this.

Across all waves and households, the majority of households donate money (82%), while about half (49%) donated time. Fig. 1 illustrates this in terms of the household's decision to donate time and/or money. It shows that most households donate only money (47%) followed by donations of both money and time (36%), with the case of households doing neither (14%) or donating only time (3%) less common.

For most households, raw donation behaviour remains largely the same before and after a health shock (further details are provided in the transition matrix outlining the raw and uncontrolled shifts across each donation category in Table 2). For example, of the 38.2% of households that donated money and time after their health shock, 33.6% had also done so before their health shock compared to 3.5% who had previously donated only money, and 1.1% who had previously donated only time. However, for those 6.7% donating only time after a health shock, most did not do so previously and there were similarly small numbers of households changing to this behaviour after a health shock (0%–2.6%). This may be due to the low proportion of households donating only time in any period in our sample (3% in Fig. 1).

The greatest change in behaviour is seen for households shifting to donating only money after their health shock. An estimated 44.7% of households donated only money after their health shock, yet 10.8% (just under a quarter of these households) had previously donated both

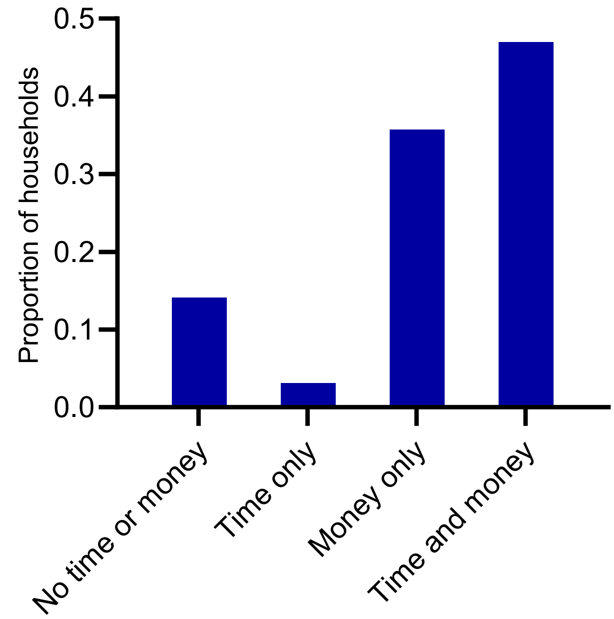

Fig. 1. Average household donations of money and/or time.

money and time. This suggests that the greatest shift in response occurs because households are no longer donating time. In the following sections we explore this relationship more formally by accounting for household characteristics and capturing in more detail the timing of the health shock.

3.3. Health shocks

Information on health conditions, events and duration are available every two years from 1999-2015.[7] In our sample, of those who experienced a health shock, 62% were diagnosed with cancer, 23% had a heart attack and 15% had a stroke.

Similar to Black et al. (2021), we use this information to determine the time since the health shock (relative to when donations were made). The timing of donations relative to the health shock is then grouped into four categories.

(1) $n = -2$: t is more than two calendar years prior to the health shock (38% of observations);
(2) $n = -1$: t is equal to one or two calendar years prior to the health shock (12% of observations);
(3) $n = 0$: t is in the calendar year of the health shock (7% of observations);

[7] Household heads are asked: "has a doctor ever told you that you have had a stroke [heart attack, cancer]?". In terms of the time since health shock, from 1999 to 2003, household heads are asked: "how long have you had this condition?". This differed from 2005 to 2015, and household heads are instead asked: "how old were you the first time you had a stroke [heart attack, cancer]?" and "have you had another stroke [heart attack] at any time in the past 12 months/a second or subsequent stroke [heart attack] since that first one?" All questions were also asked for spouses. From this information we construct our key variable, the date of the health shock. Given that this variable is based on self-reports, there is potential for measurement error, which could lead to attenuation of the estimates towards zero. We show in Appendix A (Table A3) that our measure of a health shock corresponds with a decline in self-assessed health, which provides support for our measure.

Table 2
Transition matrix – proportion of households donating money and/or time before and after a health shock, weighted.

		After health shock (1) No time or money	(2) Time only	(3) Time & money	(4) Money only	Total
Before health shock	(1) No time or money	0.059	0.000	0.000	0.067	0.126
	(2) Time only	0.000	0.015	0.011	0.005	0.032
	(3) Time & money	0.000	0.026	0.336	0.108	0.470
	(4) Money only	0.045	0.025	0.035	0.267	0.373
	Total	0.104	0.067	0.382	0.447	

Note: Weights are applied to reflect the sample size of each category. The cells shaded in grey indicate no change in donation behaviour following a health shock. Based on 1,178 observations from 2003, 2005 and 2011.

(4) $n = 1$: t is after the calendar year following the health shock (42% of observations, with an average time of six years following the health shock).

Given that data on time donations is only available for the years 2003, 2005 and 2011, timing categories have been consolidated to increase statistical power. However, we present detailed results in Appendix A (Table A2) which splits up the pre-shock period ($n = -1$) into two categories (up to one year before the health shock, and one to two years before the health shock), and splits the post-shock period ($n = 1$) into three categories (in the calendar year following the health shock year, in the calendar year two years following the health shock, and more than two calendar years following the health shock).

