Caregiving and Physical Activity: Competing Time-Use Choices?

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ABSTRACT

Caregiving for family members has been described as a 36-hour day. Previous research has suggested that because of the constant attention care recipients require, family caregivers have little time to attend to their own health needs. Using pooled data from four waves (2004-2010) of the Health and Retirement Study (HRS), we analyze the extent to which time allocation decisions reflect a conflict between time devoted to informal care and time devoted to self-health promotion through physical activity. The empirical model proposes a five-equation system in which the dependent variables are hours devoted to caregiving, frequency of three kinds of physical activity that vary in intensity, and hours spent in paid employment. Reduced-form results from estimating the five equations jointly indicate limited evidence of a competition between care hours and physical activity.

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Introduction

Informal Caregiving

On January 1st 2011, the oldest members of the Baby Boom generation celebrated their 65th birthday. In fact, according to the Pew Research Center (2010), on that day, today and on everyday for the next 18 years, 10,000 baby boomers will reach age 65. As the American population continues to age dramatically, the provision of long-term care (LTC) for older Americans becomes an increasingly urgent issue.

The current system of long-term care relies heavily on informal—that is, unpaid—caregivers to shoulder the financial, physical and emotional burdens of providing LTC to family members, thereby enabling older people to live independently in their homes and communities for much longer (Doty, 2004). Nearly three in ten U.S. households (31.2%) report that at least one person has served as an unpaid family caregiver within the last twelve months; leading to an estimate of 36.5 million households with a caregiver present (National Alliance for Caregiving & AARP, 2009). In terms of sheer numbers, in 2009, 62 million informal caregivers or approximately 30% of the US adult population, provided care to an adult who was ill, disabled or aged (National Alliance for Caregiving & AARP, 2009). There is little debate about the critical role of informal caregivers in supplying long-term care – about 80% of all community care is provided by family caregivers, at an estimated economic value of $257 billion (in 2000 dollars) annually (Arno, 2002).

A sizeable literature has focused on profiling informal caregivers as well as the context in which care occurs. Key findings from this literature indicate that caregivers are predominantly middle-aged females, a majority of whom are employed (Alecxih et al., 2002). The typical care

recipient (62%) – most often a parent – is also a female (Alecxih et al., 2002). This is mainly because women tend to live longer and often outlive their spouses. According to an analysis by Donelan et al. (2002), family caregivers devote a substantial amount of time to helping a relative or friend – about one-third of caregivers report providing 21 or more hours of help per week. In addition, many caregivers provide assistance for long periods of time—over 40 percent have been providing help for at least five years, and about one-fifth have been doing so for 10 or more years (Donelan et al., 2002).

Caregiving Burden and Physical Activity

Although the potentially rewarding aspects of caregiving are frequently acknowledged (Nolan et al, 1996), provision of prolonged personal care and assistance is said to adversely affect physical and psychological health of informal caregivers (Whitlach and Noellker, 1996; The Robert Wood Johnson Foundation, 2001). A meta-analysis conducted by Pinquart and Sorensen (2003) finds that studies consistently report higher levels of depressive symptoms and mental health problems among caregivers than among non-caregivers. Certain studies find that caregivers pay the ultimate price for providing care – increased mortality. Schulz and Beach (1999) demonstrate that elderly spousal caregivers who experience caregiving related stress have a 63% higher mortality rate than non-caregivers of the same age. Research also shows that relative to non-caregivers, caregivers are more prone to suffering from sleep problems, having lowered immunity and elevated blood pressure (King et al, 1994; Glaser et al, 1997). These negative, psychological and physical repercussions for informal caregivers are generically grouped together under a construct called the "caregiving burden."(Zarit, 1980)

Physical activity potentially plays a dual role in influencing caregiving burden. Etkin et al (2008) suggest that physical activity could be viewed as both a mediator of caregiving stress and as a health outcome. As a coping mechanism, physical activity has shown to buffer the impact of

stressors (Howard, 1984). That is, if caregivers are exercising appropriately, then the resultant stress caused by behavior and memory problems of care receivers might be better tolerated. Secondly, physical *inactivity* can also be considered as a negative outcome of the caregiving process if the provision of care somehow reduces the probability of engaging in preventive health behaviors (such as regular physical activity) due to time or other constraints (Castro et al, 2002).

Though the role of physical activity as a mediator of stress has been widely demonstrated, very few studies have examined the impact of caregiving on health promotion behaviors such as physical activity. In a study conducted by Burton et al (1997), a group of spousal caregivers were matched to non-caregivers on the basis of age and gender. The authors concluded that being a caregiver, especially a high-intensity one, was associated with an interview response of "not having enough time to exercise." However, the appropriateness of the control group and thus the degree of internal validity is called into question because matching was done only on the basis of two observables – age and gender. Moreover, due to the limited nature of the data and the study design, the authors could not examine the magnitude by which physical activity decreased relative to increases in caregiving. Therefore, even if it were to be believed that caregiving induces individuals to reduce the amount of physical activity, it is not clear if the reduction is large enough to justify a policy intervention.

When discussing the impact of caregiving on physical activity, it important to acknowledge recent evidence from studies conducted by Freedman et al (2006) and Bertrand et al (2006) which suggests a "healthy caregiver hypothesis." According to them, as high intensity care responsibilities increase, caregivers achieve better physical functioning because such activities themselves have a large physical component to them. The authors therefore conclude the

existence of a "caregiver gain" instead of a "caregiver burden." Though the "healthy caregiver hypothesis" is an interesting contribution to the literature, it does not challenge the argument that reduced physical activity can lead to deleterious health effects among caregivers. Physical activity done as a part of the caregiving process is not likely to act as a mediator of caregiving stress and to the extent that stress poses as a risk factor to a caregiver's mental and physical health, leisure-time physical activity has a significant role to play.

Research Question and Motivation

In this paper, we examine the extent to which time allocation decisions reflect a conflict between time devoted to caregiving and time devoted to investment in one's own health through physical activity. Specifically, our research addresses the question:

Is there a tradeoff between hours of informal care and frequency of physical activity?

