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**Gender and Caregiving Network Differences in Adult Child Caregiving Patterns:
Associations with Care-recipients' Physical and Mental Health**

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Abstract

Purpose of the study: To examine gender and caregiving network differences in the care provided to older adults by adult children and the association with care-recipients' physical and mental health at baseline and longitudinally. To test the hypothesis that poorer health at baseline and better health over time will be observed in care-recipients with multiple caregivers compared to care-recipients with one caregiver.

Design and Method: A secondary analysis of the most recent national cross sectional survey – National Health and Aging Trends Study (NHATS) conducted from 2011 to 2013 with 5616 older adults (65 years of age or older). The relationships between gender and caregiving network of adult child caregivers and the duration of care, type of care provided, care-recipients' physical and mental health (self-reported health status, total number of chronic diseases, depression and anxiety) were analyzed by bivariate procedures and non-parametric tests. The longitudinal effects of gender and caregiving network of adult child caregivers on the physical and mental health of care-recipients were analyzed through multivariate procedures.

Result: Daughters are more likely to serve as caregivers than sons. Primary caregivers who cooperate with other caregivers providing care to the care-recipients spend more hours of care compared to sole caregivers who are the only caregiver for the care-recipients. Care-recipients with multiple caregivers have poorer health compared to those with one caregiver at baseline and longitudinally.

Implication: Older adults who have poorer health require more hours of care that provided by multiple caregivers. More research is needed to understand the optimal caregiving network to improve or maintain older care recipients' health.

Key words: adult child caregiver, gender difference, caregiver network, primary caregiver, physical health, psychological health

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Gender and caregiving network differences in adult child caregiving patterns:

Associations with care-recipients' physical and mental health

Family caregivers serve an important role in providing care for older adults with chronic conditions and disability. It has been estimated that the total economic value of family caregiving is \$450 billion a year, approaching 90% of Medicare in 2011 (Feinberg, et al, 2011). Considering that the increase of caregivers is projected to be smaller than the increase of care-recipients in the US from 2000 to 2030 (Mack & Thompson, 2001), making sure that older adults receive adequate care will become more important in the future. Currently, about 80% of family caregivers are spouses or adult children, and the percentage of adult children acting as the family caregiver has increased steadily (Wolff & Kasper, 2006). Many of these adult children, identified as the 'sandwich generation', have to simultaneously raise children and care for their frail elderly parents. This makes the care for older adults more complex (Grundy & Henretta, 2006). As more adult children become caregivers, understanding their caregiving patterns, such as the duration and type of care provided, and the consequences of these patterns, such as the physical and psychological health of their care recipients is important.

Many studies have shown that among adult children, caregiving patterns differ between sons and daughters (Brody, et al, 1994). Daughters are more likely to be the primary caregivers (Finley, 1989; Aronson, 1992; Finch & Groves, 1983). Daughters provide more assistance with activities of daily life (ADL) and instrumental activities of daily life (IADL) compared to sons (Sankar, 1993; Stone et al. 1987; Johnson & Wiener, 2006), and daughters provide more caregiving hours per week compared to sons (Chang, 1991).

Research attention has been given to gender differences in how caregiving relates to caregiver's mental and physical health, such as burden and satisfaction (Scharlach, 1987; Schulz & Williamson, 1991; Skaff & Pearlin, 1992; Rafael, et al., 2012). This research shows that women experience more depression as caregivers compared to men. Much less research has been conducted on how the gender of the caregivers is related to the health outcome of care-recipients (Barer & Johnson, 1990; Lyman, 1989). It is been perceived that men as less aware of and less responsive to the needs for care than women (Dressel & Clark, 1990; Thompson, 1991). Whether the care provided by different gender meet the needs of the older adults may exert long-term effect on mental and physical health of care-recipients. In order to fill this gap, we analyzed the relationship between gender of the adult caregiver and the physical and mental health outcome of the care-recipients through a longitudinal analysis on the data from National Health and Aging Trends Study (NHATS).

Caregiving network differences might also have effects on care-recipients' health. Many reports showed that substitute caregivers, who are not primary caregivers, also cooperate with sons and daughters to care for the care-recipients (Chang, 1991;Rafael, et al., 2012). The participation of substitute caregivers increases the total duration of care provided to the recipients compared to having no substitute caregivers (Wolff & Kasper, 2006) However, not much research has examined how having multiple family caregivers affects the mental and physical health outcome of the care-recipients. On the one hand, care-recipients who have multiple caregivers may have poorer health compare to those who have only one caregiver and poorer health leads to worse health condition over the time. On the other hand, care-recipients who have multiple caregivers might receive adequate care and support from different caregivers, making them recover better over the time.

