Caring for Aging Parents: Health Effects of Division of Care Between Siblings*

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Abstract

This paper uses an IV strategy to test the hypothesis that the division of care-giving for aging parents between their sons and daughters influences parental health outcomes beyond the impact of the total amount of care provided. The results suggest that having a larger share of care provided by daughters is associated with more diagnosed conditions and worse mental health, but also show that the impact of care division on many other health outcomes is minimal or inconclusive. This paper fills gaps in the literature on health determinants of aging Americans and gender division of non-market labor.

1 Introduction

In the next decade, the entire baby boomer generation will have aged past 65, traditionally thought of as retirement age. By 2034, there will be more people aged over 65 than under 18 for the first time in US history [US Census Bureau, 2018]. This raises many economic questions and highlights unknowns about the health of this aging group: Has this generation saved adequately for their retirement? Is our economy prepared to handle their exit from the workforce? How will this change or strain the capacity of existing welfare programs? Are long-term care facilities prepared for growing patient populations? Many of these questions boil down to one unifying theme: who is going to care for the elderly?

Some of the questions raised about caring for the elderly have been investigated in institutional settings, particularly related to insurance markets and professionally provided health care (e.g., [Kydland and Pretnar, 2019, Brown and Finkelstein, 2011, Finkelstein et al., 2016, Osborn et al., 2017, Hurd et al., 2013]), but questions around informal care provided to the elderly remain open. Already, between 18 and 24 million American adults provide informal care to the elderly [Wolff et al., 2016]. The decisions and trade-offs that these adults make now will become more universal as the population continues to age. As shown in figure 1, the ratio of dependent elders to working adults (who are likely providers of informal care) has increased

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rapidly in recent years, and most predictions suggest that the trend will continue. Compared to the rest of the world, this trend is amplified and accelerating in the United States. As academics, families, and policy makers consider what the elder care provider of the future will look like, one question to consider is gender.

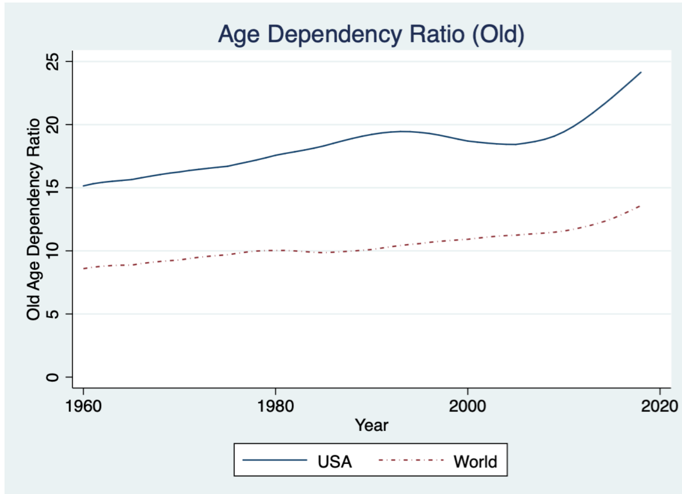

Figure 1: Old age dependency ratio over time

Note: This plot shows how the US and world old age dependency ratios have changed over time. The old age dependency ratio is defined as the number of older dependents (people over the age of 64, as defined by the World Bank) per 100 people of working age (ages 15-64). Data from [World Bank, 2019].

The division of non-market labor between genders has been an issue of interest to economists. Changes in family structures, labor behaviors, and their impacts on non-market labor have demonstrated a need to understand the factors that govern labor that, although essential, many cultures and societies have historically taken as given.

Some aspects of non-market labor, particularly childcare, have been studied and legislation exists to protect the provision of this care, although such legislation is often criticized for being insufficient (e.g., [Olivetti and Petrongolo, 2017]). Informal care for the elderly is less well-studied. Although the formal provision of care for this population is highly regulated, there is a gap in the understanding of care provided by family members. This paper begins to fill this gap in the literature by asking whether care provided by adult children to their aging parents differs in its health impacts on the elderly based on whether the care is provided by daughters or sons.

The current conversation about informal care received by the elderly in the United States focuses on the impact of this care provision on the caregivers. Like other family care-giving, such as parenting, women tend to supply more informal parent-care labor than men do as described in [Grigoryeva, 2017]. A recent New York Times article provided anecdotal evidence that this care-giving labor comes at the cost of women's formal labor supply [Porter, 2019], and another discussed the misalignment between society's professed value for this informal care and how it is actually rewarded or punished in the labor market [Gardiner, 2019]. The interviewees shared stories of having to miss work, having no other options for their parents' care, and the physical and mental tolls that this care took on them. [Kolodziej et al., 2018] documented this trade off in informal care provision in Europe and showed with an instrumental variable strategy that men and women tend to trade formal for informal labor at similar rates, conditional on their abilities and preferences (although European labor markets and regulations are different than those in the United States). The fact remains, however, that the hours of informal care (valued at an estimated $50 billion to $106 billion in 2011 [Hurd et al., 2013]) come more from women than from men.

All of this suggests that how we as a society take care of aging individuals is not just a question of morals or family ties, but an economic one of increasing urgency. The National Center for Assisted Living estimates that the average annual cost of an assisted living facility in the United States was $48,000 in 2018 [National Center for Assisted Living, 2018]. Some families forgo this expense by having adult children provide this care instead: elderly parents who live with one or more of their children are less likely to move into assisted living facilities [Dostie and Léger, 2005].

Although the division of labor along gender lines aligns with expectations based on observations about the division of parenting labor, elder care provision differs from other inter-generational care in several ways. Childcare, for example, is studied as being shared between members of a heterosexual (often married) couple, while care for parents is more often split between sibling groups, which can have more than two members and various gender compositions [Grigoryeva, 2017]. It can also differ from childcare in duration, especially since people may live for many years with chronic health conditions, and may be less predictable as aging parents experience health shocks. Unlike childcare, which some might consider to get easier with time, caring for elders is likely to get more difficult as health often deteriorates with age. This care-giving labor has been shown to impact its providers in major ways, even beyond their labor supply. Providing informal care to parents is linked to adults' physical and mental health outcomes [Centre for Economic Policy Research, 2019].