According to the Centers for Disease Control (CDC) (2010), to achieve important health benefits, adults need at least 30 minutes of moderate physical activity (i.e., brisk walking) five days a week as well as muscle strengthening activities on two or more days a week. Alternatively, the minimum physical activity guidelines could be translated into 20 minutes of vigorous physical activity (i.e., jogging or running) three days a week in addition to muscle strengthening activities on two or more days a week.

These minimum guidelines suggest that the amount of exercise a person gets is a function of intensity, duration and frequency. All three aspects are equally important in determining the overall amount of physical activity. In other words, the benefits of doing 150 minutes of moderate activity all at once are lesser than doing 30 minutes of physical activity each day for five days a week.

If increased care responsibilities are associated with a reduced frequency of physical

activity such that the probability that individuals engage in physical activity "multiple days a week" is substantially reduced, then existing caregiver support programs may need to be adjusted to include components that promote physical activity. Currently, the National Family Caregiver Support Program (NFCSP) is the key government program that provides assistance to family caregivers. With an overall budget of $154 million in FY 2010 (The U.S. Administration on Aging, Office of Budget & Finance, 2011), the key components included in the NFCSP are provision of counseling, support groups and respite care (Administration on Aging, 2004). If caregivers' physical activity levels fall below the recommended guidelines, the NFCSP may need to be adjusted to include strategies that promote physical activity among caregivers. For example, a telephone-supervised, home-based, physical activity regimen has been demonstrated in past research as one such strategy for increasing physical activity in the caregiving population (King et al, 1997).

In addition to the policy implications discussed above, part of the motivation for this study relates to limitations of previous literature. Given the time demands associated with caregiving, researchers have addressed the tradeoff between time spent in care activities and time spent in other activities. Previous literature, however, has largely concentrated on the tradeoff between care hours and hours of paid work. Initial analyses were generally based on cross-sectional models of labor market participation and parental care (Muurinen 1986; Stone and Short 1990; White-Means 1992; Boaz and Muller 1992); but these studies failed to consider the endogeneity problems arising in analyzing two theoretically competing uses of time.

More recent research has recognized the joint nature of these decisions and has tried to address this endogeneity problem. Results from these studies have been mixed. Wolf and Soldo (1994) estimated a simultaneous equations model and found no reduction in married women's

employment or hours of work due to caregiving; Ettner (1995, 1996), in contrast, found that women's labor supply is significantly reduced by co-residence with an elderly disabled parent, primarily because of withdrawal from the labor market. She uses predictors of parents' health status (education, age and marital status) and the number of siblings as instruments for co-residence.

The lack of consistent, conclusive evidence that informal care and labor supply decisions are negatively correlated has led some researchers to speculate that the time tradeoff made by caregivers may come from activities other than participation in the labor market, such as housework or leisure (Wolf and Soldo 1994). Couch, Daly and Wolf (1999) considered four demands on household time and money resources: time spent working, time spent providing care to elderly parents, time spent performing household work, and monetary transfers to noncoresident elderly parents. Their findings indicate that parental factors associated with increased time transfers to parents do not appear to induce corresponding reductions in either labor market or housework time.

The absence of negative correlations among competing time-uses in previous work suggests that there is scope to further disaggregate time spent in leisure activities into other "productive" uses of time – such as physical activity. Bittman et al. (2004) use the Australian and Canadian Time Use Surveys to compare time allocation among three sets of respondents: those without any adult care responsibilities, those caring for an adult who lives apart from them, and those caring for an adult who resides with them. Four major time-use categories are studied: paid work, domestic work, recreation and leisure, and social and community interaction. The authors find that caring for an adult in one's own household infringes on leisure time for all caregivers regardless of gender or nationality. Care responsibilities, in general, appear to specifically

constrain out-of-home entertainment and participation in active sports. These results, however, are problematic due to possible selection bias (only caregivers are included in the final analysis) and non-consideration of joint determination of time allocation decisions.

In summary, it is unclear how care responsibilities affect time allocation decisions in paid and unpaid uses of time. Because there are only 24 hours in a day, time for care must be found somewhere. This paper attempts to determine whether care time is subtracted from time that would have otherwise been devoted to activities relating to investment in one's own health, mainly exercise.

Modeling Time Use

The New Home Economics models of the early 1960s viewed families as engaging in production of goods much like a firm (Becker, 1965). In this model, families convert time, material resource inputs, and purchased services into producing abstract household goods. In particular, Becker's approach recognized the importance of time allocation in the production of household goods. In such models of family production, decisions are made so as to maximize well being given the total time available. Wages from labor deliver the income necessary to finance the production of household goods.

In models of family production, decisions are made so as to maximize well-being within the total time available. In simple models, two activities fully accounted for time available: time in the labor market and time in leisure. Gronau (1977) expanded the traditional two-dimensional time allocation model to three uses of time: market work, leisure and home production. These categories are mutually exclusive and exhaustive such that when two of the three categories are determined, the third is implied. The optimal time allocation by each individual depends on the value of time in each activity (or the opportunity cost of that time), as well as the preferences of

the individual (Couch, Daly and Wolf, 1999). Thus an individual's time allocation decisions are not only simultaneously determined but are also dependent on tastes and other unobserved variables that may be correlated across outcomes (Couch, Daly and Wolf, 1999).

Following Gronau's work, Kooreman and Kapteyn (1987) modeled the allocation of time by couples between market work and a variety of non-market activities, including home production, child-care, hobbies and personal care. Although their model takes account of multiple time uses, it does not allow for cross-equation correlations between them.

More recently, in studying mother's time use, Kimmel and Connelly (2007) further expand the Gronau trinity into five aggregated uses of time: (paid) market work, unpaid home work, child care, leisure and other (includes sleep, personal care time, education, and so on). Further, they recognize that all factors associated with the value of time spent in any one of the household's activities influence decisions about all other time allocations. Their results show that mother' caregiving time increases with the number of children, decreases with age of the child and increases with price of child care.