In this study we were interested in how gender and having multiple caregivers interact to relate to caregiving patterns and care recipient health. Past research has shown that sons are more likely to have substitute caregivers than daughters; and daughters are more likely to be sole caregivers (Ying et al, 2013). The reason might be that caregiving is often seen as a female activity due to its emphasis on nurturance, personal care tasks and household activities (Miller et al, 1992). Because men are less likely to perform personal tasks, they may need help to fill in these gaps of care. Thus, they may be more likely to be a part of a caregiving network.

In the present study, we were also interested in comparing the following types of caregivers on the baseline health condition of care-recipients and changes in their health over time: A son is the primary caregiver, but there are multiple caregivers (SP); A son is the sole caregiver (SS); A daughter is the primary caregiver, but there are multiple caregivers (DP); A daughter is the sole caregiver (DS)

Summary of hypotheses

Hypothesis 1: Based on our past research (Chang, et al. 1991, Ying, et al. 2013), we hypothesized that daughters are more likely to engage as primary and sole caregivers than sons for their aging parents. Sons who have taken the primary caregiver role are more likely to cooperate with substitute caregivers compared to daughters.

Hypothesis 2: Next, we hypothesized that type of care and duration of care will be different among the four groups: SP, SS, DP & DS. Daughters will provide more items of care in ADL (activities of daily life) and IADL (instrumental activities of daily life) and more hours of care compared to sons. SPs and DPs may provide less number of caregiving activities in ADL or

IADL compared to SSs and DSs, since substitute caregivers that cooperate with DPs and SPs could alleviate the burden of caring the care-recipients.

Hypothesis 3: There will be significant baseline differences on care-recipients' physical and mental health condition between different caregiving pattern groups (SP, SS, DP, DS). Care-recipients who have poorer health tend to need more care in terms of duration and need more assistance with basic activities of daily living. Because daughters provided more types of care compared to sons (Johnson & Wiener, 2006) and multiple caregivers provide more hours of care compared to the single caregivers, we hypothesized that care-recipients will have poorer mental and physical health condition when there are more caregivers involved and when women are the primary and sole caregivers.

Hypothesis 4: There will be significant change in care-recipients health from round 1 to round 3 that is associated with caregiving pattern (SP, SS, DP, DS). We hypothesize that those with declining health will be more likely to have multiple adult child caregivers and primarily served by sons.

Method

Study participants and procedures

The present study sample is drawn from a nationally representative study of community-dwelling Medicare beneficiaries who participated in the 2011 National Health and Aging Trends Study (NHATS). The NHATS is a population-based survey of late-life health trends and trajectories. In-person interview are conducted with each study participant or with his or her proxy if the participant is unable to respond each year. The NHATS used a stratified three-stage sample design. First stage is to select primary sampling units, which are individual counties or

groups of counties; second stage is selection of 655 secondary sampling units, which are ZIP codes or ZIP code fragments within sampled PSUs; and the third stage is the selection of beneficiaries within sampled SSUs who were age 65 and older as of September 30, 2010, with oversamples by age and for Black non-Hispanic persons were conducted. The sample for this study includes all participants living in traditional community residents and their corresponding caregivers (also called 'helpers' in NHATS) in round 1 and round 3. Participants living in nursing homes or residential care facilities were excluded due to the availability of supportive assistance (Wolff & Spillman, 2014).

Because this study is examining adult child primary caregivers and care-recipient parents, the present study is limited to the subgroup from community settings where study participants' sons or daughters providing most hours of care in round 1. If the sample person had only one caregiver, then this caregiver was called a sole caregiver. We use 'SS' and 'DS' for sons and daughters who were sole caregivers respectively. If the care-recipients had multiple caregivers, we identified those who spent the most hours on helping care-recipients per month. In this case, we use 'SP' and 'DP' for sons and daughters who are primary caregivers respectively. Furthermore, the study is limited to care-recipients data without loss of follow up for care-recipients in round 3. This study is also limited to data without missing information for both caregivers and care-recipients for the purpose of analysis.

Measures

Care-recipient characteristics. Demographic information of the care-recipient was reported. Demographics include age category, gender, race/ethnicity, education, employment, marital status, income and living arrangement. The age of sample person is categorized into 6

levels: 65-69, 70-74, 75-79, 80-84, 85-89, and 90+. Care recipients reported whether or not they have caregiver, and documented how many caregivers they have, if any.

Caregiver characteristics. Care-recipients reported the relationship between the primary caregiver and themselves. Basic information about gender, age, race, and education level of these caregivers were reported by the care-recipient.

Duration of care. The duration of care was assessed with amount of care provided, which was measured using the total length of duration the adult child primary caregiver provide care, and the units are hours of care per day, days of care per week and per month. We report the amount of care with total hours of care the adult child provided per month. Also care-recipients were asked whether the care they received has a regular schedule or is varied.

