

Impact of Caring for Grandchildren on the Health of Grandparents in Taiwan

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Objectives. To understand how caring for grandchildren affects the physical and mental health of grandparents in Taiwan.

Method. Grandparents aged 50 and older from 4 waves of the Taiwan Longitudinal Study on Aging (1993–2003, $n = 3,711$) were divided into 7 categories based on living arrangement and caregiving history. Generalized estimation equations controlling for sociodemographic characteristics and disease status were used to estimate the relationship between caregiving and 4 outcomes: self-rated physical health, mobility limitation, life satisfaction, and depressive symptoms.

Results. Compared with noncaregivers, long-term multigenerational caregivers were more likely to report better self-rated health, higher life satisfaction, and fewer depressive symptoms. We found some evidence of reduced mobility limitations for both skipped-generation and nonresidential caregivers relative to noncaregivers. The associations in self-rated health and depressive symptoms were more pronounced in long-term caregivers than among those who recently started caregiving.

Discussion. Improvements in self-rated health and mobility associated with caregiving support our hypothesis that caring for grandchildren can be beneficial for grandparents in Taiwan, especially for long-term multigenerational caregivers. Comparing Taiwanese grandparents across different types of caregiving shows that the associations of grandparent caregiving with health vary by living arrangement and duration. However, these findings may not be causal because caregiving and health outcomes were observed simultaneously in our data.

Key Words: Caregiving—Health—Grandparent—Living arrangements.

GRANDPARENTHOOD is experienced by people in all cultures, but grandparenting may have different health consequences in different cultural contexts (Goodman & Silverstein, 2002). Furthermore, grandparent caregiving can vary with living arrangement, from “multigenerational (MG) families” that tend to comprise three generations (grandparents, their adult children, and their grandchildren) to “skipped-generation (SG) households” where the adult children are absent in a family headed by a grandparent. In the past decade, most of the literature on grandparent caregiving has focused on SG households in the United States (Grinstead, Leder, Jensen, & Bond, 2003; Hayslip & Kaminski, 2005). Custodial grandparent caregivers in the United States often experience elevated morbidity and mortality relative to those who are not caregivers (Burnette, 1999; Hayslip & Kaminski, 2005; Kolomer, 2008). However, it is questionable whether these findings from U.S. grandparent caregivers are applicable to other societies with family structure and intergenerational relationships largely different from the United States. Research that focuses on different ethnic populations is needed to advance our knowledge about the health of caregiving grandparents

(Grinstead et al., 2003) and extends conceptual and theoretical views on families in different cultural context.

For example, recent studies from Chile and China provide evidence from countries where intergenerational coresidence is much more common (Chen & Liu, 2012; Grundy et al., 2012). The first longitudinal study of grandparent caregivers in Latin America by Grundy and colleagues found that regularly providing help to grandchildren was associated with better life satisfaction or lower risks of depression. The other study, which examined the effect of grandparent caregiving on the older adults’ health trajectories over a 15-year time span, concluded that health effects depended on the cultural contexts and the level of care requirements faced by the caregivers (Chen & Liu, 2012). Building on this latest body of international literature, the objective of this study is to examine the health impact of caring for grandchildren in a context where grandparents traditionally undertake the role of child care provider. We also seek to fill a gap in the literature because most studies have focused on custodial grandparenting or skipped-generation caregivers, even though these types of intensive grandparenting are less prevalent than other types of less-intensive caregiving.

A recent comparative study on grandparenthood across six Asian countries had interesting observations on different types of caregiver roles (Mehta & Thang, 2012). Grandparents in SG households in China were the most traditional type and regarded caring for grandchildren as an obligation, whereas grandparents in Hong Kong provided daily care in MG households, possibly due to soaring housing prices that discouraged separate living arrangements. Yet another group of grandparents, regarded as nontraditional in the Asian context, has emerged in Singapore and in Japan. These grandparents usually have better resources to be living on their own but still in proximity to their adult children, and they enjoy the independence to spend their life on other opportunities outside the family setting. Some grandparents in this last group may provide occasional care for their grandchildren, but they may also desire their own social life and cherish time freed from caregiving responsibility (Teo, Mehta, Thang, & Chan, 2006). Given the differences faced by grandparent caregivers in various living arrangements, it is important to account for living arrangements in studying the health impacts of grandparent caregiving in the Asian context.

Currently, Taiwan is undergoing a demographic change of two forces, which makes it a very interesting case study. On the one hand, with the proportion of elderly adults (65 years and older) growing from 7% in 1993 to 11% in 2011, the Taiwanese population is living longer, and furnishing an increased pool of grandparents (Ministry of Interior, Department of Statistics, Taiwan, 2011); on the other hand, Taiwan's birth rate has plummeted from 7.04 in 1951 to 2.06 in 1984 and to only 1.06 children born per childbearing-age woman in 2011 (Ministry of Interior, Department of Statistics, Taiwan, 2012). These statistics have several important implications. First, increased life expectancy implies that older people will spend more years of their lifetime in grandparenthood. Moreover, the combination of a traditional focus on family lineage and having so few grandchildren makes grandparents more likely to volunteer for grandchild care. Previous research has found that more resources are available for grandchild care when the ratio of grandparents to grandchildren drops as a result of the declining birth rate (Sheng & Settles, 2006). Furthermore, more women are working outside the home, generating increased demand for child care (Directorate General of Budget, 2010). Subsequently, the percentage of grandparents caring for grandchildren aged 3 or younger in Taiwan has increased by 7% points over the past two decades, reflecting demographic and economic trends that come with modernization (Directorate General of Budget, 2010). Despite the rise of grandparent caregiving in Taiwan, little is known about its consequences for grandparents' health (Lo & Liu, 2009).