The literature on Americans is particularly scarce on the subject of the impacts of this care-giving labor on recipients: the aging parents, although this subject has been studied in other settings. [Zeng et al., 2017] used data from China to find that emotional care provided by daughters to aging parents had more positive physical and mental health impacts than that provided by sons. [Wahba and Wang, 2019] also used Chinese data including adult children's zodiac signs to instrument for children's likelihoods to migrate from rural to urban areas and found that daughters migrating away from rural homes had positive health impacts for their parents while migration by sons had no similarly beneficial effects. The results suggest that this difference may be due to daughters being more likely to stay in close contact with parents after migrating. A study using longitudinal data from the United States found that while aging parents are generally happier in life than their childless peers, parents with only daughters are more satisfied with their relationships with their children than parents with only sons [Pushkar et al., 2014], but this one gender setting is not conducive to studying the division of care between genders. The scant literature on this subject should not be interpreted as a response to an irrelevant question. Not only are families making these decisions every day, but those choices have consequences for all parties involved. [Pezzin et al., 2006] used a game theoretic approach to show that adult children bargaining within sibling groups regarding provision of care for their parents can lead to inefficient outcomes.

The question posed by this paper is whether, beyond the total amount of care received by an aging parent, the division of the care between sons and daughters has an impact on parental health. The analysis focuses on the effect of gender division separate from total amount of care because the relationship between gender and total amount of care is well documented (e.g., [Grigoryeva, 2017]). This imbalance persists in the sample used as shown in table 11, but the analysis includes specifications designed to address concerns about this potentially confounding variable. This paper's main contribution is the use of an instrumental variables (IV) strategy based on the gender mix in the child generation to study causal impacts of the share of care provided by daughters versus sons. This adds to existing economic literature using children's genders as random variables with plausible exogeneity. Studying the impact of parenting daughters on congresspeople's feminist sympathies, [Washington, 2008] used the number of daughters conditional on total number of children as a random variable and found that each daughter increases the representative's likelihood to vote liberally, especially on reproductive rights issues. [Angrist and Evans, 1998] used the gender composition of the first two births in a family as an instrument for the likelihood of having a third child in order to study exogenous variation in family size as a determinant of parental labor supply. Both papers make the critical assumption that gender is essentially random at each birth and that there is no sex-selective fertility. The evidence presented in this paper also relies on these assumptions, which are discussed and defended in section 3.2.

By using the gender composition of the child generation as an instrument to find exogenous variation in the share of care provided by daughters to elderly parents, this paper presents evidence suggesting that an increase in the share of care provided by daughters is not substantially different from that provided by sons in its impact on most health outcomes, but has significant impacts on clinically diagnosed conditions and mental health. This paper begins in section 2 by describing the data used. Section 3 discusses the model and its assumptions and presents evidence for the validity of the gender mix instrument. Section 4 presents empirical results from IV estimates on the relationship between the gendered share of care provided and health outcomes of parents and discusses robustness. Section 5 concludes.

2 Data

This paper examines the care received by respondents to the 11th wave (administered in 2012) of the Health and Retirement Study (HRS) and their health outcomes. The HRS is a longitudinal panel study conducted by the University of Michigan's Institute for Social Research [Health and Retirement Study, 2019]. The study surveys a representative sample of approximately 20,000 Americans over age 50 [Bugliari et al., 2018]. The data used in this paper's analysis come from the RAND HRS Longitudinal data file and RAND HRS Family data files, which are user-friendly versions of the raw HRS data produced by the RAND Center for the Study of Aging[1].The analysis presented in this paper is cross sectional in nature because it focuses on one wave of the survey. Out of the 20,554 people who responded to the survey in wave 11, 93% (19,164) reported that they had children. Only 7% (1,424), however, reported receiving help from their children, measured as the estimated hours of help provided over the last month. Note that this excludes financial support, since the question posed by this paper focuses on direct care provided by the children.

This paper examines several types of health outcomes: self-reported health, clinical outcomes, mental health, and health care utilization. For self-reported health, the HRS asks respondents to categorize their health as "excellent", "very good", "good", "fair", or "poor". The outcome variables used in this paper are an indicator for whether the respondent reported their own health as "good" or better and an indicator for whether they reported maintaining or improving their health since the last administration of the survey. For clinical outcomes, the outcome studied is the number of conditions the respondent has ever been told by a doctor that they have ever had. This number is out of eight conditions the HRS asks about: high blood pressure, diabetes, cancer, lung disease, heart disease, stroke, psychiatric problems, and arthritis. The

[1] I am grateful to Amy Finkelstein for recommending the RAND data resources.

analysis also considers the number of new diagnoses (i.e., the number of these conditions that the respondent was told they have ever had at the time of the wave 11 interview that they had not ever had before the last administration of the survey). The mental health outcomes considered are the respondents' CESD scores and whether they reported feeling lonely all or most of the time. A CESD score is a mental health index using the Center for Epidemiologic Studies Depression scale. It is the sum of five negative indicators (whether the respondent reported experiencing the following feelings all or most of the time: depression, everything being an effort, restless sleep, loneliness, sadness, or an inability to get going) minus two positive indicators (feeling happy or enjoying life all or most of the time). Note that by construction, a more positive CESD score is associated with worse mental health. The utilization measures studied are indicators for whether the respondent had been hospitalized or seen a doctor in the last two years, the log of their out-of-pocket medical costs over the last two years, and indicators for whether they had a cholesterol test or received a flu shot in the last two years.

Many of these health conditions worsen with age, and old age is generally associated with more acute care needs and greater reliance on help both from family and other sources. Section 4.1 includes analysis on subsets of the sample population over ages 65 and 75 and provides evidence that the estimates are generally consistent across these subsets. Another subset of interest would be people who report needing help, in order to study effects among those who are likely to call upon their children the most. Unfortunately, this is not a well-defined category in the HRS data and the self-reported measures of ”needing help” are sparse, leading to unusable sample sizes.

The exogenous independent variable of interest is the gender mix of the respondent's children, measured as the fraction of the respondent's children that are daughters. A respondent's children include anyone they reported as being their own child or step-child. This fraction is used as an instrument for the fraction of the respondent's hours of care in the last month provided by children that were provided by daughters. This does not take into account hours of care received from non-children family members or other sources. The hours of care were selected as the measure of interest because data on other measures of help (e.g., which children help with specific tasks) were very sparse and because hours of care encompasses a wide variety of non-financial support, thus decreasing the chance of omitting activities that have health impacts.