Type of care. This was recorded as either needing help with instrumental activities of daily living (IADLs) only or activities of daily living (ADLs) (Johnson & Wiener, 2006). For IADLs, the items are helping with laundry, shopping, food preparation, driving and managing finances. For ADLs, the items are helping with eating, bathing, toileting, dressing, getting around inside or outside the home and getting outside of the bed. We also calculated numbers of IADLs and ADLs with which the caregivers assisted their care-recipients. Further, they were asked if their caregivers helping with medicines in terms of keeping track of medicine, sitting in with them during doctor visit and helping with insurance decisions. In addition, care-recipients were asked if they talk about important things with their caregivers.

Care-recipients' self-reported health status. Care-recipients self-reported their overall health status using a scale from 1 to 5 illustrating poor, fair, good, very good, and excellent, respectively.

Number of care-recipients' chronic diseases. The care-recipients were asked if they had the following chronic disease: heart attack, heart disease, high blood pressure, arthritis, osteoporosis, diabetes, lung disease, stroke, dementia or Alzheimer's disease or cancer. Additionally, they were asked if they had other serious diseases or illness we not listed. This measure was the summed number of reported chronic diseases.

Care-recipients' depression and anxiety. NHATS uses the PHQ-2 (Kroenke et al. 2003) and the GAD-2 (Kroenke et al. 2007), which are brief screening instruments for depression and anxiety, respectively. The questions are administered: "Over the last month, how often have you: a) had little interest or pleasure in doing things; b) felt down, depressed, or hopeless; c) felt nervous, anxious, or on edge; d) been unable to stop or control worrying?" Response categories are: not at all, several days, more than half the days, and nearly every day. Items "a" and "b" form the PHQ-2; items "c" and "d" form the GAD-2. Scores were calculated for a combined measure (Kroenke et al. 2009 and Lowe et al. 2009), based on summing scores for the items (1 = not at all; 2= several days; 3=more than half the days; 4=nearly every day).

Potential covariates. We tested the extent to which the following potential covariates were significantly related to gender of the primary or sole caregiver and the health of the care recipients: demographics of care-recipients, such as caregivers and care-recipients' age, education, marital status, income, etc.

Results

Preliminary Analyses

First, we summarized the caregiver role distribution in acting as sole caregivers and primary caregivers and the relationship of caregivers and their care-recipients in three rounds of

data (Table 1). We also calculated the descriptive statistic for care-recipients who had daughter or son as their sole or primary caregivers in round 1 (Table 2). As for descriptive statistic, we observed that ethnicity, education, marital status, living arrangements of care-recipients are associated with the four adult caregiving groups. Next, we explored the nature of the missing data from round 1 to round 3. Specifically, we examined the descriptive statistic of care-recipients in the round 1 who were missing in round 3. Apart from care-recipients marital status and living arrangements, no other significant difference was found among different caregiving groups. We also showed the descriptive statistic for caregivers who served as the sole or primary adult child caregiver in round 1 (Table 3). Caregiver's education, total number of children, number of children under 18 and marital status are associated with the four different caregiving groups, and As shown in Table 4, we examined the caregiving status change in round 3 based on their caregiving status in round 1. Approximately 20% of the adult child caregivers maintain their caregiving role compared to round 1. And the caregiver status change is not associated with gender.

Hypothesis testing

Hypothesis 1: As hypothesized, daughters are more likely to engage as primary and sole caregivers than sons for their aging parents. Sons who have taken the primary caregiver role are more likely to cooperate with substitute caregivers compared to daughters (Table 1).

Hypothesis 2: Next, we hypothesized that type of care and duration of care will be different among the four groups: SP, SS, DP & DS. Daughters provide more items of care (ADL & IADL) and longer duration of care compared to sons. SPs and DPs may provide less number of caregiving activities in ADL or IADL compared to SSs and DSs.

Significant differences in duration of care per month were found among the four groups in round 1 (Table 5). Primary caregivers (who were one of multiple caregivers) provided more hours of care compared to sole caregiver for sons and daughters respectively in non-parametric test (SP vs. SS, DP vs. DS). Although more proportion of sons provided less care hours compared to daughters (SS vs. DS, SP vs. DP), there were not significant gender differences.

Also, significant differences in type of care were also observed in the four groups (Table 6) through non-parametric test. Primary caregivers cooperating with substitute caregivers assisted in higher amount of items in ADLs than sole caregivers given the same gender (DP vs. DS, SP vs. SS). Between primary caregivers, daughters provide higher amount of items in ADLs than sons (DP vs. SP). As for IADLs, daughters provide higher items of IADLs than sons given the same caregiver role (DP vs. SP, DS vs. SS). Among daughters, primary caregiver provides higher items of IADLs compared to sole caregivers (DP vs. DS).

Hypothesis 3: There will be significant baseline differences on care-recipients' physical and mental health condition between different caregiving pattern groups (SP, SS, DP, DS). Specifically, care-recipients will have poorer mental and physical health condition when there are more caregivers involved and when women are the primary and sole caregivers.