Model Specification and Estimation

Households are productive units whose primary resources are time and money. More time devoted to one activity necessarily means less time devoted to some other activity. As discussed above, if caregiving and physical activity are assumed to be two kinds of time uses, then it is theoretically indefensible to model one decision as a function of the other. Such an equation would not have a precise *ceteris paribus* interpretation because the amount of time devoted to both care and physical activity is decided by the same individual (Wooldridge, 2002). The interrelationships among time uses suggest that all factors associated with the value of time spent in any one activity influence decisions about all other time allocations. In this case, one cannot

hold time spent in caregiving "fixed," because anything that influences the decision on how much time to spend on physical activity, simultaneously influences the decision regarding care hours. This also implies that an exclusion variable is impossible to find – i.e., there does not exist a variable that influences one category of time allocation without affecting all other types of time uses.

Thus, from a theoretical point of view, it makes sense to estimate these decisions jointly. Following the discussion in the previous section, the basic estimation model in this paper is a system of five time-use equations where for each individual, decisions about time-allocation are jointly determined. The outcomes in this reduced-form model are time spent in caregiving, frequency of three types of physical activity (mild, moderate and vigorous) and time spent in paid employment. Because the five time-uses come from the same respondent, error terms are assumed to be correlated across the five equations. The five equations take the form:

$t_j = \beta_{0j} + \beta_j^{'} X + \varepsilon_j$ for j = care, paid employment

$f_p = \beta_{0p} + \beta_p^{'} X + \varepsilon_p$ for p = mild, moderate, vigorous

Here, X is an array of explanatory variables common to all equations. This model is analogous to a Seemingly Unrelated Regression, except that non-linear estimation techniques are used to account for the limited nature of the dependent variable in the five equations. The outcomes are measured in ways that dictate that the hours of care equation is estimated as an interval regression, the physical activity equations are estimated as ordered Probits, and the labor market hours equation is estimated as a Tobit equation.

Data

The analysis uses pooled data from four waves (2004-2010) of the Health and Retirement Study (HRS). The HRS is a nationally representative, biannual survey of the near elderly in the

United States. Persons aged 50-61 entered the sample initially, thus making their parents prime candidates to be care recipients. The HRS collects detailed information not only about the respondents and their spouses, but also important information about their parents and siblings. Supported by the National Institute on Aging and the Social Security Administration, the HRS includes a sample of more than 26,000 Americans. We use only four waves because the question on frequency of physical activity was asked for the first time in 2004.

Sample

Although a variety of caregiving scenarios may exist - such as parental care, spousal care, care provided to a relative or a friend – this research focuses exclusively on parental caregiving. Parental caregiving is not only the most common type of caregiving situation, but also the most relevant given the middle-age profile of the large majority of respondents in the sample. Spousal caregiving is a commonly reported care situation for those over 75 years of age. While this research does not focus on spousal caregiving, because hours of spousal care may influence hours of parental care, we control for spousal health condition in the multivariate analyses.

Given the focus on parental caregiving, we restrict the sample to those respondents who have at the minimum, one parent alive, or a parent in-law alive or to those who have experienced the recent death of either a parent or an in-law.[1] Respondents who have experienced the death of a parent/in-law since the time of the last interview are included in the sample because a substantial amount of care is provided at the end-of-life stage. This inclusion assumes that the parent/in-law died due to age-related chronic illness. This assumption is not unreasonable given that the respondents in the sample are between 52-94 years in age. Further, to ensure that

[1] Parents or in-laws could be living in the community, with the respondent or in a nursing home. We do not distinguish between these locations because it is common for adult children to continue to provide supportive informal care even in the nursing home setting.

respondents were of working age—i.e., those for whom labor market participation is most relevant—we restricted the sample to individuals below age 65. After deleting observations with missing values, these criteria lead to a final sample size of 8,068 individuals. Of these individuals, 3,656 (45%) are women and 4,412 (55%) are men.

Dependent Variables

The five dependent variables used in this analysis are hours of care (Table 1), frequency of mild, moderate and vigorous physical activity (Figure 1) and hours spent in paid employment (Table 1).

Hours of care is only asked if the respondent provided at least 100 hours of care in assisting parents with Activities of Daily Living (ADL) or Instrumental Activities of Daily Living (IADL). ADL include self-care activities such as eating, bathing, dressing, transfers (getting in and out of bed, wheelchair, onto or off the toilet) and walking. This question is asked as follows: *"Did you spend a total of 100 or more hours [since last interview, in the last two years] helping your (deceased) [parents/in-laws] with basic personal activities like dressing, eating, and bathing?* Unlike ADL, IADL are not necessary for fundamental functioning, but they let an individual live independently in a community. Similar to the question on ADL, for IADL, the HRS asks: "*Did you (or your husband/wife/partner) spend a total of 100 or more hours [since last interview] helping your (deceased) [parents/in-laws] with other things such as household chores, errands, transportation, etc*.?" If the answer either of these questions is "yes" then the respondent is asked: "*Roughly how many hours did you spend [since last interview, in the last two years] giving such assistance to your parents/in-laws?"* This question is repeated, separately, for the spouse.

We used a combined measure of caregiving (personal care and chores) as the dependent variable in the first equation. That is, the effective time (over two years) spent caring for parents is defined as the sum of time spent helping parents with basic personal needs and time spent helping parents with household chores. Both kinds of help (ADL and IADL) are included in this measure as spending time in either can lead to a conflict with time spent doing other things – like working or exercising.

A sizeable proportion of the respondents who said "yes" to providing more than 100 hours of ADL answered "don't know" to the subsequent question on the actual number of care hours. This may reflect the difficulty of recalling the intensity of care efforts as much as two years in the past. These respondents were then asked a follow-up question that asked them to choose from among three possible ranges of care hours: 0-199 hours; 200-499 hours; and 500-5000 hours.