The control variables included in the analysis contain information on the respondents and their children. On respondents, this information includes: log household income, age at the time of the survey, total hours of help received in the last month (from all sources), years of education, gender, race, partnership status, census division, and religion. Partnership status is categorized into married or partnered, divorced or separated, widowed, or never married. On the respondents' children, the information includes: log average sons' income, log average daughters' income, fraction of daughters living within 10 miles of the respondent, and fraction of sons living within 10 miles of the respondent. When possible, missing values for individual children's incomes were imputed using the last reported income for the child from a previous wave. Children's incomes are measured as the bottom of the reported bracket.

Tables 1 and 2 show sample means broken down by gender for respondents and their children. Note that most children were not reported as helping their parents in the month preceding the HRS survey.

For both respondents and children, observations with identifiers flagged as being badly linked between HRS waves were dropped. For respondents only having children of one gender, variables for the missing gender of children were imputed if possible. The fraction of children of the missing gender living within 10 miles are

Table 1: Sample Means for Respondents

Variable	(1) Men	(2) Women	(3) All
Age	66.953	66.772	66.847
	(11.010)	(11.992)	(11.594)
Years of education	12.763	12.550	12.638
	(3.352)	(3.129)	(3.225)
Hours children helped last month	3.632	11.441	8.231
	(34.499)	(70.026)	(58.240)
Household income ('000s)	74.848	58.927	65.542
	(119.056)	(90.822)	(103.787)
Number of children living w/in 10 miles	0.878	0.928	0.907
	(1.132)	(1.138)	(1.135)
Total number of children	3.731	3.727	3.729
	(2.362)	(2.419)	(2.395)
Fraction daughters	0.490	0.494	0.492
	(0.307)	(0.309)	(0.308)
Fraction care hrs from daughters	0.616	0.686	0.670
	(0.467)	(0.443)	(0.450)
Good health (self-reported)	0.716	0.699	0.706
	(0.451)	(0.459)	(0.456)
White	0.733	0.711	0.720
	(0.442)	(0.453)	(0.449)
Black	0.175	0.207	0.194
	(0.380)	(0.405)	(0.395)
Other	0.092	0.083	0.086
	(0.288)	(0.275)	(0.281)
Married/partnered	0.764	0.546	0.636
	(0.424)	(0.498)	(0.481)
Divorced/separated	0.109	0.157	0.137
	(0.312)	(0.364)	(0.344)
Widowed	0.079	0.247	0.177
	(0.270)	(0.431)	(0.382)
Never married	0.048	0.050	0.049
	(0.213)	(0.218)	(0.216)
Observations	8,540	12,014	20,554

Note: This table shows means across men and women who were respondents in wave 11 of the HRS.

reported as 0, since no children of that gender live within that radius of the parent. The log average income of children of that gender is reported as the sample average.

3 Method

3.1 Description of model

The causal relationship between the gender of the child providing care to an aging parent and the parent's health is difficult to estimate because many aspects of care within a family are endogenous. The likelihood of a child to care for their parent depends on a multitude of factors, including the child's career, their own children, proximity to their parent, their care giving skills, and their relationship with their parent, along

Table 2: Sample Means for Respondents' Children

Variable	(1) Men	(2) Women	(3) All
Age	40.954	41.187	41.069
	(13.069)	(12.943)	(13.007)
Lives within 10 mi of parent	0.277	0.303	0.290
	(0.447)	(0.460)	(0.454)
Household income (range min, '000s)	33.551	33.661	33.606
	(32.769)	(32.304)	(32.539)
Contributes to parents' finances	0.446	0.509	0.476
	(0.497)	(0.500)	(0.499)
Number of children	1.673	1.841	1.757
	(1.640)	(1.585)	(1.615)
Helped parent in last month	0.018	0.036	0.027
	(0.133)	(0.186)	(0.161)
Hours helped in last month*	1.109	2.586	1.837
	(18.508)	(28.488)	(23.959)
Not married/partnered	0.371	0.358	0.365
	(0.483)	(0.479)	(0.481)
Married/partnered	0.592	0.602	0.597
	(0.491)	(0.489)	(0.491)
Other	0.037	0.040	0.038
	(0.188)	(0.196)	(0.192)
Observations	36,711	35,797	72,568

*Hours helped in last month is calculated conditional on the child helping at all.
Note: This table shows means across sons and daughters of respondents in wave 11 of the HRS.

with many others. Some of these factors, such as proximity to parents, differ between genders as shown in table 2. This paper uses an instrumental variable strategy to find variation in care division between siblings that is not explained by these factors, and instead comes from the random variation in the gender mix of the sibling group.

The natural experiment this paper uses is as follows. An adult has some number of children of randomly assigned gender. When the parent ages, the adult children divide up (perhaps unequally) the child-provided care hours provided to the parent between the siblings. Given the child-generation's gender mix, the assumption is that the division of care hours is a function of this mix along with other attributes about the family. There are many other factors both related and unrelated to gender that may influence a child's decision about how much care to provide for their parent, but the underlying relationship between gender-mix and care division should persist and forms the first stage. Further, since the gender-mix is plausibly random, using it as an instrument should avoid potential confounding variable concerns. This relationship for a respondent i is approximated as follows:

$$\textit{Fraction care hrs from daughters}_i = \alpha + \beta_1 \textit{Fraction daughters}_i + \gamma_i + \beta_2 X_i + \epsilon_i$$

γ_i is a set of fixed effects for the respondent's total number of children. X_i is vector of controls about the respondent, including log household income, age at the time of the survey, years of education, gender, race, partnership status, census division, and religion. These controls are similar to those used in other literature studying the health of the elderly (e.g., [Finkelstein et al., 2019, Finkelstein et al., 2016]) with the addition of some which are likely to influence family structure.

Some of the regressions discussed in section 4 include controls for the total hours of care provided to the parent and attributes about the child generation. These specifications approximate the following equation:

$$\textit{Fraction care hrs from daughters}_i = \alpha + \beta_1 \textit{Fraction daughters}_i + \gamma_i + \beta_2 X_i + \beta_3 \textit{Total care hrs}_i + \beta_4 Y_i + \epsilon_i$$

In the equation above, $\textit{Total care hrs}_i$ is the total number of hours of help received in the last month from all sources. Y_i is a vector of controls about the child generation, including log average sons' income, log average daughters' income, fraction of daughters living within 10 miles of the respondent, and fraction of sons living within 10 miles of the respondent. The evidence presented in section 4 shows that the conclusions drawn are robust to the inclusion of these controls.