Through non-parametric test, different physical and mental health conditions of care-recipients were observed between multiple caregivers and sole caregivers (Table 1). However, there were no significant gender differences. With regard to self-reported health and number of chronic disease, poorer condition was observed among care-recipients who have multiple caregivers compared to those who have sole caregiver (DP vs. DS, SP vs. SS). Care recipients who had a daughter as a primary caregiver had a higher level of depression compared to those who had a daughter as a sole caregiver (DP vs. DS).

Hypothesis 4: It was hypothesized that care recipients with multiple caregivers would have a greater decline in health.

There were no significant differences among and the groups in terms of changes in care-recipients number of chronic disease (Table 7) and level of depression (Table 9) in round 3, controlling for care-recipients corresponding round 1 data as the baseline.

However, poorer self-reported health from care-recipients who have multiple caregivers were found compared to those who have daughters as sole caregivers in round 3 (DP vs. DS, SP vs. DS, Table 8), controlling for round 1 data as the baseline through multiple regression analysis.

Discussion

The result of the analyses revealed interesting differences in caregiving patterns of adult child caregivers that may have an important impact on providing care to their older parents. As hypothesized, daughters were more likely to serve as primary or sole caregivers than sons. However, in contrast to our hypothesis, primary caregivers (who had help from other caregivers) provided more hours of care compared to sole caregivers. Moreover, primary caregivers provide more ADLs than sole caregivers. Also, sons provided less IADLs compared to daughters.

As hypothesized, care-recipients with multiple caregivers reported poorer health compared to the care-recipients with one caregiver. There were no significant associations between the gender of the caregiver and the care recipients' health. As for self-reported health, care-recipients reported poorer health when they had multiple caregivers as compared to care recipients who had a sole caregiving daughter during the 2 years of follow-up.

Findings from this study are consistent with previous research showing that women play predominant role in caregiving for aging parents. Research found that in a group of Organization

for Economic Co-operation and Development (OECD) countries, care for older people is provided by the family and, more specifically, by women in the family (OECD, 2009). Although caregivers were most likely to be spouses in the overall NHATS study, there were a higher percentage of daughters involved in caregiving compared to sons, which is consistent with past findings (Stone et al. 1987). Informal care falls predominantly to women since the opportunity costs of caregiving are lower for them, men in the paid labor force earn more than women (Walker, et al. 1995).

However, we did not find that daughters provided more hours of care than sons. Instead, we found that caregivers who were one of many provided more hours of care than sole caregivers. This is presumably because their caregivers were in poorer health and required more care.

We also found that there were gender differences in the type of care provided (ADL in primary caregivers, IADL in primary and sole caregivers). This finding is consistent past research showing that most day-to-day and personal care were provided by women (Miller & Cafasso, 1992). However, caregivers who were one of many provided more of all types of care, which is probably because their care recipients were in poorer health and need more care in general.

Most caregiving research focused on gender differences in caregivers' subjective burden, and women were reported to have higher burden and higher depressive symptoms (Rafael, et al, 2012). Few studies examined whether there are differences in care-recipient health that is associated with the gender of the caregiver. In this study, we did not observe differences in the health of care-recipients at baseline between son and daughter caregiver group given the same

caregiving network pattern, suggesting that daughters and sons are both likely to provide adequate support.

As for caregiving network difference, past research showed that the likelihood to have multiple caregivers rather than one caregiver is related to who the most important caregiver is (Townsend & Poulshock, 1986). For instance, if the main caregiver is spouse, the older person is less likely to have help from other caregivers (Tennstedt, et al, 1989). In this study, we found that the care-recipients health condition might also be associated with the likelihood of having substitute caregivers. Those have multiple caregivers had poorer self-reported health, larger number of chronic disease and higher level of depression (only in daughters) at baseline compared to care-recipients who have only one caregiver. This might be associated with the fact that sicker care-recipients needed more time and items of care, which required multiple caregivers providing care. Also, if a care-recipient was sicker, relatives of that care-recipient in addition to the adult children were more likely to get involved in providing care as substitute caregivers. Moreover, this baseline health difference among care-recipients might also be associated with differences on care-recipients education, ethnicity, living arrangements and marital status among the four groups

Finally, we found that care recipients with multiple caregivers were more likely to have declining health over time. This might be due to the fact the care-recipients who have multiple caregivers had poorer health condition compared to care-recipients and people with poorer health condition are more likely to get worse. Another potential reason is that care-recipients who have multiple caregivers for two years are more likely to feel being a burden to caregivers and that they perceived themselves in a worse health condition compared to the care-recipients with

single caregiver. Having one caregiver versus multiple caregivers may lead to differences in feeling of dependency from others.