Table 1 presents summary statistics for "hours of care" for women and men. Interval-coded values appear as "lower" and "upper" bounds, respectively, in this table. For those that specified a value for their care hours, the same value appears as a lower and upper bound. The unconditional (i.e., including zeros) mean for the lower bound of care hours for women is around 191 hours over a two year time period, while the same for the upper bound is 660 hours. Not surprisingly, these numbers are much higher for women than men, suggesting that women provide more hours of care, in general. Also, as expected, for caregivers[2] (42% among women and 35% among men), the mean values for both the lower and upper bounds are considerably higher than those for the entire sample of women and men (unconditional means). The prevalence of caregiving (especially among men) seems relatively high because care provision includes assistance with IADL activities.

[2] Those with positive ADL or IADL care hours

With regard to the second, third and fourth dependent variables, frequency of various types of physical activity, the HRS asks respondents how often they engage in three kinds of physical activity – mild, moderate and vigorous. For vigorous physical activity, the HRS asks, *"How often do you take part in sports or activities that are vigorous such as running or jogging, swimming, cycling, aerobic or gym workout?"* Similarly, for moderate physical activity, the HRS asks respondents, *"How often do you take part in sports or activities that are moderately energetic such as, brisk walking, gardening, cleaning the car, dancing, floor or stretching exercises?* Finally, for mild exercise, the respondents are asked: "*How often do you take part in sports or activities that are mildly energetic, such as vacuuming, laundry, home repairs*?" The response for all three questions is captured in one of the following four categories: "hardly ever or never," "one to three times a month," "once a week," or "more than once a week/everyday."

As demonstrated in Figures 1a and 1b, approximately 42% of men and 56% of women report "never" doing any *vigorous* physical activity. In contrast, only 12% of men and 16% of women report "never" doing any *moderate* physical activity. Because a large percentage of both men and women do not engage in *vigorous* physical activity, it is possible that the results from estimating this equation are imprecise.

Over 70% of women report doing *mild* physical activity "multiple times a week," while 60% of men report doing *mild* physical activity "multiple times a week." Also, more men are like to "never" do any *mild* physical activity as compared to women. This is reasonable as the HRS questionnaire describes *mild* exercise largely in terms of energetic activities done around the "home" – which are more likely to be performed by women. In general, the descriptive statistics show that men are likely to engage in all types of physical activity (except for mild) more frequently than women.

The hours of work variable is taken from the RAND HRS (2011) data files. It is the sum of the typical number of hours per week the respondent works at the main job and at a secondary job, (if any). If the respondent is working for pay, then he/she is asked, "*How many hours per week do you work at your main job?*" If the respondent is not working, the hours of work are coded to zero. The question on hours of work at a secondary job, if any, is worded similarly.

Table 1 shows substantial differences between the unconditional and conditional means for employment hours. This is because 40% of women and 30% men do not work. When everyone is included, the mean hours spent in paid employment are 23 hours per week for women and 32 hours per week for men; and when considering only those who are employed, the mean hours spent in paid employment are around 38 hours per week for women and 45 hours per week for men. The large number of respondents with zero time use in this category suggests that the estimation strategy should explicitly take account of left censoring of the time responses at zero. For this reason, a tobit specification is used to estimate the hours of work equation.

Independent Variables

The explanatory variables (Table 1) include characteristics of parental health and need, P_i, the respondent's individual and household characteristics, D_i, characteristics of respondent's health, H_i, and health characteristics of the respondent's spouse, S_i.

The vector P_i represents the key explanatory variables - variables that measure parental health status[3]. As parental health declines, hours of care are hypothesized to increase and frequency of physical activity is expected to decrease. It is also expected that as parental health declines, hours of work should also decrease. These variables include a dummy for whether the parent can be left alone for an hour (coded as 1 if the parent cannot be left alone for an hour), if

[3] Separate indicators for mother, father, mother in-law and father in-law are included in the regression analyses

the parent has ADL needs,[4] a dummy representing the recent (in the time between the last and the current interview) death of a parent, and a dummy representing parents' marital status. If parents are married (whether to each other or otherwise), then the adult child is less likely to provide care due to the availability of an alternate caregiver – the spouse.

As depicted in Table 1, almost 60% of the women have a living mother, while only 24% have a living father. Though the numbers are smaller for men, the trend is similar. Not only are more mothers alive than fathers, mothers are also more likely to require care – while 7% of the women report that their mothers "cannot be left alone for an hour", only 2% of the women report that their fathers "cannot be left alone for an hour." It is assumed that the variable "whether mother/father cannot be left alone for an hour" represents the most severe indicator for parental need. Note also that the parental need variables pertain only to parents alive at the time of the interview.

The vector D_i includes variables such as the respondent's age, education, race, marital status, number of siblings, number of grandchildren and the natural log of hourly wage. The mean age for women and men is 58 and 59 years, respectively. Approximately, 78% of women and 84% of men are white. Further, a large majority of both men and women are married or living together.

As discussed above, for a large percentage of individuals in the sample—those not presently working--the hourly wage rate is missing. Because this is suggestive of selection bias, to confront this issue, we predict wages for the entire sample (men and women together) using a two-step, Heckman estimation procedure.[5] While theoretically one can estimate this type of

[4] To reduce Multicollinearity, this measure excludes those who said "yes" to whether parents can be left alone for an hour. Almost all respondents who said "yes" to whether parents can be left alone for an hour also reported parents having ADL needs.

[5] Two-step Heckman estimation results are available on request.

sample-selection model identifying off of the functional form only, most researchers feel more comfortable basing identification on exclusions, that is variables that are thought to affect the dichotomous choice of being employed or not, but are not expected to affect the wage. In this case, we include a number of potential identifiers in the dichotomous-choice selection equation. Variables included in the reduced form employment equation that are not included in the wage equation include measures of parental need, spousal need, respondent health and marital status. Age, education, experience, a second order term for experience and gender are included in the wage equation (logged wages are used as the dependent variable here).[6]

The first stage estimation shows that several of the identifying variables, including spousal need and some measures of parental health are significant predictors of employment. In addition, the F-test of the wage equation estimation is also significant at 0.01 level, indicating that all the included variables contribute to the prediction of wage levels. After the second stage, selectivity corrected, predicted log wage is imputed for all respondents. As expected, the mean predicted log wage is higher for men than women.