With this variation in the division of care between sons and daughters, the second stage equation links outcomes to the fraction of care hours provided by daughters. This relationship is modelled with the following equation:

$$\textit{Outcome}_i = \alpha + \beta_1 \textit{Fraction care hrs from daughters}_i + \gamma_i + \beta_2 X_i + \epsilon_i$$

As with the first stage equation, the analysis in section 4 includes specifications with controls for total hours of care and child generation attributes.

Lastly, some of the analysis presented uses the following reduced form equation (once again, with versions including controls for total hours of care and child generation attributes):

$$\textit{Outcome}_i = \alpha + \beta_1 \textit{Fraction daughters}_i + \gamma_i + \beta_2 X_i + \epsilon_i$$

3.2 Identifying assumptions

This identification strategy relies on the assumption that, conditional on the respondent's total number of children, the number of female children is a random variable. To defend the validity of the gender-mix instrument, this paper presents evidence that the gender mix of adult children in the sample suggests no bias towards either gender and is plausibly random based on the arguments presented in [Washington, 2008, Angrist and Evans, 1998]. While the United States is not typically thought of as a setting in which parents choose their children's gender based on endogenous factors, this assumption must still be defended. The adult children in this analysis would have been born before the technology for fetal sex selection at the time of gestation was widely available, but there is still the possibility of sex-selection through adoption or abortion, and since this analysis includes step-children as potential care providers, there is the possibility that elderly adults choose partners based on children from previous relationships.

Figure 2 below shows that the distribution of the fraction of each respondent's children that are daughters is consistent with an equal probability that each birth is a boy or girl, and on average 49.5% of respondents' children are daughters. The peaks in the histogram are consistent with family size changing discontinuously with each child, since children are not continuously divisible.

Further support for the assumption of randomness in sibling groups' gender mix comes from table 3. If aging parents had followed a gender-based fertility stopping rule (e.g., having children until the first son is born, then stopping), there would be a relationship between the gender of the first-born and the total number of

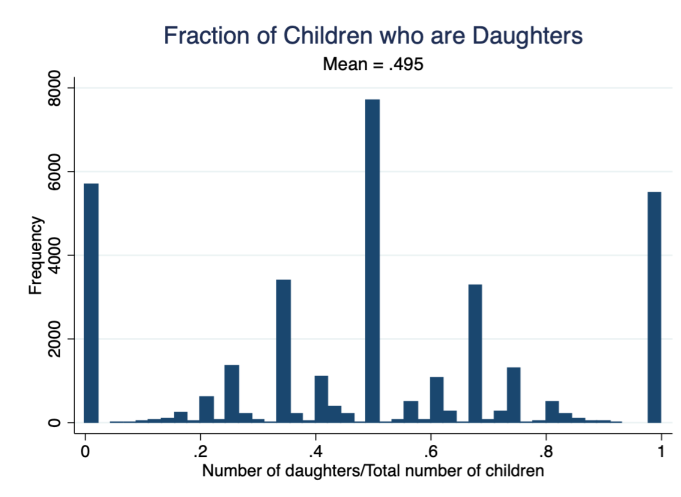

Figure 2: Distribution of share of children who are daughters

Note: This histogram shows the distribution of the fraction of the sibling-group who are daughters for each respondent.

children. Table 3 shows the results of regressing the respondent's total number of children on an indicator for whether the first-born child is a girl and shows that no such relationship exists in the data.

Table 3: Relationship between total number of children and gender of first born.

	(1) Total number of children
First-born girl	0.0292 (0.0349)
N	18619

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: This table reports results from an OLS regression of respondents' total numbers of children on the gender of their first-born. Respondents for whom the oldest child could not be determined were excluded. Robust standard errors reported.

Thus, this paper's reliance on the premise that the parents in the HRS sample did not practice sex selection is supported, so the gender mix of children can be treated as exogenously given and random, and satisfies the assumption of independence.

For the gender mix to be a valid instrument for care division between genders, it is also necessary that the exclusion restriction is satisfied. There is no simple test to show that there are no uncontrolled factors that are related to both gender mix and parental health, but the following arguments suggest that this is a plausible assumption.

As mentioned earlier, it has been shown in descriptive studies that women provide more care to aging parents than men do [Grigoryeva, 2017]. Thus, a potential violation of the exclusion restriction is that conditional on the total number of children, having more daughters might not only affect parental health through the division of care, but through the total amount of care provided. To alleviate this concern, the analysis in this paper shows that results are robust to the inclusion of controls for the total hours of care provided to the respondent. It is also true that adult children may make decisions that affect their ability to care for their aging parents that are influenced by gender. For example, table 2 shows that women are more likely than men to live within 10 miles of their parents. Proximity may influence their ability to provide care of different types and quality than care provided by a sibling who lives farther away. It may also be true that women face different opportunity costs and constraints for caring for their parents than men do, based on their careers or other factors. Although the randomness of the instrumental variable should mitigate this concern, the analysis in this paper also shows that results are robust to controlling for indicators of the children's financial ability to provide care (i.e., proximity to parent and household income).

A third requirement for the validity of the gender mix instrument is the presence of a first-stage relationship between the gender mix of a group of siblings and the division of care for the parent between genders of siblings. Table 4 presents the results of OLS regressions of the division of care on gender mix and shows that there is a strong positive relationship between the share of a sibling group who are daughters and the share of child-provided care the parent receives that is provided by daughters. These results suggest, as one might expect, that having more daughters corresponds to more care being provided by daughters and the estimated effect is robust to the inclusion of various sets of controls.

Table 4: First-stage relationship between share of care hours provided by daughters and share of daughters.