Our study had certain limitations that need to be considered. Firstly, although we studied the longitudinal analysis from round 1 to round 3, we are not able to establish causal relationships. Secondly, our baseline target sample is a subgroup of a national study that might be vulnerable to generalization and representativeness problems. Thirdly, the longitudinal analysis is limited to caregivers and care-recipients who continuously follow up for three rounds of data. In this way, selection bias was introduced in the study. Fourthly, both the baseline and longitudinal analysis on various characteristics and outcomes are vulnerable to missing data. However, this study provided baseline analysis of health condition of care-recipients and their association with the caregiving pattern, suggesting that the health condition of the care-recipients might be an important indicator of having secondary caregivers. Also, this study found that only a small proportion of adult child caregiver maintained the same caregiving pattern (being a sole caregiver versus a primary caregiver with help from others) during the two years. Furthermore, the study analyzed the longitudinal effect of caregiving pattern that might be associated with the care-recipients health.

Our study supports the notion that the gender of adult children and whether they are providing care by themselves or in collaboration with others is related to the health of their care recipient. Sons are more likely to have substitute caregivers to help meet the needs of their parents. Care-recipients who have multiple caregivers tend to be sicker compared to care-recipients who have single caregiver. Further research should focus more on the indicators of likelihood of having substitute caregivers such as health condition of care-recipients. Also, it worth studying the factors that contributes to the changing pattern of adult child caregiving

pattern. Moreover, the longitudinal effect of caregiver gender and caregiver network on health condition of care-recipients needs to be further studied. The poorer self-reported health of care-recipients with multiple caregivers compared to care-recipients with single daughter caregiver in longitudinal analysis suggest that multiple caregivers should focus more on providing high quality care that specifically meets the needs of the care-recipients.

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Table 1. Description of the caregiver sample according to caregiver role and relationship in Round1, Round 2 & Round 3^a

Characteristic	Caregiver's role		
	All	Sole	Primary
R1-Relationship with			
CR Total	(N = 9459) ^b	(N = 3174) ^b	(N = 2394) ^b
Husband	1028(10.9)	629(19.8)	274(11.5)
Wife	1793(19.0)	1313(41.4)	364(15.2)
Daughter	2166(22.9)	478(15.1)	602(25.2)
Son	1246(13.2)	225(7.1)	324(13.5)
Other relative	1633(17.3)	235(7.4)	412(17.2)
Non-relative	1593(16.8)	294(9.3)	418(17.5)
R2-Relationship with			
CR Total	(N=7959)	(N=2497)	(N=2077)
Husband	771(9.7)	479(19.2)	201(9.7)
Wife	1386(17.4)	970(38.9)	326(15.7)
Daughter	1789(22.5)	364(14.6)	518(24.9)
Son	1019(12.8)	178(7.1)	243(11.7)
Other relative	1437(18.1)	203(8.1)	359(17.3)
Non-relative	1557(19.6)	303(12.1)	430(20.7)
R3-Relationship with			
CR Total	(N = 6507) ^b	(N = 1876) ^b	(N = 1765) ^b
Husband	632(9.7)	377(20.1)	186(10.5)
Wife	1069(16.4)	702(37.4)	296(16.7)
Daughter	1449(22.3)	270(14.5)	415(23.5)
Son	815(12.5)	124(6.6)	204(11.6)
Other relative	1158(17.8)	170(9.1)	265(15.0)
Non-relative	1383(21.3)	233(12.4)	399(22.7)

^a Table values are mean \pm SD for continuous variables and n (column %) for categorical variables.

^b Numbers may not sum to total due to missing data, and percentages may not sum to 100% due to rounding.

Table 2. Descriptive Characteristics of care-recipients (CR) according to the caregiving pattern^a

Descriptive Characteristics	Caregiving pattern to the care-recipients				p
	DS ^b	DP ^b	SS ^b	SP ^b	
Total Number	478	602	225	324	
Age					0.64
65-69	36(7.5)	51(8.5)	22(9.8)	29(9.0)	
70-74	78(16.3)	82(13.6)	32(14.2)	33(10.2)	
75-79	72(15.1)	103(17.1)	41(18.2)	70(21.6)	
80-84	119(24.9)	142(23.6)	53(23.6)	80(24.7)	
85-89	95(19.9)	117(19.4)	43(19.1)	61(18.8)	
90+	78(16.3)	107(17.8)	34(15.1)	61(18.8)	
Sex					0.25
Male	87(18.2)	124(20.6)	45(20.0)	78(24.1)	
Female	391(81.8)	478(79.4)	180(80.0)	246(75.9)	
Ethnicity					<0.01
White (non-hispanic)	294(61.5)	335(55.7)	165(73.3)	196(60.5)	
Black (non-hispanic)	129(27.0)	192(31.9)	45(20.0)	86(26.5)	
Other (non-hispanic)	8(1.7)	14(2.3)	5(2.2)	14(4.3)	
Hispanic	44(9.2)	60(10.0)	10(4.4)	27(8.3)	
Education					<0.01
Less than high school	197(41.2)	253(42.0)	59(26.2)	133(41.1)	
High School	126(26.4)	181(30.1)	75(33.3)	80(24.7)	
Beyond high school but less than college	97(20.3)	101(16.8)	54(24.0)	70(21.6)	
College and above	56(11.7)	65(10.8)	36(16.0)	38(11.7)	
Employment					0.31
Yes	20(4.6)	26(4.6)	17(8.9)	13(4.4)	
No	186(42.4)	230(41.1)	76(39.6)	117(39.4)	
Retired	233(53.1)	304(54.3)	99(51.6)	167(56.2)	
Marital status					<0.01
Married or live with partner	64(13.4)	132(21.9)	22(9.8)	62(19.2)	
Divorced or Separated	64(13.4)	69(11.5)	44(19.6)	53(16.4)	
Widowed	337(70.7)	390(64.8)	152(67.9)	205(63.3)	
Never Married	12(2.5)	11(1.8)	6(2.7)	4(1.2)	
Living Arrangements					<0.01
Alone	230(48.1)	195(32.4)	125(55.6)	132(40.7)	
With spouse/partner only	39(8.2)	70(11.6)	11(4.9)	28(8.6)	
With spouse/partner and other	25(5.2)	60(10.0)	10(4.4)	28(8.6)	
With others only	184(38.5)	277(46.0)	79(35.1)	136(42.0)	
Total Income (from all sorts of income & assets)	13725 (62615)	13663 (21245)	12904 (23550)	18132 (55782)	0.43