Note, for the predicted natural log wage, the estimation involves a sample-selected wage regression that includes two variables not also appearing in the time-use equations: experience and experience-squared. Both these identifiers for the wage equation are significant in the wage equation estimation.

The vector $H_{i,}$ includes plausibly exogenous variables that determine a respondent's health status. Health status is likely to have an effect on how the respondent decides to allocate his/her time. $H_{i,}$ consists of two indicator variables: ever smoked (smoked 100 cigarettes or more in lifetime), a lagged measure (from the previous wave of the HRS) of the respondent's Body Mass Index (BMI). Other health status variables in the HRS, for example subjective physical and

[6] We include gender because the Heckman two-step procedure is done for the entire sample.

mental health status, are not included because they may be simultaneously determined along with the dependent variables and thus are likely to be endogenous.

Finally, spousal health characteristics, S_i include indicator variables for whether the respondent's spouse has cancer, diabetes or a heart condition. The spousal health characteristics capture the intra-household demands on the individual's time.

Results

Tables 2 and 3 present estimates of our models of time-allocation decisions of women and men, respectively. The five equations (care hours, frequency of mild, moderate and vigorous exercise, and work hours) were estimated jointly through a mixed-process model that included an interval regression for care hours,[7] three ordered Probits for the frequency of mild, moderate and vigorous physical activity and a Tobit for work hours.[8] To account for clustering in the pooled data, a person-level random effect was added to each equation. Further, besides the explanatory variables discussed above, we also controlled for year of interview (wave) using dummy variables.

Parental Need

As expected, care hours respond positively to almost all parental need characteristics. Having a mother or father who cannot be left alone for one hour, or requires help in completing ADL tasks, or has recently died, all lead to significant increases in care hours. The results also suggest that women's increases in time allocated to caregiving in response to parental needs are larger than men's. In addition, as demonstrated in the literature previously (Lee, 1993), there is evidence of same-gender preferences – women are likely to increase care hours more in response to their mother's physical needs than to their father's. Similarly, men are likely to increase their

[7] Observations reporting zero caregiver hours are coded as falling into the $-\infty$, 0 interval, creating an "interval Tobit" estimating equation.
[8] The estimation was done as a system of equations using the statistical software package aML.

care hours more strongly in respect to father's physical needs as opposed to mother's.

Overall, there is limited support for the existence of a time conflict between hours of care and frequency of physical exercise. That is, the reduced-form results demonstrate that even though most parental need characteristics positively predict *hours of care*; they do not predict across-the-board decreases in the *frequency of physical* activity. Among women, who provide the large majority of informal care, only mother's marital status has a significant impact on the frequency of physical activity. Specifically, having a mother who is married significantly increases the frequency of engaging in moderate physical activity. Mother's marital status negatively predicts care hours, though the estimate is not statistically significant.

Among men, having a mother who cannot be left alone for an hour predicts an increase in the number of care hours and a statistically significant decrease in the frequency of engaging in mild physical activity.[9] Even though the nature of mild exercise as described in the HRS questionnaire makes it more likely to be a female dominated activity, the above result is consistent with the idea that it is more feasible to decrease time spent in dispensable activities around the home – like yard work, auto maintenance and home repairs (many of which are traditionally "male tasks") than decreasing time spent in indispensable activities like laundry and grocery shopping (most of which are traditionally "female tasks").

Interestingly, among both women and men, the estimated correlations of unobservables between time spent in caregiving and, mild and moderate physical activity are positive (see bottom of Table 2 and 3) - though not statistically significant for women[10]. This suggests that after controlling for parental need and other variables, unobservable factors influence time

[9]The fact that males are responding to mothers' care needs more strongly than to fathers' in terms of decreases in the frequency of physical activity, may appear counterintuitive to the same-gender preferences idea. However, this probably because fewer fathers have severe care needs as compared to mothers.

[10] This is probably because the women-only sub-sample has a smaller sample size. Among women, the correlations are significant between care hours and frequency of mild and moderate physical activity at a 10% significance level.

allocation in caregiving and physical activity in the same direction. Some of these unobservables may include family values (in reference to the positive correlation between care hours and mild physical activity – recall, mild exercise is defined as energetic activities around the home), self-efficacy, beliefs regarding quality of life and health, and so on. Further, it may also be likely that better mental health - which we don't include in the regressions as it is clearly endogenous – positively predicts both, the amount of care time and frequency of physical activity.

Focusing on another type of time conflict – that between care hours and work hours – the results demonstrate that among women, having a mother who cannot be left alone for an hour negatively influences hours of work. The corresponding result for men is also negative but statistically insignificant. As discussed previously, the literature has yet to reach a general consensus on the effect of informal care provision on labor force participation. The results from this study suggest that among women, there is some evidence of reducing work as parental needs become more severe. With regard to error correlations, among women, there is a negative and statistically significant correlation between care hours and work hours. In this case, the unobservable factors provide a clear indication of a time conflict between two the competing uses of time. Among men, this correlation is much smaller and statistically insignificant.

Wage Effects

Theory predicts that higher wages should lead to an increase in hours of work. In addition, as the opportunity cost of time increases, there should be simultaneous decline in hours of care. The results show that an increase in predicted log wage leads to a decrease in care hours for men. However, among women, there is no effect of the predicted log wage on care hours. Though insignificant, it is further surprising that the coefficient is positive. Conclusions from recent literature can help explain this seemingly puzzling result. According to Nizalova (2012), wage

elasticity estimates of informal care are subject to an omitted variable bias and thus biased upward. For example, some people may be more productive in everything they do, which is difficult to control for with a conventional set of variables available to researchers. Therefore, these people would provide more care, but also would be rewarded in the market with higher wages. In addition, the price of formal care is likely to be higher for people living in high-wage areas, and a high price of formal care might mean more hours of informal care (if formal and informal care are substitutes for each other). Thus, failure to control for price of formal care would further result in an upward biased estimate of wage effect on informal caregiver time.