4. Empirical strategy

To estimate the change in the probability of households donating time and/or money to charity in response to a health shock, we employ a within-household fixed effects model. This controls for all time-invariant household characteristics that may influence donating behaviour. We use an event study design to estimate changes in donating behaviour in the year during and following the health shock compared to behaviour prior to the health shock.[8]

The empirical model can be described as:

$$Y_{it} = \sum_{n=-1}^{n=1} \beta_n HS_{nit} + X_{it}^{'}\gamma + \alpha_i + \lambda_s + \varepsilon_{it} \tag{1}$$

where Y_{it} is defined as the probability of the following three potential outcomes relative to donating neither forms of charity for household i at calendar year t: (i) donating both time and money; (ii) donating only money; and (iii) donating only time. Each equation in (1) is estimated using a linear probability model with standard errors clustered at the household level.[9]

We include a set of indicators, HS_{nit}, for when charitable giving in a particular calendar year occurred in relation to the health shock, where time n represents three different time periods in relation to the timing of the health shock: $n = -1$ (when t is one to two years prior to the health shock; n = 0 (when t is the year of the health shock); and $n = 1$ (when t is one or more years following the health shock).

We select $n = -2$ as the reference category, so our model compares household donation behaviours relative to their own donating behaviour when t is more than two years prior to the health shock. This period is selected because it enables a clean point of comparison relative to other periods such as $n = -1$ where health, on average, begins to significantly deteriorate (refer to Appendix A, Table A3) which can affect the ability to donate.[10]

In addition, α_i are household fixed effects, λ_s are survey year fixed effects and ε_{it} is an error term. $X^{'}$ is a vector of time varying control variables affecting charitable giving which includes the age of each household member, household size, presence of an unrelated health condition in the household and a life event such as the birth or death of a child.[11] Each of these control variables have been included because they capture slightly different variations in household structure. Household size may capture factors such as children moving out of home, or extended family moving into the home which may influence giving. Births and deaths are major life events that can potentially have an influence on giving behaviour independently from household size.

Health status, income and healthcare expenditure are potential mechanisms through which a health shock could influence donations as a decline in health could impact labour force participation and income

[8] In an event study design or a within-household fixed effects model, the R squared is often low (as the R-squared refers to the remaining variation after the variation between households have been removed). However, this does not mean that the model is mis-specified. Indeed, these models help to produce valid estimates of the independent variables of interest (Roth et al., 2023) – in our case, the random-like timing of health shocks. By design, these approaches are differencing out all time-invariant (household) confounders, including unobserved factors, rather than adjusting for observed confounders through control variables. This is particularly valuable when the concern is that confounders may bias the estimate of health shocks, and there is limited survey data on the characteristics of households which may drive both the probability of health shocks and donating behaviours.

[9] The linear probability model is used for ease of estimation and interpretation of the estimates. Because the dependent variable is dichotomous, it may not provide the most efficient specification nor provide appropriate predictions at an individual level. Estimating specification (1) using a nonlinear maximum likelihood model such as probit or logit (and extensions of these models such as bivariate probit or multinomial logit) with fixed effects has its own issues such as the incidental parameters problem, perfect prediction and small sample bias (e.g. refer to Kunz et al., 2017). Nevertheless, we test the robustness of our estimates using a logit model with fixed effects and find the results are similar (Appendix A, Table A5).

[10] This is supported by various studies which have reported that the time from symptom onset to diagnosis can vary, ranging from 49 to 280 days, with a median of around 98 days (Pitiphat et al., 2002; Hansen et al., 2011; Walter et al., 2015). For example, initial symptoms reported for lung cancer prior to diagnosis can include fatigue and breathlessness (Walter et al., 2015) which may not be perceived to be serious and necessitate immediate medical assessment, but it may impact on an individual's assessment of their health status relative to prior periods.

[11] There is a possibility that all these control variables may be 'bad controls', so we also test the robustness of our results using no control variables (Appendix A, Table A13).

(Garcia-Gomez, 2011; Jones et al., 2016), and there may be an increase in healthcare expenditure due to out-of-pocket costs due to ongoing care (Paez et al., 2009; Narang and Nicholas, 2017). We consider these characteristics further in two ways. First, we consider the extent to which these potential mediators are impacted by a health shock in (refer to Appendix A, Table A3 and Section 5.2). Second, we include them in the main model as covariates to see how they change the estimated impact of the health shock on donations.[12] Including them as covariates in the main model has limited impact on our results (refer to Appendix A, Table A6, Table A7 and Table A8), implying that the health shock itself appears to be directly influencing donations and that there is limited mediation through these pathways. While there may be other potential mediators,[13] we focused the analysis on these three mediators due to data availability.

Recent literature has identified that standard fixed effects models can produce biased estimates of the average treatment effects when there are heterogeneous effects of the treatment across units that depend on when they are exposed to treatment (Borusyak and Jaravel, 2017; Goodman-Bacon, 2021). Another issue is that when already-treated units act as controls for later-treated units, changes in their outcomes may include time-varying treatment effects which can potentially bias the fixed effects estimator (Goodman-Bacon, 2021). We address these concerns in Section 5.1 by undertaking robustness checks using the imputation estimator derived by Borusyak et al. (2022) and considering the results according to whether the health shock occurred early or late.

5. Results

5.1. Choosing between charitable activities following a health shock

In Fig. 2, we show how the probability of donating money and/or volunteering time varies with time relative to the health shock. The results indicate that in the years following the health shock ($n = 1$), there is a significant reduction by around 11 percentage points ($p = 0.036$) in households that donate both money and time relative to $n = -2$ (more than two years prior to the health shock). This corresponds to a 23 percent reduction relative to the pre-shock mean of 0.47. In the years following the health shock there is a small increase in the probability of donating time only relative to $n = -2$ (4 percentage points, $p = 0.183$), but this estimate is not significant noting that only 3 percent of households fall within this category of donating behaviour. However, we find a significant increase in the probability of households donating money only by around 14 percentage points ($p = 0.021$) or 39 percent relative to the pre-shock mean of 0.36. We find the estimated coefficients for the year of the health shock and the calendar year prior to the health shock to be small and statistically insignificant for all donating behaviours.