Self-reported Health Average Score ^c	3.05(1.10)	3.32(1.09)	2.98(1.08)	3.31(1.06)	<0.01
Number of Chronic Disease ^d	2.89(1.57)	3.25(1.62)	2.79(1.65)	3.20(1.60)	<0.01
Depression level ^e	2.38(2.61)	2.99(2.95)	2.30(2.51)	2.90(2.97)	<0.01

^a Table values are mean ± SD for continuous variables and n (column %) for categorical variables.

^b Numbers may not sum to total due to missing data, and percentages may not sum to 100% due to rounding.

^c Non parametric test significant at 0.05 in Self-reported health: DP is higher than DS, SP is higher than SS, higher value indicates poorer self-reported health

^d Non parametric test significant at 0.05 in number of chronic disease: DP is higher than DS, SP is higher than SS, higher value indicates larger number of chronic disease

^e Non parametric test significant at 0.05 in depression level: DP is higher than DS, higher value indicates higher level of depression and anxiety

Table 3. Descriptive Characteristics of caregivers (CG) according to the caregiving pattern^a

Descriptive Characteristics	Caregiving pattern to the care-recipients				p
	DS ^b	DP ^b	SS ^b	SP ^b	
Total Number	478	602	225	324	
Age					0.29
<=29	5(1.2)	7(1.4)	2(1.0)	4(1.4)	
30-34	9(2.2)	11(2.2)	5(2.5)	8(2.8)	
35-39	18(4.4)	35(7.0)	16(8.0)	11(3.9)	
40-44	35(8.5)	53(10.6)	16(8.0)	32(11.2)	
45-49	64(15.6)	82(16.3)	43(21.5)	48(16.8)	
50-54	80(19.5)	96(19.1)	37(18.5)	73(25.5)	
55-59	91(22.2)	88(17.5)	37(18.5)	48(16.8)	
60-64	73(17.8)	74(14.7)	27(13.5)	43(15.0)	
65-69	20(4.9)	34(6.8)	14(7.0)	14(5.0)	
70+	15(3.7)	22(4.4)	3(1.5)	5(1.8)	
Education					<0.01
Less than high school	31(6.5)	64(10.6)	18(8.0)	52(16.1)	
High School	134(28.0)	195(32.4)	69(30.7)	125(38.6)	
Beyond high school but less than college	155(32.4)	160(26.6)	55(24.4)	66(20.4)	
College and above	150(31.4)	179(29.7)	78(34.7)	80(24.7)	
Living with CR					>0.05
Yes	178(37.2)	250(41.5)	82(36.4)	143(44.1)	
No	3(0.6)	9(1.5)	7(3.1)	4(1.2)	
Inapplicable	297(62.1)	343(57.0)	136(60.4)	177(54.6)	
Number of children under 18					<0.01
0	261(71.9)	325(70.8)	94(64.4)	137(62.8)	
1	60(16.5)	86(18.7)	22(15.1)	40(18.4)	
2	26(7.2)	35(7.6)	13(8.9)	28(12.8)	
3 or more	16(4.4)	13(2.8)	17(11.6)	13(6.0)	
Means	0.45(0.84)	0.43(0.81)	0.75(1.25)	0.63(0.97)	<0.001 ^c
Number of total children					<0.01
0	110(23.3)	142(23.6)	75(33.8)	101(31.7)	
1	101(21.4)	119(19.8)	39(17.6)	45(14.1)	
2	154(32.6)	168(28.0)	57(25.7)	88(27.6)	
3 or more	108(22.8)	172(28.6)	51(23.0)	85(26.7)	
Means	1.65(1.28)	1.81(1.28)	1.55(1.50)	1.76(1.69)	0.09
Marital status					0.01
Married or live with partner	244(51.5)	301(50.2)	108(48.2)	151(47.0)	
Divorced or Separated	109(23.0)	135(22.5)	52(23.2)	67(20.9)	
Widowed	30(6.3)	38(6.3)	6(2.7)	9(2.8)	
Never Married	91(19.2)	126(21.0)	58(25.9)	94(29.3)	

^a Table values are mean \pm SD for continuous variables and n (column %) for categorical variables.