	(1)	(2)	(3)	(4)
Fraction daughters	1.169***	1.137***	1.019***	1.038***
	(0.0337)	(0.0365)	(0.0682)	(0.125)
Total help hrs			0.0000533	0.0000987
			(0.0000600)	(0.0000943)
Total children FE	Yes	Yes	Yes	Yes
Respondent controls	No	Yes	Yes	Yes
Child controls	No	No	Yes	No
Unimputed child controls	No	No	No	Yes
N	1424	1394	1121	647

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: This table reports results from an OLS regression of gendered share of care-hours on gender-mix of children. The outcome variable in all columns is the share of child-provided care-hours provided by daughters as reported by respondents to the 2012 wave of the HRS. Respondents without children or who receive no care from their children are mechanically excluded. All columns control for the fixed effects of total number of children. Columns (2)-(4) include controls for the respondents' log household income, age, years of education, gender, race, partnership status, census division, and religion. Columns (3) and (4) include controls for sons' average log income, daughters' average log income, share of sons who live within 10 miles of the respondent, and share of daughters who live within 10 miles of the respondent. Some values for the child-generation controls were imputed. Robust standard errors reported.

As discussed in section 2, some values for the sibling-group controls were imputed. Columns (3) and (4) of table 4 compare the results of regressions including and excluding imputed values, respectively, and find that the imputation is inconsequential to the results of the first-stage. Other tables included in the analysis in section 4 only include regressions using the imputed values, but the exclusion of the imputed values does not change the conclusions of this paper. As shown in column (2), the coefficient of interest is 1.137 ($p < 0.01$), which can be interpreted as the percentage point impact on the share of care provided by daughters from a 100 percentage point increase in the share of children who are daughters. To put this in real-world terms, this means that a 25.0 (for example) percentage point increase in the share of daughters in the sibling group corresponds to a 28.4 percentage point increase in the share of child-provided care that is provided by daughters. The coefficient being larger than 1 suggests, as other research has shown, that daughters are in general likely to provide more than their "fair share" of care, compared to what they would contribute if the division were equal between siblings regardless of gender. The coefficients are consistent across the columns, showing that the result is robust to the controls used.

Figure 3 below visualizes this relationship using a binned scatter plot, which shows the first stage relationship described above including the controls from column (2) of table 4, and demonstrates this strong positive relationship.

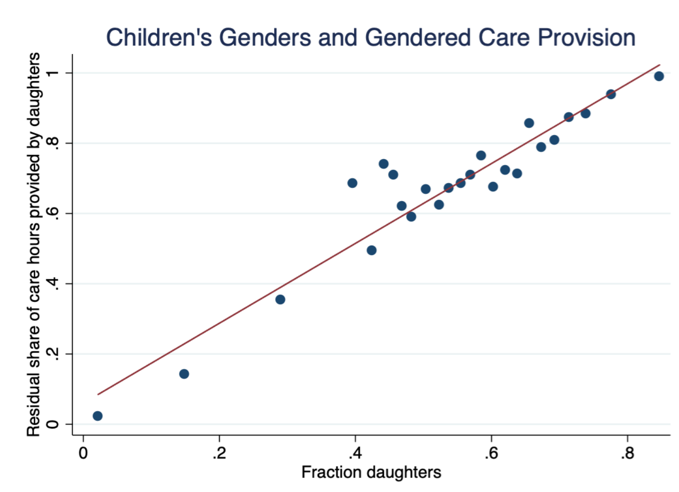

Figure 3: First Stage: Share of care hours provided by daughters and share of daughters

Note: This binned scatter plot shows the relationship between the share of an HRS respondent's care provided by daughters and the fraction of their children who are daughters after controlling for respondent variables. Respondent controls include total number of children, log household income, age, total hours of help received, gender, race, partnership status, census division, and religion. Results are binned into 25 quantiles based on x-values.

4 Results

For most health outcomes, having a larger share of care provided by daughters seems to have inconclusive effects, but there appear to be significant effects on some clinical outcomes, respondents' mental health, and the likelihood that the respondent recently saw a doctor. In general, results are only marginally significant if at all but are consistent when examined using older subsets of the population and reduced form equations.

The HRS survey asks respondents to describe their own health as "excellent", "very good", "good", "fair", or "poor". Table 5 uses this metric to analyze the relationship between self-reported health and the share of care provided by daughters. The outcome in columns (1)-(3) is an indicator for whether the respondent rated their own health as "good" or better. The coefficients can be interpreted in the percentage point change in likelihood that a respondent reported good or better health corresponding to a 100 percentage point increase in the share of care provided by daughters. Not only are none of these coefficients significant, but they are also small in magnitude, suggesting that the gender division of care between siblings has minimal impacts on their parent's self-reported health. The outcome in columns (4)-(6) is an indicator for whether the respondent reported their own health as being as good or better than they reported in the previous survey wave, which was administered two years earlier. The coefficients can be interpreted as the percentage point change in the likelihood that the respondent improved or maintained their health corresponding to a 100 percentage point change in the share of care provided by daughters. Once again, the coefficients are small and not significant. These results appear robust to the inclusion of various sets of controls.

Table 5: IV regression of self-reported health on share of care hours provided by daughters.

	Self-reported health			Δ Self-reported health		
	(1)	(2)	(3)	(4)	(5)	(6)
Fraction care hrs from daughters	-0.0527	-0.0401	-0.0221	0.0468	0.0205	0.00343
	(0.0556)	(0.0570)	(0.0921)	(0.0558)	(0.0590)	(0.0946)
Total help hrs			-0.000104			-0.000113
			(0.0000902)			(0.0000900)
Total children FE	Yes	Yes	Yes	Yes	Yes	Yes
Respondent controls	No	Yes	Yes	No	Yes	Yes
Child controls	No	No	Yes	No	No	Yes
N	1422	1392	1119	1409	1379	1111

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: This table reports results from an IV regression of self-reported health on the gendered share of care-hours instrumented by the gender-mix of children. The outcome variable in columns (1)-(3) is an indicator for whether the respondent reported that their health was "Good" or better. The outcome in columns (4)-(6) is an indicator for whether the respondent reported being in as good or better health than in their previous interview (so a 1 corresponds to maintaining or improving health). Respondents without children or who receive no care from their children are mechanically excluded. All columns control for the fixed effects of total number of children. Columns (2)-(3) and (5)-(6) include controls for the respondents' log household income, age, years of education, gender, race, partnership status, census division, and religion. Columns (3) and (4) include controls for sons' average log income, daughters' average log income, share of sons who live within 10 miles of the respondent, and share of daughters who live within 10 miles of the respondent. Some values for the child-generation controls were imputed. Robust standard errors reported.