The results from Fig. 2 show that on the one hand, households are reducing both money and time donations, but on the other hand, they are increasing money only donations. If we add these opposing results together, we find that there is overall little change in the probability of donating money following a health shock; the net result is a small, statistically insignificant increase in the probability of donating money (by 3 percentage points, $p = 0.493$). Overall, households are reducing their time spent volunteering following a health shock (by 7 percentage points, $p = 0.179$) and this reduction is largely coming from a shift away from donating both money and time towards donating only money.

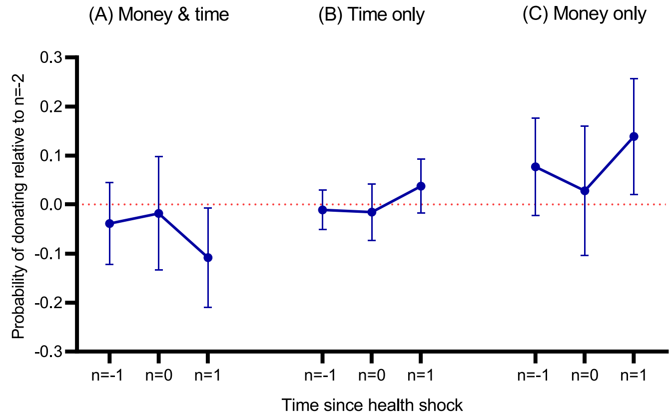

Fig. 2. Dynamics of donating relative to a health shock – probability of donating.
Estimates are from household fixed effects models and indicate the change in the probability of donating in each time period relative to more than two years prior to the health shock (n=-2). Error bars are 95% confidence intervals based on cluster-robust standard errors. All models include as covariates: age of head and spouse, family unit size, death of child, new birth in household, other unrelated health condition (asthma, arthritis, other) and time (year) dummies. Further details are provided in Appendix A, Table A4

These results are robust to expanding the sample to include multiple health shocks and changes in household composition (due to deaths), and excluding all control variables (refer to Appendix A, Table A9, Table A12 and Table A13).

These results indicate that the donating behaviour in response to a health shock varies depending on whether donations are monetary or time. They are not complementary donating behaviours and there is little evidence to suggest that they are substitutes, at least not at the extensive margin. While we were limited by the lack of data on volunteering time to explore whether substitution could occur at the intensive margin (i.e. if the reduction in volunteering was compensated by increases in donation amounts), this could represent an area for further research.

We next investigate whether the change in volunteering behaviour differs for the individual experiencing the health shock and their spouse (Table 3). We find that the shift away from time donations occurs for both the individual who experienced the health shock and their spouse, though the reduction is stronger for the spouse. For instance, in the years following the health shock ($n = 1$), there is a significant shift away from money and time donations by around 10 percentage points ($p = 0.048$) for the spouse without the health shock, while for the household member with the health shock, the reduction is around 8 percentage points and not statistically significant ($p = 0.124$).

The literature has identified that where there is heterogeneous effects of the treatment across units that depend on when they are exposed to the treatment, then standard fixed effects models can produce bias estimates of the average treatment effects of interest (Borusyak and Jaravel, 2017; Goodman-Bacon, 2021). This can result in estimates of the average treatment effects which overweights short-run effects and under or even negatively weights long-run effects (Borusyak and Jaravel, 2017). In our case this is unlikely to be of concern because people do not elect to have a health shock and the timing of when households experience health shocks is likely to be random. We provide evidence for this by considering donations according to whether the health shock was experienced early (before 2007) or late (2007 and after). The results in Appendix A (Table A10) indicate that donating behaviour following an early health shock is not significantly different to a late health shock,

[12] Given their potentially mediating role, they could be considered 'bad controls' so are not included as covariates in our main model.

[13] This could include an increase in carer duties for the household member without the health shock, which may influence giving. The health shock may also influence other household members to improve their own health behaviours (e.g. Falba and Sindelar, 2007; Fadlon and Nielsen, 2019), thereby changing the way these members allocate their time and investments.

Table 3
Dynamics of donating relative to a health shock – probability of donating by whether the household member had a health shock or not.

VARIABLES	Probability of donating by whether the household member had a health shock or not				
	Money & time		Time only		Money only
	(1) Household member with health shock	(2) Household member without health shock	(3) Household member with health shock	(4) Household member without health shock	(5) Household's response
Time relative to health shock					
Reference category: n = −2 (more than 2 years prior)	–	–	–	–	–
n = −1 (one to 2 years prior)	−0.032	−0.044	−0.016	−0.018	0.077
	(0.043)	(0.042)	(0.019)	(0.018)	(0.050)
n = 0 (year of health shock)	−0.029	−0.094*	−0.038	−0.018	0.028
	(0.059)	(0.052)	(0.024)	(0.028)	(0.067)
n = 1 (after year of health shock)	−0.078	−0.102**	0.021	0.017	0.139**
	(0.051)	(0.052)	(0.026)	(0.023)	(0.060)
Mean (pre-shock)	0.190	0.191	0.011	0.012	0.358
Observations	1225	1225	1225	1225	1225
Unique households	442	442	442	442	442
R-squared	0.031	0.015	0.024	0.013	0.018

Estimates are from household fixed effects models and indicate the change in the probability of donating by donation type (money or time) and by whether household member experienced the health shock, in each time period relative to more than two years prior to the health shock (n = −2). Money donations are reported at the household level, so column 5 only reports the whole household's response. All models include as covariates: age of head and spouse, family unit size, death of child, new birth in household, other unrelated health condition (asthma, arthritis, other) and time (year) dummies. Cluster-robust standard errors in parentheses. ***p < 0.01, **p < 0.05, *p < 0.1.

with similar findings to our main results.[14] We also undertake a robustness check using the imputation estimator derived by Borusyak et al. (2022) in Appendix A (Table A11). The pre-trend test for parallel trends and no anticipation is insignificant, and donating behaviour following a health shock is similar to our main results although there is a greater reduction in the probability of donating money and time (by 29 percentage points, $p = 0.022$), and larger increase in the probability of donating time only (by 10 percentage points, $p = 0.140$) and money only (by 26 percentage points, $p = 0.078$). This indicates that the estimates from the main model may represent a lower end estimate.