Further, in a related study, Kimmel and Connelly (2007) study mother's time choices and find that an increase in wage significantly increases childcare time. According to them, this result comes from a strong income effect on the demand for high quality of childcare and that high quality childcare takes more maternal time rather than more purchased child resources. We believe that a strong income effect may also be at play here in the context of informal caregiving. We plan to control for wealth in the next version of this paper.

Other Characteristics

With regards to other demographic variables, an increase in age decreases the monthly frequency of mild physical activity and weekly work hours for women. For men, an increase in age only decreases weekly work hours. It does not significantly influence care hours for either. Being white (as opposed to being African American) decreases care hours among both men and women, but the result is significant only for men. Among women, being white increases the frequency of all types of physical activity. Among men, being white increases the frequency of mild exercise and the amount of work hours. Each additional sister reduces care hours for both men and women. This variable is most likely picking up the presence of substitute caregivers.

One key set of variables that are of interest include plausibly exogenous indicators that reflect the respondent's health characteristics. Interestingly, indicators of health risk factors (smoking history and lagged BMI) do not significantly predict care hours for either men or women. However, as expected, these health risks (especially each additional unit of lagged BMI) are associated with decreases in the frequency of physical activity as well as hours of work. Spousal health variables reflect additional, intra-household demands on the respondent. Among both men and women, poor spousal health leads to decreases in time spent in parental care – although none of these effects are statistically significant. For men, having a spouse with diabetes or cancer leads to statistically significant decreases in the frequency of vigorous physical activity. Among women, having a spouse with cancer similarly decreases the frequency of moderate physical activity. Work hours are only decreased for men who have a spouse with cancer.

Conclusions

Caregiving for family members has often been described as a 36-hour day. This notion has motivated researchers to ask the following question: If family members are allocating their time to provide care, what other productive uses of their time are they giving up?

In this paper, we examined whether, from a time allocation perspective, a conflict exists between care hours and frequency of leisure-time physical activity. If such a tradeoff is present and if it induces a decrease in physical activity to levels below the minimum guidelines set forth by the CDC, we argued that strategies to promote physical activity be incorporated within the larger framework of the NFCSP.

In our joint model of time-use, parental factors associated with increased allocation of time to parents do not appear to strongly induce corresponding reductions in the frequency of physical

activity – at least among women, who shoulder the bulk of caregiving responsibilities. Further, we were surprised to find that unobserved factors influencing time transfers to parents and frequency of physical activity – factors collectively represented by the regression error terms – were positively correlated. This positive correlation indicates that net of measured covariates, individuals who have a taste for providing care also have a taste for engaging in physical activity. Put another way, these two types of time-allocation decisions appear to be complements rather than substitutes. It may be the case that busy, active individuals are those most likely to take on caregiver tasks, but that they simply add those tasks to an already-busy schedule, contributing to the "36-hour day" image.

In the previous section, we provided a few examples of unobservable factors that might explain this positive correlation. In addition to those factors, it is possible that the variation in the time units used when measuring each type of activity--biannual (care), week (exercise), and month (work)--could have led to this result. Because care hours are measured over such a long interval, it can potentially bias estimates downwards. That is, over a long time-period, such as two years, individuals are likely to make adjustments to accommodate potential time-allocation conflicts. Alternatively, it is probable that if one had daily measures on time spent in various activities (such as time diary data), the results would demonstrate large negative tradeoffs. However, such results might overstate the effects if these time conflicts smooth-out over a two-year period. Therefore, the time-period over which to examine these conflicts remains a subjective question, one that has key implications for any policy intervention in this area.

That said, the empirical results of this paper are suggestive of a tradeoff between caregiving and work hours. At least among women, as parental needs become more severe, time spent in the labor market decreases and time spent in caregiving increases. Even after controlling

for parental need, predicted log wage and other variables, the error correlations show a statistically significant, negative correlation between time spent in providing care to parents and work hours. Consistent with some studies from the mixed previous literature on this topic, the negative correlation here indicates that time in the care category competes with time in the labor market among women.

To conclude, we found that increases in caregiving hours primarily appear to be in response to the severity of parental health needs. There was only limited evidence that these parental need factors were also associated with a decreasing frequency of physical activity. However, these need factors were found to be strongly associated with a decrease in work hours. An extension of this work would be to further disaggregate leisure hours (into sleep time, recreation, family time) to more comprehensively answer the question: where do care hours come from?

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Figure 1a: Summary Statistics: Dependent Variable – Frequency of Physical Activity for <u>Women</u>: Mild, Moderate and Vigorous

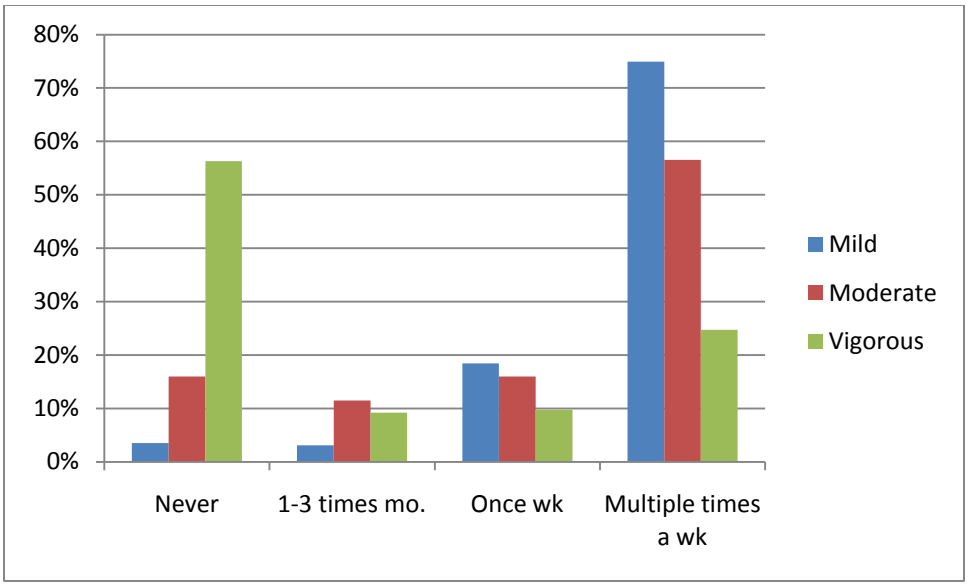

Figure 1b: Summary Statistics: Dependent Variable – Frequency of Physical Activity for <u>Men</u>: Mild, Moderate and Vigorous