Table 6 below shows the reduced form specification. Note that the signs of the coefficients match those in table 5 and that within both tables, the coefficients to not change substantially between columns (2) and (3) or between columns (4) and (5). This suggests that the estimated coefficients are robust to the inclusion of controls about the child generation and to controls for the total amount of help the respondent receives, which should alleviate some concerns about confounding variables or endogeneity. We interpret the coefficient in column (2), for example, as a 100 percentage point increase in the share of children who are daughters corresponding to a 2.8 percentage point decrease in the likelihood that a person reports their health as good or better.

Table 7 shows results on the clinical outcomes considered by the HRS questions, which ask whether the respondent has ever been diagnosed as having certain conditions by a doctor. The list of conditions includes high blood pressure, diabetes, cancer, lung disease, heart disease, stroke, psychiatric problems, and

Table 6: Reduced form: Regression of self-reported health on share of children who are daughters.

	Self-reported health			Δ Self-reported health		
	(1)	(2)	(3)	(4)	(5)	(6)
Fraction daughters	-0.121***	-0.0278*	-0.0694***	-0.0301**	-0.0111	-0.000145
	(0.0159)	(0.0156)	(0.0240)	(0.0150)	(0.0155)	(0.0234)
Total help hrs			-0.000730***			-0.000147*
			(0.000101)			(0.0000780)
Total children FE	Yes	Yes	Yes	Yes	Yes	Yes
Respondent controls	No	Yes	Yes	No	Yes	Yes
Child controls	No	No	Yes	No	No	Yes
N	19145	18639	15229	18835	18353	15017

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: This table reports results from an OLS regression of self-reported health on the fraction of the respondent's children who are daughters. The outcome variable in columns (1)-(3) is an indicator for whether the respondent reported that their health was "Good" or better. The outcome in columns (4)-(6) is an indicator for whether the respondent reported being in as good or better health than in their previous interview (so a 1 corresponds to maintaining or improving health). Respondents without children or who receive no care from their children are mechanically excluded. All columns control for the fixed effects of total number of children. Columns (2)-(3) and (5)-(6) include controls for the respondents' log household income, age, years of education, gender, race, partnership status, census division, and religion. Columns (3) and (4) include controls for sons' average log income, daughters' average log income, share of sons who live within 10 miles of the respondent, and share of daughters who live within 10 miles of the respondent. Some values for the child-generation controls were imputed. Robust standard errors reported.

arthritis. The outcome in columns (1)-(3) is the number of these conditions that the respondent had ever been diagnosed with as of wave 11 of the HRS (administered in 2012). The coefficients can be interpreted as the change in the number of diagnoses corresponding to a 100 percentage point change in the share of care provided by daughters. The coefficient in column (2) is statistically significant ($p < 0.05$), and suggests that with the controls listed, a 100 percentage point increase in the share of care provided by daughters corresponds to the respondent being diagnosed with 0.382 more conditions on average. The positive sign of these three coefficients suggests that having more care provided by daughters increases the number of diagnosed conditions the parent has. This relationship might suggest a negative relationship between the share of daughter-provided care and parental health, but this could also be the result of care from daughters being associated with some care action that makes a diagnosis of an existing condition more likely, which is arguably a good thing. Note also that although the coefficient in column (3) is not significant,the coefficient is consistent in sign and magnitude and as shown in column (3) of table 8, the reduced form relationship is significant with these controls so the result in column (2) is likely to be robust. The outcome in columns (4)-(6) is the number of new diagnoses the respondent reported receiving in the two years since the previous administration of the survey. These coefficients can be interpreted as the difference in number of new diagnoses corresponding to a 100 percentage point increase in the share of care provided by daughters, but none are significant. In this table, total hours of help received is related to the outcomes with statistically significant coefficients. One possible explanation is that people with more diagnosed conditions tend to be in worse health and therefore require, request, and/or receive more help, either from family or other sources.

Table 8 below shows the results of the reduced form specification for these outcomes. In the reduced form table, the inclusion of controls for the total hours of help received or information about the child generation do not significantly alter the coefficients between columns (2) and (3), as was the case in table 7.

Studies of the impact of familial care on aging parents in other countries such as [Zeng et al., 2017, Wahba

Table 7: IV regression of health diagnoses on share of care hours provided by daughters.

	Conditions diagnosed			Δ Conditions diagnosed		
	(1)	(2)	(3)	(4)	(5)	(6)
Fraction care hrs from daughters	0.424**	0.382**	0.408	-0.0653	-0.0764	-0.131
	(0.184)	(0.194)	(0.314)	(0.0749)	(0.0792)	(0.119)
Total help hrs			0.00104***			0.000264**
			(0.000315)			(0.000129)
Total children FE	Yes	Yes	Yes	Yes	Yes	Yes
Respondent controls	No	Yes	Yes	No	Yes	Yes
Child controls	No	No	Yes	No	No	Yes
N	1424	1394	1121	1412	1382	1113

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: This table reports results from an IV regression of clinical outcomes on the gendered share of care-hours instrumented by the gender-mix of children. The outcome variable in columns (1)-(3) is the sum of indicators for whether a doctor has ever told the respondent (in the 2012 wave of the HRS) that they have ever had a particular disease. The list of included diseases is: high blood pressure, diabetes, cancer, lung disease, heart disease, stroke, psychiatric problems, and arthritis. The outcome variable in columns (4)-(6) is the change in the number of conditions the respondent has been told they currently have by a physician since the last interview (two years before). Respondents without children or who receive no care from their children are mechanically excluded. All columns control for the fixed effects of total number of children. Columns (2)-(3) and (5)-(6) include controls for the respondents' log household income, age, years of education, gender, race, partnership status, census division, and religion. Columns (3) and (6) include controls for sons' average log income, daughters' average log income, share of sons who live within 10 miles of the respondent, and share of daughters who live within 10 miles of the respondent. Some values for the child-generation controls were imputed. Robust standard errors reported.