5.2. *Why is there a shift away from donating time?*

In this section we explore some possible reasons why we see a significant shift in donating behaviours away from donating both time and money towards donating only money.

Time donations often require a minimum level of health and time. Black et al. (2021) showed using a larger sample of 3133 observations of the same 452 PSID households analysed in this study, that the reported health status of the affected household member worsens in the year of the health shock and remains lower in the years following. This suggests that the affected member has reduced capacity to engage in volunteer activities and may explain the shift away from time donations. The spouse may also be preoccupied with caring and wider household responsibilities, leaving them less time to volunteer. We do not have information on time spent caring for another family member, leisure or engaging in household tasks to empirically confirm this mechanism. However, we are able to explore labour market responses, which are a priori ambiguous.

As discussed in section 2.2, the available time that the spouse of the household member with the health shock has for volunteering depends largely on their labour market response to the health shock. Black et al. (2021) showed that following a health shock, households experience a large and significant, but temporary, reduction in total income by approximately $10,200 in the year following the health shock. They also experience a significant increase in healthcare expenditure, by approximately $1300 in the year following the health shock, and this remains significantly higher (though by a lower amount of about $1100) in the years following the health shock. These results suggest that if compensating for the loss of income and higher expenses is a priority, then the spouse without the health shock may respond to the health shock by increasing their work hours (*added worker effect*).

Fig. 3 shows how the total annual work hours changes in response to a health shock at the household level (Panel A), and separately for the household member experiencing the health shock (Panel B) and the household member without the health shock (Panel B). Panel A indicates that total household work hours reduce by only a small amount (around 17 hours per annum) in the year of the health shock ($n = 0$), and recovers somewhat in the years following ($n = 1$) such that total work hours is reduced by only around 9 hours per annum, in comparison to $n = -2$. These small changes are however not statistically significant at the 5% level. Panels B and C show that these small overall changes mask the considerable heterogeneity in changes to work hours depending on whether the household member experienced the health shock. Panel B indicates that total work hours of the household member with the health shock significantly reduces by around 266 hours per annum ($p = 0.013$) at $n = 0$ and 195 hours per annum at $n = 1$ ($p = 0.098$). Relative to a pre-shock mean of 1583 hours per annum, this reflects about a 17% and 12% decrease in work hours at $n = 0$ and $n = 1$ respectively. In contrast, the total work hours of the household member without the health shock increase by around 248 hours per annum (or 16%) ($p = 0.031$) at $n = 0$ and 203 hours per annum ($p = 0.041$) (or 13%) at n = 1 (Panel C). The coefficient estimates are all shown in Appendix Table A14.

These results suggest that following a health shock, instead of maintaining or reducing work hours to spend time caring for the affected spouse, the spouse without the health shock responds by increasing work hours. While the literature on this has been mixed, a similar response has been shown by Acuña et al. (2019) for younger age groups and Coile (2004) for when the male is the unaffected spouse. This is the first time to our knowledge that this has been examined in the context of explaining household donating behaviour. This considerable increase in spousal work hours combined with the reduced capacity of the spouse affected by the health shock likely explain the reduction in time donations following a health shock in the household.

[14] In our context (with treatment being health shocks), we would expect this given that people are not self-selecting into having an earlier or later health shock. This is in contrast to many studies in the literature where people or regions are selecting when they receive treatment (e.g. an intervention or policy change) and we would expect those who would benefit the most from treatment to be more likely to seek treatment early.

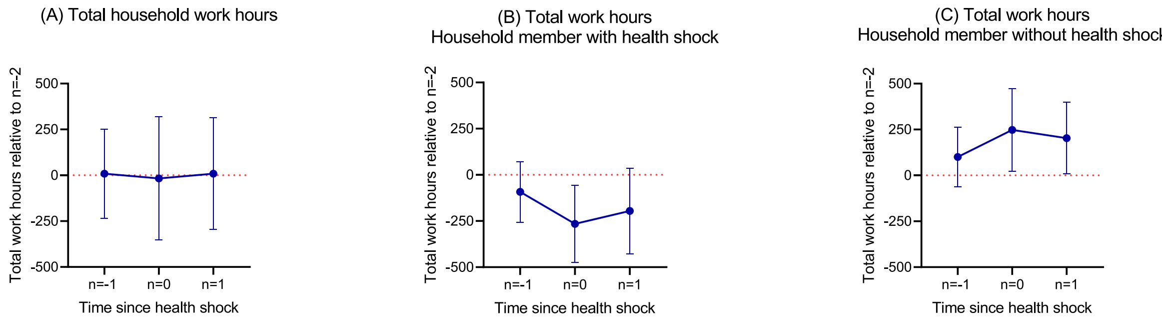

Fig. 3. Total work hours per annum.
Estimates are from household fixed effects models and indicate the change in annual work hours experienced by (A) the household, (B) the household member experiencing the health shock, and (C) the household member without the health shock, in each time period relative to more than two years prior to the health shock (n=-2). Based on 1,231 observations of 442 unique households. Error bars are 95% confidence intervals based on cluster-robust standard errors. All models include as covariates: age of head and spouse, family unit size, death of child, new birth in household, other unrelated health condition (asthma, arthritis, other) and time (year) dummies. Further details are provided in Appendix A, Table A14).