^b Numbers may not sum to total due to missing data, and percentages may not sum to 100% due to rounding.

^c Multiple comparison significant at 0.05 level: SS is higher than DS & DP; SP is higher than DP

Table 4. Adult Children caregiving status change in round 3 compared in round1

Caregiver Role in Round 3	DS	DP	SS	SP	Substitute CG	Missing CR	Missing CG	Total
Caregiver Role in Round 1								
DS	100	70	--	--	46	147	115	478
DP	37	123	--	--	84	187	171	602
SS	--	--	33	24	12	74	82	225
SP	--	--	10	50	51	103	110	324
Total	137	304	43	128	28	511	478	1629

Table 5. Descriptive Characteristics of round 1 caregiver(CG) helping duration and schedule according to the caregiving pattern^a

Descriptive Characteristics	Caregiving pattern to the care-recipients				p
	DS ^b	DP ^b	SS ^b	SP ^b	
Total duration of care (per month)					<0.01
Total number of helpers by cat.	478	602	225	324	
0-30	278(58.2)	223(37.0)	143(63.6)	150(46.3)	
30-59	69(14.4)	131(21.8)	34(15.1)	65(20.1)	
60-119	53(11.1)	92(15.3)	16(7.1)	34(10.5)	
120-179	25(5.2)	45(7.5)	10(4.4)	21(6.5)	
180-744	53(11.1)	111(18.4)	22(9.8)	54(16.7)	
Average duration of care per mon ^c	77(155.7)	122(190.1)	79(182.7)	107(179.5)	<0.01
Help is scheduled or not					<0.01
Total Number	476	601	222	324	
Regular	131(27.5)	240(39.9)	58(26.1)	105(32.4)	
Varied	345(72.5)	361(60.1)	164(73.9)	219(67.6)	

^a Table values are mean \pm SD for continuous variables and n (column %) for categorical variables.

^b Numbers may not sum to total due to missing data, and percentages may not sum to 100% due to rounding.

^c Non parametric test significant at 0.05 level: DP is higher than DS, SP is higher than SS

Table 6. Descriptive Characteristics of round 1 caregiver(CG) helping duration and schedule according to the caregiving pattern^a

Descriptive Characteristics	Caregiving pattern to the care-recipients				p
	DS ^b	DP ^b	SS ^b	SP ^b	
Total number of helpers	478	602	225	324	
ADLs assisting					
Eating	28(5.9)	70(11.6)	10(4.4)	32(9.9)	<0.01
Bathing	47(9.8)	93(15.5)	9(4.0)	25(7.7)	<0.01
Toileting	21(4.4)	53(8.8)	3(1.3)	15(4.6)	<0.01
Dressing	55(11.5)	134(22.3)	12(5.3)	36(11.1)	<0.01
Getting around inside the home	44(9.2)	114(18.9)	20(8.9)	45(13.9)	<0.01
Getting outside the home	87(18.2)	169(28.1)	35(15.6)	77(23.8)	<0.01
Getting outside the bed	26(5.4)	69(11.5)	8(3.6)	30(9.3)	<0.01
Total No. of ADLs^c	0.6(1.5)	1.2(1.8)	0.4(1.1)	0.8(1.6)	<0.01
IADLs assisting					
Laundry	156(32.6)	240(39.9)	41(18.2)	78(24.1)	<0.01
Shopping	258(54.0)	388(64.5)	100(44.4)	167(51.5)	<0.01
Food preparation	200(41.8)	312(51.8)	75(33.3)	130(40.1)	<0.01
Driving	320(67.0)	422(70.1)	136(60.4)	213(65.7)	0.07
Managing Finances	189(39.5)	252(41.9)	77(34.2)	91(28.1)	<0.01
Total No. of IADLs^d	2.3(1.6)	2.7(1.5)	1.9(1.4)	2.1(1.4)	<0.01

^a Table values are mean \pm SD for continuous variables and n (column %) for categorical variables.

^b Numbers may not sum to total due to missing data, and percentages may not sum to 100% due to rounding.

^c Non parametric test significant at 0.05 level in total number of ADLs: DP is higher than DS & SP, SP is higher than SS.

^d Non parametric test significant at 0.05 level in total number of IADLs: DP is higher than DS & SP, DS is higher than SS.

Table 7. Multiple linear regression of number of CR's chronic diseases (Scale 0~10).