and Wang, 2019] have found differences in the emotional care provided by sons and daughters, both in terms of the amount of care received and its effects. Following this literature, table 9 displays results for outcomes related to respondents' emotional states and mental health. The outcomes in each column are the respondents CESD score, change in CESD score, and an indicator for whether the respondent reported feeling lonely all or most of the time. The CESD score for each respondent is a measure derived by RAND using questions asked in the HRS survey. The score is the sum of five "negative" indicators minus two "positive" indicators. The negative indicators include whether the respondent reported feeling depressed, that everything is an effort, sleep is restless, loneliness, sadness, or an inability to get going all or most of the time. The positive indicators include whether the respondent reported feeling happy or that they enjoy life all or most of the time. Note that a more positive CESD score is indicative of worse mental health. The coefficient in column (1) of table 9 can be interpreted as a 100 percentage point increase in the share of care provided by daughters being associated with a 0.773 higher CESD score, and is significant ($p < 0.05$). This suggests that having more care provided by daughters corresponds to worse mental health. The change in CESD score is the respondent's CESD score in wave 11 minus their score from the previous wave, so a positive value indicates a decline in mental health. The corresponding coefficient in column (2) is also significant, showing that having 100 percentage points more of ones care provided by daughters is associated with an increase of 0.77 in their CESD score over the last two years ($p < 0.05$). Since the CESD score ranges from -2 to 5, these are fairly large effects. The coefficient in column (3) can be interpreted as a 100 percentage point increase in the share of care provided by daughters being associated with a 17.4 percentage point increase in the likelihood that the respondent reported feeling lonely all or most of the time ($p < 0.05$). With these statistically significant results, it seems as if having more care provided by daughters is associated with worse mental health, contrary to similar effects estimated in other countries. Although not included, versions of these regressions with controls including total hours of care and child-generation variables were run. Although significance levels shifted, the magnitude and signs of the coefficients remained roughly the same, suggesting that the effects are robust to the inclusion of those controls. Reduced form regressions were

Table 8: Reduced form: Regression of health diagnoses on share of children who are daughters

	Conditions diagnosed			Δ Conditions diagnosed		
	(1)	(2)	(3)	(4)	(5)	(6)
Fraction daughters	0.530***	0.241***	0.212***	0.0284	0.0146	0.0292
	(0.0531)	(0.0508)	(0.0791)	(0.0177)	(0.0183)	(0.0285)
Total help hrs			0.00245***			0.000451***
			(0.000320)			(0.000121)
Total children FE	Yes	Yes	Yes	Yes	Yes	Yes
Respondent controls	No	Yes	Yes	No	Yes	Yes
Child controls	No	No	Yes	No	No	Yes
N	19163	18658	15245	18860	18379	15039

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: This table reports results from an OLS regression of clinical outcomes on the fraction of the respondent's children who are daughters. The outcome variable in columns (1)-(3) is the sum of indicators for whether a doctor has ever told the respondent (in the 2012 wave of the HRS) that they have ever had a particular disease. The list of included diseases is: high blood pressure, diabetes, cancer, lung disease, heart disease, stroke, psychiatric problems, and arthritis. The outcome variable in columns (4)-(6) is the change in the number of conditions the respondent has been told they currently have by a physician since the last interview (two years before). Respondents without children or who receive no care from their children are mechanically excluded. All columns control for the fixed effects of total number of children. Columns (2)-(3) and (5)-(6) include controls for the respondents' log household income, age, years of education, gender, race, partnership status, census division, and religion. Columns (3) and (6) include controls for sons' average log income, daughters' average log income, share of sons who live within 10 miles of the respondent, and share of daughters who live within 10 miles of the respondent. Some values for the child-generation controls were imputed. Robust standard errors reported.

also run but not included, and the results support those reported here.

In most measures of respondents' health-care utilization, the share of care provided by daughters seems to have no impact. Table 10 provides estimates of the effect of the share of care provided by daughters on: (1) the likelihood that the respondent was hospitalized in the last two years, (2) the likelihood that the respondent saw a doctor in the last two years, (3) the natural log of the respondent's out-of-pocket medical expenses over the last two years, (4) the likelihood that the respondent had a cholesterol test in the last two years, and (5) the likelihood that the respondent received a flu shot in the last two years. None of the coefficients are significant. Versions of these regressions with other controls and in their reduced form were also run and, although they are not shown here, the results were generally consistent with those presented.

4.1 Robustness

As mentioned in sections 2 and 3, there are a few remaining questions about the validity of these estimates. Tables 5 through 8 addressed concerns about the inclusion of certain controls and showed that the results on self-reported and clinical outcomes were robust to the inclusion of total hours of help received, whether children live near the respondent, and children's household incomes. Although not included, the results for mental health and health care utilization outcomes are similarly robust.

Another open question is whether these effects vary across age groups, as discussed in section 2. Table 12 in the appendix reexamines the results in table 6 for older subsets of the sample by restricting to ages 65 and older and ages 75 and older. Although the significance of the results change, the coefficients are generally consistent in size and magnitude in the reduced form specification. Table 13 does the same for the results in columns (1)-(3) of table 8, which examines clinically diagnosed outcomes. The coefficients roughly consistent

Table 9: IV regression of diagnosed mental health on share of care hours provided by daughters.

	(1) CESD Score	(2) Δ CESD Score	(3) Felt Lonely
Fraction care hrs from daughters	0.773**	0.770**	0.174**
	(0.339)	(0.331)	(0.0721)
Total children FE	Yes	Yes	Yes
Respondent controls	Yes	Yes	Yes
N	1009	955	1006

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: This table reports results from an IV regression of mental health outcomes on the gendered share of care-hours instrumented by the gender-mix of children. The outcome variable in column (1) is the respondent's CESD score, which is defined here. The outcome variable in column (2) is the change since the previous survey (2 years ago) in respondent's CESD score. The outcome variable in column (3) is an indicator variable for whether the respondents reported feeling lonely all or most of the time. The outcome variable in column (4) is an indicator for whether the respondent has ever been diagnosed with a psychiatric problem. Respondents without children or who receive no care from their children are mechanically excluded. All columns control for the fixed effects of total number of children and include respondent controls. Respondent controls include the log household income, age, years of education, gender, race, partnership status, census division, and religion. Robust standard errors reported.

in sign and magnitude between the tables and across the subsets. Although these subsets are not a perfect match for which respondents are in need of the most help, age is a reasonable proxy and we can see that the effect on health of care division between sons and daughters is consistent across age groups of elderly parents.

Another concern is that this paper tests multiple hypotheses, which increases the chances of mistakenly finding a significant result. The analysis presented attempts to mitigate this possibility by including multiple sets of controls for each result, but a more convincing argument could be made using a multiple comparison correction, such as a Bonferroni correction. Although the results as presented do not include this correction, it would be a welcome extension to this analysis and the un-corrected results should be taken with (perhaps several) grains of salt.