6. Discussion

Following a health shock, there is an overall reduction in the probability that households volunteer their time, which arises from a significant shift from donating both money and time (−11 percentage points or −23 percent relative to the pre-shock mean) to donating only money (14 percentage points or 39 percent relative to the pre-shock mean). The overall change in the probability of donating money is negligible and statistically insignificant. These findings contribute to the literature by shedding light on the joint decision to donate money and time at the household level. The shift away from time donations can be explained by the reduced capacity within the household due to health and time constraints. We demonstrate that one possible explanation for the shift away from time donations is the added-worker effect, where the spouse of the household member with the health shock increases their work hours following a health shock. To the best of our knowledge, this has not been examined empirically before in the context of household donating behaviour.

Previous studies have examined whether donations of time and money are substitutes or complements at an individual level, with limited consensus (Brown and Lankford, 1992; Feldman, 2010; Bauer et al., 2013). We find that following a health shock, the form of donation becomes particularly important because money and time donations have different requirements. There is greater variation in the types of activities associated with time donations, so time donations typically require a minimum level of health and time, both of which are impacted by a health shock. However, donations of time represent important contributions to the public good, so a reduction in volunteering could result in a reduction of social capital and a loss of potential positive health effects for the volunteers themselves (Wilson, 2000). Our results indicate that donations of time and money after a health shock are not complements, as we do not see a corresponding reduction in only monetary donations. Therefore, it may be more useful to consider time and money donations as different entities.

Our results are consistent with the added worker effect where spouses of those who experience a health shock increase their work hours (Coile, 2004; Acuña et al., 2019). These results differ to findings of a joint leisure effect and caregiver effect in the literature (García-Gómez et al., 2013; Braakmann, 2014; Jeon and Pohl, 2017). This may be due to country-specific differences in health care systems and care giving options in the US compared to the countries studied in this literature (Canada, Germany and the Netherlands).

While the PSID is a unique dataset which combines information regarding money and time donations, the data on volunteering was restricted to three years (2003, 2005 and 2011) which limited the ability to more comprehensively explore the trade-offs following a health shock using a dynamic approach, including the impact on the intensive margin (volunteering hours and donation dollars). The dataset also had limited information on other household time uses such as caregiving, leisure and household tasks, so we were only able to focus on household work hours and volunteering as the major time uses. These areas could therefore represent avenues for future research.

Our results have implications for non-profit organisations which rely on donations of both money and time. There appears to be a shift to donations of only money, so non-profit organisations could focus efforts on facilitating this form of pro-social behaviour following a health shock in the household. However, in recognising the diverse nature of time donations, non-profit organisations could also consider expanding the range of volunteer activities that are appropriate to different levels of health status and time commitments, reducing barriers to participation. Our results also highlight the importance of considering the role of the household in the donation decision-making process, so non-profit organisations could consider targeting households rather than individuals.

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Declaration of competing interest

The authors declare no conflicts of interest.

Data availability

Data will be made available on request.

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APPENDIX A

Table A1
Difference in means between health shock and no health shock samples – sociodemographic variables (2003, 2005, 2011)

	Mean		
	Health shock	No health shock	Difference
Demographics			
Age – head	54.7	47.7	7.0***
Age – spouse	52.4	45.6	6.7***
Household characteristics			
Household size	3.0	3.4	−0.4***
Annual household equivalised income (real 2015, USD '000)	64.0	62.9	−1.2
Number of children	0.6	1.1	−0.4***
Death of child (=1 if death of child occurred %)	0.14	0.08	0.07
Birth of child (=1 if birth of child occurred %)	3.0	7.9	−4.9***
Other unrelated health condition (=1 if has asthma or arthritis %)*	64.1	49.4	14.7***
Race			
White – head	0.77	0.75	0.03***
White – spouse	0.78	0.75	0.02**
Black – head	0.16	0.17	−0.01
Black – spouse	0.15	0.16	−0.01
Other – head	0.07	0.08	−0.01
Other – spouse	0.07	0.09	−0.02***
Education			
<=High school – head	0.46	0.42	0.04***
<=High school – spouse	0.52	0.41	0.12***
Some college – head	0.24	0.22	0.02
Some college – spouse	0.22	0.26	−0.04***
College degree – head	0.30	0.36	−0.06***
College degree – spouse	0.26	0.33	−0.08***
Observations	1338	3919	

***p < 0.01, **p < 0.05, *p < 0.1.
Difference = mean(health shock) – mean(no health shock).

Table A2
Dynamics of donating relative to a health shock – probability of donating, time periods extended to six categories

	Probability of donating		
VARIABLES	(1)	(2)	(3)
	Money & time	Time only	Money only
Time relative to health shock			
Reference category: t = −3 (more than 2 years prior)	–	–	–
t = −2 (1–2 years prior)	0.027	−0.032	−0.041
	(0.043)	(0.025)	(0.056)
t = −1 (up to 1 year prior)	0.009	−0.020	0.049
	(0.061)	(0.025)	(0.070)
t = 0 (year of health shock)	0.050	−0.035	−0.080
	(0.059)	(0.028)	(0.067)
t = 1 (up to 1 year after)	0.040	0.002	−0.006
	(0.055)	(0.028)	(0.061)
t = 2 (1–2 years after)	−0.074	0.009	0.077
	(0.051)	(0.021)	(0.057)
t = 3 (more than 2 years after)	0.057	0.002	−0.124
	(0.065)	(0.036)	(0.077)
Observations	1225	1225	1225
Unique households	442	442	442
R-squared	0.025	0.015	0.027

Estimates are from household fixed effects models and indicate the change in the probability of donating in each time period relative to more than two years prior to the health shock (t = −3). All models include as covariates: age of head and spouse, family unit size, death of child, new birth in household, other unrelated health condition (asthma, arthritis, other) and time (year) dummies. Cluster-robust standard errors in parentheses. ***p < 0.01, **p < 0.05, *p < 0.1.