Characteristic	Adjusted model (N=646)	
	Beta(SE)	p
Caregiving pattern		
DS	Ref	
DP	-0.03(0.10)	0.78
SS	0.01(0.14)	0.95
SP	0.14(0.12)	0.25
Caregiving change		
No Change	Ref	
Change into secondary caregivers	0.12(0.11)	0.26
From Sole to Primary	0.04(0.15)	0.81
From Primary to Sole	-0.05(0.19)	0.77
Missing in round3	-0.03(0.10)	0.78
Caregiving time per month	<0.01(<0.01)	0.79
No. of Chronic Disease in round 1	0.68(0.02)	<0.01
CR Education		
Less than high school	Ref	
High School	-0.02(0.10)	0.80
Vocational	-0.16(0.11)	0.16
College and above	-0.34(0.14)	0.02
CR Race		
White(non-his)	Ref	
Black(non-his)	0.15(0.09)	0.09
Other(non-his)	-0.49(0.26)	0.06
Hispanic	0.43(0.14)	<0.01
CR Employment		
Retired	Ref	
Employed	-0.21(0.17)	0.22
Unemployed	-0.03(0.08)	0.69
CR Marital Status		
Married	Ref	
Divorced	-0.02(0.14)	0.89
Widowed	-0.00(0.11)	0.99
Not married	-0.08(0.30)	0.78
CG Education		
High school	Ref	
Less than high school	-0.32(0.13)	0.02
Vocation(>high school, <college)	-0.11(0.10)	0.27
College and above	-0.04(0.11)	0.70
CG No. of children under 18		
0	Ref	
1	-0.11(0.10)	0.27

2	-0.02(0.14)	0.86
3 or more	-0.07(0.16)	0.68

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Table 8. Multiple linear regression analysis of CR self-reported health (1=Excellent~5=Poor)

Characteristic	Adjusted model (N=958)	
	Beta(SE)	p ^c
Caregiving pattern		
DS	Ref	
DP	0.18(0.08)	0.01
SS	0.11(0.09)	0.23
SP	0.19(0.09)	0.03
Caregiving change		
No Change	Ref	
Change into secondary caregivers	0.13(0.08)	0.11
From Sole to Primary	0.01(0.11)	0.95
From Primary to Sole	0.11(0.14)	0.43
Missing in round3	-0.08(0.07)	0.26
Caregiving time per month	<0.01(<0.01)	0.24
Self-health Report in round 1	0.52(0.03)	<0.01
CR Education		
Less than high school	Ref	
High School	-0.14(0.07)	0.06
Vocational	-0.04(0.08)	0.60
College and above	-0.08(0.10)	0.43
CR Race		
White(non-his)	Ref	
Black(non-his)	0.07(0.07)	0.34
Other(non-his)	-0.18(0.16)	0.27
Hispanic	0.22(0.11)	0.04
CR Marital Status		
Married	Ref	
Divorced	0.31(0.30)	0.30
Widowed	0.30(0.29)	0.31
Not married	0.51(0.36)	0.16
CR living arrangement		
Alone	Ref	
Live with spouse/partner	0.24(0.30)	0.42
Live with spouse/partner and other	0.24(0.30)	0.42
Live with other	-0.08(0.07)	0.25
CG Education		
High school	Ref	
Less than high school	0.03(0.10)	0.76
Vocation(>high school, <college)	-0.02(0.07)	0.77
College and above	-0.11(0.08)	0.15
CG No. of total children		

0	Ref	
1	-0.01(0.08)	0.88
2	0.06(0.08)	0.41
3 or more	0.08(0.08)	0.30

Table 9. Multiple linear regression of CR depression and anxiety (higher value indicates higher level of depression and stress)

Characteristic	Adjusted model (N=680)	
	Beta(SE)	p ^c
Caregiving pattern		
DS	Ref	
DP	0.06(0.26)	0.83
SS	-0.16(0.34)	0.65
SP	-0.13(0.30)	0.68
Caregiving change		
No Change	Ref	
Change into secondary caregivers	0.49(0.28)	0.09
From Sole to Primary	0.09(0.39)	0.83
From Primary to Sole	0.06(0.49)	0.90
Missing in round3	0.29(0.25)	0.25
Caregiving time per month	<0.01(<0.01)	0.19
Depression in round 1	0.52(0.03)	<0.01
CR Education		
Less than high school	Ref	
High School	-0.33(0.26)	0.20
Vocational	-0.29(0.29)	0.32
College and above	0.12(0.36)	0.74
CR Race		
White(non-his)	Ref	
Black(non-his)	0.23(0.24)	0.35
Other(non-his)	1.09(0.64)	0.09
Hispanic	0.92(0.36)	0.01
CG Education		
High school	Ref	
Less than high school	-0.30(0.36)	0.43
Vocation(>high school, <college)	-0.10(0.26)	0.69
College and above	-0.10(0.28)	0.73
CG No. of children under 18		
0	Ref	
1	-0.28(0.27)	0.30
2	-0.48(0.35)	0.17
3 or more	-0.72(0.43)	0.09