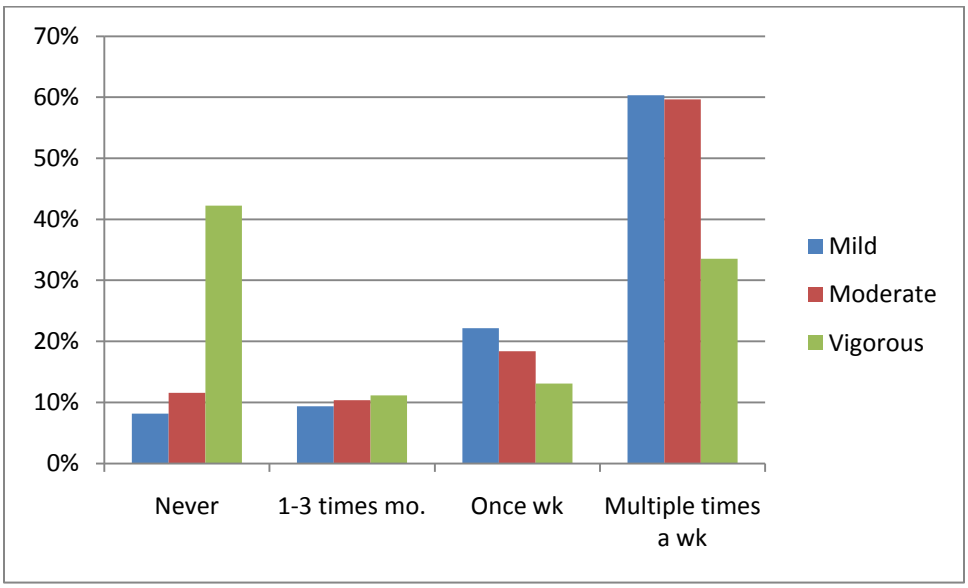

Table 1: Descriptive Statistics				
	Females		Males	
Sample Size	3,656		4,412	
A. Dependent Variables	Mean	S.D	Mean	S.D
Upper Bound Care Hours, unconditional	660.10	1994.33	356.98	1383.13
Lower Bound Care Hours, unconditional	190.80	624.56	104.70	360.57
Upper Bound Care Hours, conditional	1576.90	2839.16	989.94	2163.39
Lower Bound Care Hours, conditional	456.10	900.84	290.35	553.85
Prevalence of caregiving	0.42		0.35	
Work Hours, unconditional (weekly)	23.23	21.69	31.84	23.70
Work Hours, conditional (weekly)	38.09	14.33	44.72	14.60
B. Explanatory Variables				
If mother alive	0.59	0.49	0.49	0.50
If mother cannot be left alone for an hour	0.07	0.26	0.05	0.21
If mother needs ADL care	0.09	0.28	0.07	0.26
If mother died in last two years	0.09	0.29	0.07	0.26
If mom married	0.15	0.36	0.14	0.34
If father alive	0.24	0.43	0.21	0.41
If father cannot be left alone for an hour	0.02	0.14	0.02	0.13
If father needs ADL care	0.03	0.17	0.03	0.17
If father died in last two years	0.05	0.22	0.04	0.20
If father married	0.15	0.36	0.14	0.35
Age/100	0.58	0.03	0.59	0.03
Race: If white	0.78	0.41	0.84	0.36
Race: If black	0.17	0.38	0.11	0.32
Race: If other	0.05	0.21	0.04	0.20
If Married/ together	0.72	0.45	0.88	0.33
Predicted Log Wage	2.83	0.33	3.13	0.31
Number of grand children	3.80	4.33	3.15	3.84
Education: HS dropout	0.11	0.31	0.12	0.33
Education HS Grad	0.34	0.47	0.27	0.44
Education: Some College	0.29	0.45	0.27	0.45
Education: College Plus	0.26	0.44	0.33	0.47
Number of Sisters	1.72	1.59	1.51	1.45
Number of Brothers	1.54	1.44	1.51	1.51
If Not Working	0.39	0.49	0.29	0.45
Years Worked	28.44	12.54	36.68	9.40
If ever smoked	0.48	0.50	0.64	0.48
Lagged BMI	28.53	6.45	28.54	4.85
If spouse has diabetes	0.14	0.34	0.10	0.30
If spouse has cancer	0.04	0.21	0.07	0.26
If spouse has a heart condition	0.11	0.32	0.08	0.27