Table A3
Impact of a health shock on health status

VARIABLES	(1)
	Health status
Time relative to health shock	
Reference category: n = −2 (more than 2 years prior)	–
n = −1 (one to 2 years prior)	−1.353***
	(0.447)
n = 0 (year of health shock)	−1.674***
	(0.520)
n = 1 (after year of health shock)	−2.325***
	(0.578)
Observations	4000

Reference category is more than two years prior to the health shock ($t < -2$). Estimates are from a fixed effects ordered logit Blow-Up and Cluster Estimator for self-assessed health status. 1194 individuals with a health shock dropped because of all the same outcomes. Self-reported health status measured on a scale of 1–5 where a lower value corresponds to poorer health: (1) poor; (2) fair; (3) good; (4) very good; (5) excellent. Cluster-robust standard errors in parentheses. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

Table A4
Dynamics of donating relative to a health shock – probability of donating

VARIABLES	Probability of donating		
	(1)	(2)	(3)
	Money & time	Time only	Money only
Time relative to health shock			
Reference category: n = −2 (more than 2 years prior)	–	–	–
n = −1 (one to 2 years prior)	−0.039	−0.011	0.077
	(0.043)	(0.020)	(0.050)
n = 0 (year of health shock)	−0.018	−0.016	0.028
	(0.059)	(0.029)	(0.067)
n = 1 (after year of health shock)	−0.108**	0.037	0.139**
	(0.051)	(0.028)	(0.060)
Mean (pre-shock)	0.467	0.031	0.358
Control variables			
Age (head)	−0.026	−0.062	0.111
	(0.130)	(0.058)	(0.152)
Age (spouse)	0.025	0.004	−0.047
	(0.051)	(0.022)	(0.061)
Household size	0.022	0.010	−0.034
	(0.094)	(0.011)	(0.025)
Death of child	−0.201	0.000	0.187
	(0.495)	(0.033)	(0.510)
Birth of child	−0.027	−0.006	−0.024
	(0.075)	(0.052)	(0.087)
Other unrelated health condition	−0.012	−0.024	0.064
	(0.041)	(0.020)	(0.047)
Observations	1225	1225	1225
Unique households	442	442	442
R-squared	0.020	0.017	0.018

Estimates are from household fixed effects models and indicate the change in the probability of donating in each time period relative to more than two years prior to the health shock (n = −2). All models include as covariates: age of head and spouse, family unit size, death of child, new birth in household, other unrelated health condition (asthma, arthritis, other chronic condition) and time (year) dummies. Cluster-robust standard errors in parentheses. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

Table A5
Dynamics of donating relative to a health shock – probability of donating, logit model with fixed effects

VARIABLES	Probability of donating (odds ratio)		
	(1)	(2)	(3)
	Money & time	Time only	Money only
Time relative to health shock			
Reference category: n = −2 (more than 2 years prior)	–	–	–
n = −1 (one to 2 years prior)	0.682	0.452	1.654
	(0.262)	(0.423)	(0.538)
n = 0 (year of health shock)	0.740	0.508	1.251
	(0.366)	(0.691)	(0.552)

(*continued on next page*)

Table A5 (*continued*)

VARIABLES	Probability of donating (odds ratio)		
	(1)	(2)	(3)
	Money & time	Time only	Money only
n = 1 (after year of health shock)	0.346**	2.141	2.713**
	(0.172)	(2.213)	(1.135)
Observations	416	95	532
Unique households	144	32	184

Estimates are from household fixed effects logit models and indicate the change in the probability of donating in each time period relative to more than two years prior to the health shock (n = −2). (1) 298 households (809 observations) dropped because of all the same outcomes.(2) 410 households (1,130 observations) dropped because of all the same outcomes.(3) 258 households (693 observations) dropped because of all the same outcomes.All models include as covariates: age of head and spouse, family unit size, death of child, new birth in household, other unrelated health condition (asthma, arthritis, other) and time (year) dummies. Cluster-robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table A6
Dynamics of donating relative to a health shock – probability of donating, health status included as a control variable

VARIABLES	Probability of donating		
	(1)	(2)	(3)
	Money & time	Time only	Money only
Time relative to health shock			
Reference category: n = −2 (more than 2 years prior)	–	–	–
n = −1 (one to 2 years prior)	−0.047	−0.009	0.092*
	(0.044)	(0.021)	(0.052)
n = 0 (year of health shock)	−0.028	−0.012	0.047
	(0.059)	(0.029)	(0.068)
n = 1 (after year of health shock)	−0.122**	0.041	0.167***
	(0.053)	(0.028)	(0.063)
Health status			
Reference category: Health status: poor	–	–	–
Health status: fair	0.001	0.052	−0.098
	(0.076)	(0.049)	(0.098)
Health status: good	0.035	0.041	−0.081
	(0.074)	(0.051)	(0.101)
Health status: excellent	−0.016	0.025	−0.006
	(0.078)	(0.051)	(0.105)
Observations	1175	1175	1175
Unique households	420	420	420
R-squared	0.025	0.022	0.025

Estimates are from household fixed effects models and indicate the change in the probability of donating in each time period relative to more than two years prior to the health shock (n = −2). All models include as covariates: age of head and spouse, family unit size, death of child, new birth in household, other unrelated health condition (asthma, arthritis, other) and time (year) dummies. Cluster-robust standard errors in parentheses. ***p < 0.01, **p < 0.05, *p < 0.1.