5 Conclusion

Anecdotes about aging parents and their children making decisions about care show that families are making choices all the time about the costs, benefits, and trade-offs related to the provision of this care. As the US population ages, these decisions will become more common and may become more difficult and constrained. With this in mind, this paper presents evidence on just one aspect of this care: its division between sons and daughters. The results suggest that in most ways, the division of care between genders within a sibling group has either minimal or indeterminate impacts on parental health outcomes. The notable exceptions are as follows: having a larger share of care provided by daughters corresponds to a higher number of clinically diagnosed conditions and worse mental health. In all cases, however, further analysis would still be beneficial and the results of this paper do not speak to precise mechanisms through which the care provided by children

Table 10: IV regression of healthcare utilization and spending on share of care hours provided by daughters.

	Utilization			Preventative care	
	(1)	(2)	(3)	(4)	(5)
	Hospitalized	Visited doctor	Log Medical Costs	Cholesterol Test	Flu shot
Fraction care hrs from daughters	-0.0138	0.0508	0.128	0.0582	0.0779
	(0.0636)	(0.0316)	(0.238)	(0.0484)	(0.0542)
Total children FE	Yes	Yes	Yes	Yes	Yes
Respondent controls	Yes	Yes	Yes	Yes	Yes
N	1388	1392	1156	1360	1384

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: This table reports results from an IV regression of healthcare outcomes on the gendered share of care-hours instrumented by the gender-mix of children. The outcome variable in column (1) is an indicator for whether the respondent was hospitalized in the last two years. The outcome variable in column (2) is an indicator for whether the respondent visited a doctor in the last two years. The outcome variable in column (3) is the log of the respondent's out-of-pocket medical costs in the last two years. The outcome variable in column (4) is an indicator for whether the respondent had their cholesterol levels tested in the last two years. The outcome variable in column (5) is an indicator for whether the respondent received a flu shot in the last tow years. Respondents without children or who receive no care from their children are mechanically excluded. All columns control for the fixed effects of total number of children and include respondent and child-generation controls. Respondent controls include log household income, age, years of education, gender, race, partnership status, census division, and religion. Child-generation controls include sons' average log income, daughters' average log income, share of sons who live within 10 miles of the respondent, and share of daughters who live within 10 miles of the respondent. Some values for the child-generation controls were imputed. Robust standard errors reported.

affects parents or how it differs between genders of children.

The analysis presented in this paper would be greatly strengthened by a larger sample size. Future analysis could pool observations across waves of the HRS, to try and capture results on respondents who were excluded from wave 11. This would require ensuring that respondents are not double-counted and that the additional observations do not differ in some systematic way from those in wave 11. Another path to pursue would be to further exploit the time-series nature of the HRS data. Using respondent fixed effects, future analysis could study changes in the division of care between siblings over time to find causal impacts on parental health. The conclusions reached in this paper would benefit from being further refined and validated, whether by these proposed methods or others.

This paper speaks to two larger questions: what are the determinants of health for aging individuals, and how do men and women differ in what, at a surface level, seems to be similar work? As American families continue making thoughtful choices about health care and the division of non-market labor, this paper and future work in this area may illuminate aspects of care-giving that have previously been left up to uninformed negotiation or societal norms.

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A Total hours of care

Table 11: Relationship between total amount of care received and gender mix of children.

	Total Hours of Care	
	(1)	(2)
Fraction daughters	11.52***	6.278***
	(2.116)	(2.139)
Total children FE	Yes	Yes
Respondent controls	No	Yes
N	19075	18581

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: This table reports results from an OLS regression of respondents' total hours of care received in the last month on the fraction of their children who are daughters. Both columns control for the total number of children. Column (2) includes controls for log household income, age, total hours of help received, gender, race, partnership status, census division, and religion. Robust standard errors reported.

B Restricting sample by age

Table 12: Reduced form: Regression of self-reported health on share of children who are daughters.

	Ages 65+			Ages 75+		
	(1)	(2)	(3)	(4)	(5)	(6)
Fraction daughters	-0.0859***	-0.0122	-0.0416	-0.0699**	-0.0233	-0.0451
	(0.0226)	(0.0219)	(0.0342)	(0.0317)	(0.0312)	(0.0481)
Total help hrs			-0.000610***			-0.000571***
			(0.000105)			(0.000108)
Total children FE	Yes	Yes	Yes	Yes	Yes	Yes
Respondent controls	No	Yes	Yes	No	Yes	Yes
Child controls	No	No	Yes	No	No	Yes
N	10221	10112	8975	5375	5323	4745

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: This table reports results from an OLS regression of self-reported health on the fraction of the respondent's children who are daughters. The outcome variable in all columns is an indicator for whether the respondent reported that their health was "Good" or better. Columns (1)-(3) include respondents age 65 and older, and columns (4)-(6) include respondents 75 and older. Respondents without children or who receive no care from their children are mechanically excluded. All columns control for the fixed effects of total number of children. Some values for the child-generation controls were imputed. Robust standard errors reported.

Table 13: Reduced form: Regression of health diagnoses on share of children who are daughters.

	Ages 65+			Ages 75+		
	(1)	(2)	(3)	(4)	(5)	(6)
Fraction daughters	0.378***	0.276***	0.229**	0.412***	0.358***	0.194
	(0.0701)	(0.0697)	(0.111)	(0.0944)	(0.0945)	(0.151)
Total help hrs			0.00195***			0.00184***
			(0.000294)			(0.000316)
Total children FE	Yes	Yes	Yes	Yes	Yes	Yes
Respondent controls	No	Yes	Yes	No	Yes	Yes
Child controls	No	No	Yes	No	No	Yes
N	10232	10124	8985	5382	5330	4751

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: This table reports results from an OLS regression of clinical outcomes on the fraction of the respondent's children who are daughters. The outcome variable in all columns is the sum of indicators for whether a doctor has ever told the respondent (in the 2012 wave of the HRS) that they have ever had a particular disease. Columns (1)-(3) include respondents age 65 and older, and columns (4)-(6) include respondents 75 and older. Respondents without children or who receive no care from their children are mechanically excluded. All columns control for the fixed effects of total number of children. Some values for the child-generation controls were imputed. Robust standard errors reported.