Table 2: Determinants of Time Allocation: Women										
	CARE		**MILD**		**MOD**		**VIG**		**WORK**	
Constant	312.36								-112.42	***
	(543.74)								(19.98)	
Mom cannot be left alone	297.57	***	-0.05		0.11		0.21		-3.99	*
	(54.58)		(0.13)		(0.11)		(0.12)		(1.85)	
Mom has ADL needs	412.39	***	0.15		0.12		0.08		-1.33	
	(53.77)		(0.13)		(0.11)		(0.12)		(2.02)	
Dad cannot be left alone	212.47	*	0.18		0.23		0.01		0.07	
	(104.88)		(0.24)		(0.19)		(0.23)		(2.96)	
Dad has ADL needs	208.68	**	0.13		0.09		-0.25		0.31	
	(80.57)		(0.21)		(0.16)		(0.21)		(2.76)	
Mom died recently	367.10	***	0.07		0.05		-0.02		1.17	
	(72.40)		(0.14)		(0.11)		(0.12)		(2.24)	
Dad died recently	71.78		0.10		0.10		0.01		1.25	
	(81.05)		(0.15)		(0.13)		(0.14)		(2.30)	
Mom married	-80.90		0.26		0.29	*	0.15		-0.53	
	(84.50)		(0.15)		(0.13)		(0.14)		(2.60)	
Dad married	-90.10		-0.11		0.16		-0.11		-2.11	
	(104.93)		(0.18)		(0.16)		(0.18)		(3.19)	
Predicted log wage	80.77		0.68	*	0.34		0.43		114.31	***
	(142.57)		(0.26)		(0.24)		(0.29)		(7.61)	
R's age	-701.87		-2.76	*	-0.90		-2.36		-295.40	***
	(701.49)		(1.27)		(1.08)		(1.22)		(24.63)	
White	-78.94		0.50	***	0.28	**	0.27	*	1.21	
	(55.62)		(0.11)		(0.10)		(0.12)		(2.17)	
Other	45.11		0.38		0.32		0.41		10.57	*
	(100.55)		(0.21)		(0.18)		(0.23)		(4.83)	
Ever smoked	-34.74		-0.04		-0.15	*	-0.14		-3.19	*
	(45.31)		(0.08)		(0.07)		(0.08)		(1.59)	
Lagged BMI	-1.82		-0.03	***	-0.05	***	-0.04	***	-0.30	*
	(3.58)		(0.01)		(0.01)		(0.01)		(0.12)	
Number of Sisters	-40.98	**	-0.03		0.01		0.02		0.23	
	(15.65)		(0.03)		(0.02)		(0.03)		(0.53)	
Spouse has diabetes	-31.88		0.14		-0.03		-0.02		0.51	
	(65.98)		(0.11)		(0.09)		(0.10)		(1.65)	
Spouse has cancer	-52.22		0.22		0.42	**	0.21		-3.51	
	(115.73)		(0.17)		(0.15)		(0.15)		(3.21)	
Rho: Care-			0.13		0.10		0.05		-0.18	**
			(0.07)		(0.06)		(0.06)		(0.05)	
Rho: Mild-					0.79	***	0.51	***	0.16	***
					(0.04)		(0.05)		(0.05)	
Rho: Mod-							0.87	***	0.06	
							(0.03)		(0.04)	
Rho: Vig-									0.04	
									(0.04)	

Significance: '*' = 5%; '**'=1%; '***'=0.1%

Table 3: Determinants of Time Allocation: Men										
	CARE		**MILD**		**MOD**		**VIG**		**WORK**	
Constant	-56.73								-7.31	
	(367.33)								(25.93)	
Mom cannot be left alone	131.01	***	-0.29	*	-0.11		-0.21		-2.55	
	(33.21)		(0.11)		(0.11)		(0.13)		(2.16)	
Mom has ADL needs	83.95	**	0.00		-0.04		-0.06		1.34	
	(28.15)		(0.10)		(0.10)		(0.11)		(1.75)	
Dad cannot be left alone	234.92	***	-0.02		0.28		-0.03		3.16	
	(57.39)		(0.18)		(0.22)		(0.23)		(3.29)	
Dad has ADL needs	190.29	***	0.05		-0.18		-0.24		-1.84	
	(39.04)		(0.15)		(0.17)		(0.17)		(2.89)	
Mom died recently	259.55	***	0.01		-0.03		0.07		3.15	
	(29.66)		(0.10)		(0.10)		(0.11)		(1.75)	
Dad died recently	105.06	**	0.02		0.02		-0.09		-2.38	
	(33.85)		(0.12)		(0.12)		(0.13)		(1.95)	
Mom married	-111.44	*	0.08		0.17		-0.06		-2.41	
	(53.67)		(0.12)		(0.12)		(0.15)		(2.63)	
Dad married	137.02	*	0.11		-0.15		0.16		-1.83	
	(64.83)		(0.15)		(0.16)		(0.19)		(3.35)	
Predicted log wage	-126.14		1.16	***	0.93	**	0.87		62.58	***
	(99.66)		(0.31)		(0.33)		(0.47)		(8.87)	
R's age	376.25		-0.66		-0.09		-1.91		-259.58	***
	(343.54)		(0.96)		(1.00)		(1.10)		(20.68)	
White	-108.89	***	0.26	**	0.12		0.00		9.42	***
	(29.87)		(0.09)		(0.10)		(0.12)		(2.21)	
Other	-58.22		0.24		0.12		0.03		14.61	***
	(60.21)		(0.16)		(0.19)		(0.21)		(3.97)	
Ever smoked	0.72		-0.02		-0.13		-0.22	**	-6.54	***
	(23.70)		(0.06)		(0.07)		(0.08)		(1.55)	
Lagged BMI	4.07		-0.01	*	-0.03	***	-0.05	***	-0.11	
	(2.13)		(0.01)		(0.01)		(0.01)		(0.13)	
Number of Sisters	-17.95	*	-0.01		0.02		0.04		-0.30	
	(8.08)		(0.02)		(0.02)		(0.02)		(0.48)	
Spouse has diabetes	-38.99		-0.04		-0.17		-0.22	*	-1.00	
	(45.06)		(0.09)		(0.09)		(0.11)		(1.99)	
Spouse has cancer	-18.30		-0.06		0.09		-0.23	*	-4.50	*
	(52.89)		(0.10)		(0.11)		(0.12)		(1.88)	
Rho: Care-			0.15	**	0.18	***	0.09		-0.08	
			(0.06)		(0.05)		(0.05)		(0.05)	
Rho: Mild-					0.94	***	0.55	***	0.10	**
					(0.03)		(0.04)		(0.04)	
Rho: Mod-							0.77	***	0.19	***
							(0.03)		(0.03)	
Rho: Vig-									0.17	***
									(0.03)	

Significance: '*' = 5%; '**'=1%; '***'=0.1%