Table A7
Dynamics of donating relative to a health shock – probability of donating, income included as a control variable

VARIABLES	Probability of donating		
	(1)	(2)	(3)
	Money & time	Time only	Money only
Time relative to health shock			
Reference category: n = −2 (more than 2 years prior)	–	–	–
n = −1 (one to 2 years prior)	−0.037	−0.011	0.076
	(0.043)	(0.020)	(0.051)
n = 0 (year of health shock)	−0.019	−0.016	0.029
	(0.059)	(0.029)	(0.067)
n = 1 (after year of health shock)	−0.107**	0.038	0.138**
	(0.051)	(0.028)	(0.060)
Household equivalised income ('000s)	−0.003**	−0.000	0.003
	(0.001)	(0.000)	(0.002)
Observations	1225	1225	1225
Unique households	0.024	0.017	0.020
R-squared	442	442	442

Estimates are from household fixed effects models and indicate the change in the probability of donating in each time period relative to more than two years prior to the health shock (n = −2). All models include as covariates: age of head and spouse, family unit size, death of child, new birth in household, other unrelated health condition (asthma, arthritis, other) and time (year) dummies. Cluster-robust standard errors in parentheses. ***p < 0.01, **p < 0.05, *p < 0.1.

Table A8
Dynamics of donating relative to a health shock – probability of donating, healthcare expenditure included as a control variable

VARIABLES	Probability of donating		
	(1)	(2)	(3)
	Money & time	Time only	Money only
Time relative to health shock			
Reference category: n = −2 (more than 2 years prior)	–	–	–
n = −1 (one to 2 years prior)	−0.039	−0.011	0.077
	(0.043)	(0.020)	(0.050)
n = 0 (year of health shock)	−0.020	−0.016	0.028
	(0.059)	(0.029)	(0.067)
n = 1 (after year of health shock)	−0.111**	0.037	0.139**
	(0.051)	(0.028)	(0.060)
Healthcare expenditure ('000s)	0.003	0.001	−0.000
	(0.004)	(0.001)	(0.004)
Observations	1225	1225	1225
Unique households	442	442	442
R-squared	0.021	0.017	0.018

Estimates are from household fixed effects models and indicate the change in the probability of donating in each time period relative to more than two years prior to the health shock (n = −2). All models include as covariates: age of head and spouse, family unit size, death of child, new birth in household, other unrelated health condition (asthma, arthritis, other) and time (year) dummies. Cluster-robust standard errors in parentheses. ***p < 0.01, **p < 0.05, *p < 0.1.

Table A9
Dynamics of donating relative to a health shock – multiple health shocks included in sample

VARIABLES	Probability of donating		
	(1)	(2)	(3)
	Money & time	Time only	Money only
Time relative to health shock			
Reference category: n = −2 (more than 2 years prior)	–	–	–
Primary health shock			
n = −1 (one to 2 years prior)	−0.005	0.006	0.004
	(0.035)	(0.016)	(0.042)
n = 0 (year of health shock)	−0.060	−0.005	0.081
	(0.045)	(0.020)	(0.053)
n = 1 (after year of health shock)	−0.094**	0.025	0.124**
	(0.040)	(0.018)	(0.048)
Secondary health shock			
n = 0 (year of health shock)	−0.086	0.010	0.091
	(0.072)	(0.030)	(0.089)
n = 1 (after year of health shock)	−0.048	0.005	0.080
	(0.065)	(0.028)	(0.080)
Observations	1747	1747	1747
Unique households	593	593	593
R-squared	0.030	0.004	0.020

Estimates are from household fixed effects models and indicate the change in the probability of donating in each time period relative to more than two years prior to the health shock (n = −2). All models include as covariates: age of head and spouse, family unit size, death of child, new birth in household, other unrelated health condition (asthma, arthritis, other) and time (year) dummies. Cluster-robust standard errors in parentheses. ***p < 0.01, **p < 0.05, *p < 0.1.

Table A10
Dynamics of donating relative to a health shock – probability of donating, by whether the health shock occurred early (before 2007) or late (2007 and after)

VARIABLES	Probability of donating		
	(1)	(2)	(3)
	Money & time	Time only	Money only
Time relative to health shock			
Reference category: n = −2 (more than 2 years prior)	–	–	–
Early health shock: n = −1 (one to 2 years prior)	−0.014	−0.001	0.009
	(0.063)	(0.020)	(0.072)
Late health shock: n = −1 (one to 2 years prior)	−0.057	0.008	0.121
	(0.071)	(0.032)	(0.085)
Early health shock: n = 0 (year of health shock)	−0.028	0.018	−0.020
	(0.090)	(0.044)	(0.102)
Late health shock: n = 0 (year of health shock)	0.024	−0.027	0.009
	(0.087)	(0.033)	(0.096)
Early health shock: n = 1 (after year of health shock)	−0.078	0.067*	0.067

(*continued on next page*)

Table A10 (*continued*)

VARIABLES	Probability of donating		
	(1)	(2)	(3)
	Money & time	Time only	Money only
	(0.074)	(0.035)	(0.085)
Late health shock: n = 1 (after year of health shock)	−0.134**	0.022	0.185***
	(0.060)	(0.036)	(0.069)
Hypothesis testing: early vs late health shock at t = 1			
Whether early = late, Prob > F	0.512	0.314	0.211
Observations	1225	1225	1225
Unique households	442	442	442
R-squared	0.022	0.020	0.021

Estimates are from household fixed effects models and indicate the change in the probability of donating in each time period relative to more than two years prior to the health shock (n = −2) by whether the health shock occurred early (before 2007) or late (2007 or after). Hypothesis testing examines whether the coefficient of an early health shock at n = 1 is the same as a late health shock at n = 1. All models include as covariates: age of head and spouse, family unit size, death of child, new birth in household, other unrelated health condition (asthma, arthritis, other) and time (year) dummies. Cluster-robust standard errors in parentheses. ***$p < 0.01$, **$p < 0.05$, * $p < 0.1$.

Table A11
Dynamics of donating relative to a health shock – imputation estimator

VARIABLES	Probability of donating		
	(1)	(2)	(3)
	Money & time	Time only	Money only
Time relative to health shock			
Pretrend1	−0.022	−0.011	0.113
	(0.042)	(0.024)	(0.118)
n = −1 (one to 2 years prior)	−0.010	−0.005	0.011
	(0.049)	(0.021)	(0.058)
n = 0 (year of health shock)	−0.051	−0.031	0.069
	(0.073)	(0.038)	(0.081)
n = 1 (after year of health shock)	−0.286**	0.101	0.262*
	(0.124)	(0.069)	(0.149)
Observations	1060	1060	1060

Estimates are from household fixed effects models and indicate the change in the probability of donating in each time period relative to pre-treatment observations based on the imputation estimator described in Borusyak et al. (2022). Reference category is more than two years prior to the health shock (n = −2). 165 observations are dropped because fixed effects could not be imputed as these individuals were treated in all periods in the sample. All models include as covariates: age of head and spouse, family unit size, death of child, new birth in household, other unrelated health condition (asthma, arthritis, other) and time (year) dummies. Cluster-robust standard errors in parentheses. ***$p < 0.01$, **$p < 0.05$, * $p < 0.1$.

Table A12
Dynamics of donating relative to a health shock – those who die included in sample

VARIABLES	Probability of donating		
	(1)	(2)	(3)
	Money & time	Time only	Money only
Time relative to health shock			
Reference category: n = −2 (more than 2 years prior)	–	–	–
n = −1 (one to 2 years prior)	−0.032	−0.001	0.060
	(0.036)	(0.017)	(0.042)
n = 0 (year of health shock)	−0.057	0.005	0.049
	(0.052)	(0.025)	(0.059)
n = 1 (after year of health shock)	−0.082*	0.039*	0.070
	(0.044)	(0.023)	(0.052)
Observations	1820	1820	1820
Unique households	722	722	722
R-squared	0.018	0.010	0.013

Estimates are from household fixed effects models and indicate the change in the probability of donating in each time period relative to more than two years prior to the health shock (n = −2). All models include as covariates: age of head and spouse, family unit size, death of child, new birth in household, other unrelated health condition (asthma, arthritis, other) and time (year) dummies. Cluster-robust standard errors in parentheses. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

Table A13
Dynamics of donating relative to a health shock – no control variables

VARIABLES	Probability of donating		
	(1)	(2)	(3)
	Money & time	Time only	Money only
Time relative to health shock			
Reference category: n = −2 (more than 2 years prior)	–	–	–
n = −1 (one to 2 years prior)	−0.033	−0.003	0.061
	(0.041)	(0.019)	(0.049)
n = 0 (year of health shock)	−0.019	−0.013	0.022
	(0.058)	(0.029)	(0.067)
n = 1 (after year of health shock)	−0.111**	0.038	0.140**
	(0.053)	(0.028)	(0.061)
Observations	1225	1225	1225
Unique households	442	442	442
R-squared	0.010	0.009	0.010

Estimates are from household fixed effects models and indicate the change in the probability of donating in each time period relative to more than two years prior to the health shock (n = −2). All models include time (year) dummies. Cluster-robust standard errors in parentheses. ***p < 0.01, **p < 0.05, *p < 0.1.

Table A14
Total work hours per annum in response to a health shock

VARIABLES	(1)	(2)	(3)
	Total household work hours	Total work hours: Household member with health shock	Total work hours: Household member without health shock
Time relative to health shock			
Reference category: n = −2 (more than 2 years prior)	–	–	–
n = −1 (one to 2 years prior)	8.94	−92.24	100.74
	(123.53)	(83.82)	(83.09)
n = 0 (year of health shock)	−17.17	−265.59**	247.91**
	(170.79)	(106.23)	(114.67)
n = 1 (after year of health shock)	8.53	−195.35*	203.08**
	(154.86)	(117.90)	(99.14)
Outcome pre-shock mean	3104.98	1583.00	1512.71
(standard deviation)	(1527.11)	(1046.86)	(1005.36)
Observations	1231	1231	1231
Unique households	442	442	442
R-squared	0.18	0.13	0.11

Estimates are from household fixed effects models and indicate the change in total household work hours per annum relative to more than two years prior to the health shock (n = −2).
Column (1) estimates the change in total work hours per annum in the household (from the household member with the health shock and their spouse without the health shock). Column (2) estimates the change in total work hours per annum by the household member with the health shock. Column (3) estimates the change in total work hours per annum by the household member without the health shock. Each column is estimated separately to enable flexibility in the way coefficients can vary in each model.
All models include as covariates: age of head and spouse, family unit size, death of child, new birth in household, other unrelated health condition (asthma, arthritis, other) and time (year) dummies. Cluster-robust standard errors in parentheses. ***p < 0.01, **p < 0.05, *p < 0.1.

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