Although three studies have examined the health consequences of grandparent caregiving in Taiwan, their results were inconclusive (Chi, 2004; Liu, 2001; Lo & Liu, 2009). All three studies used cross-sectional data from

convenience sampling, and two of them lacked a control group. Several studies examined the association between providing instrumental support to grandchildren and the health status of Chinese elders in the People's Republic of China (China) (Chen & Silverstein, 2000; Liu, Liang, & Gu, 1995; Silverstein, Cong, & Li, 2006), but only one recent study specifically looked at the health impact of caring for grandchildren (Chen & Liu, 2012). Chen and Liu used the China Health and Nutrition Survey to examine the effect of living arrangements and caregiving intensity on the older adults' health trajectories. Their study found that elders in SG households were not only similar in self-reported health to those elders living without grandchildren, they also benefited from higher economic benefit brought by adult children working away from home. This finding confirmed an earlier study that suggested that SG households seemed to have a quite different implication for grandparents in China than households with a breakdown in family functioning associated with the missing middle generation (Silverstein et al., 2006).

Although Chen and Liu's study provided important evidence on the health consequences of grandparent caregiving in China, this study seeks to further their work in several directions: First, we examined multiple physical and mental health outcomes in addition to self-rated health, which was the only health outcome examined in that study due to limited data. Second, we combined the effect of living arrangement and caregiving into one analysis. Third, our sample included grandparent caregivers who are nonresident grandparents caring for grandchildren.

In a society that emphasizes collective goals over individual goals, the contributions of grandparents to the welfare of their extended families are highly valued (Sheng & Settles, 2006; Yan, 2003). Many studies have shown that grandparents caring for grandchildren in three-generation families is culturally encouraged in Chinese societies (Chen, Short, & Entwistle, 2000; Hermalin, Roan, & Perez, 1998). In Taiwan, 15% of households were MG in 2009, almost three times the rate in the United States. (Directorate General of Budget, 2009; Harrel, Kassner, & Figueiredo, 2011). In a recent government survey, 68% of Taiwanese grandparents aged 65 and older reported coresidence with adult children to be the ideal living arrangement (Ministry of Interior Department of Statistics, 2009). Therefore, we hypothesize that the effect of caring for grandchildren will be most beneficial among MG caregivers. We also expect that SG caregivers would not suffer net negative health effects, according to existing literature on elders in SG households in China (Chen & Liu, 2012; Silverstein et al., 2006). However, we hypothesize that the association between caregiving and health will attenuate for SG caregivers compared with MG caregivers because previous studies have shown that the presence of an adult child was associated with better health outcomes in the grandparent caregivers (Blustein, Chan, & Guanais, 2004; Goodman &

Silverstein, 2002; Hughes, Waite, LaPierre, & Luo, 2007; Musil & Ahmad, 2002).

Previous research indicated that U.S. grandparents who were the primary caregivers differed substantially from those who were occasional caregivers (Hughes et al., 2007; Minkler & Fuller-Thomson, 2001). We expect nonresident grandparent caregivers to have better health than the noncaregivers based on the literature on participation in multiple roles among older adults (Pillemer, Moen, Wethington, & Glasgow, 2000). Grandparents who are living on their own tend to have more social activities with caregiving being just one of their multiple roles (Mehta & Thang, 2012). A study found that volunteer work helped to reduce depression among the elderly population, partly due to increased social integration (Musick & Wilson, 2003). Another study that specifically looked at the impact of participating in multiple roles among grandparent caregivers concluded that grandparents who have been raising a grandchild for longer periods of time appear to benefit from their participation in multiple roles (Baker & Silverstein, 2008). Although our study did not intend to test the effect of multiple roles assumed by grandparents other than caregiving, this theory leads us to assume that the health effect on nonresidential (NR) caregivers will be positive.

This study also accounts for caregiving duration by comparing the effect of recent caregiving versus long-term caregiving in different types of living arrangements. The literature on caregiving duration is built upon two different hypotheses: (a) The health effects of caregiving may persist over time and affect long-term caregivers more than short-term caregivers (Coe & Van Houtven, 2009; Solomon & Marx, 1999); and (b) caregivers who are newly involved in caring for a grandchild may experience a greater change in health than noncaregivers (Baker & Silverstein, 2008; Minkler, Fuller-Thomson, Miller, & Driver, 1997). The second hypothesis is based on the family adjustment and adaptation response model, which emphasizes that during care transitions, the well-being of a family member may be reduced by this new role; however, after a period of time, a family member will gradually adjust to the negative consequences associated with caregiving (Patterson, 1988). The majority of evidence from previous longitudinal studies of grandparent caregivers in the United States also seemed to support the adaptation hypothesis, reporting negative health effects associated with transition. (Baker & Silverstein, 2008; Hughes et al., 2007; Musil et al., 2011). In our study, we used longitudinal information on one's prior caregiver status to separate long-term caregiving from recent caregiving and to test for differential effects of duration. Although we do not assume that caregiving is associated with negative health outcomes for our sample of Taiwanese grandparents, we expect that the changes in health experienced by recent caregivers during transition should diminish for continuous caregivers as they adapt to the situation over time.

METHOD

Data and Sample

We used the Survey of Health and Living Status of the Elderly in Taiwan, also known as the Taiwan Longitudinal Study on Aging (TLSA), which includes a nationally representative sample of the Taiwanese population aged ≥ 60 in 1989 (Bureau of Health Promotion, 2003). We used the first two cohorts, including the second cohort of elders aged 50–66 that was added in 1996; we did not include the third cohort who entered only in 2003 due to the lack of information on their caregiving history. One strength of the TLSA is its high response rates, which varied between 79% and 91% during the 10-year study period (Bureau of Health Promotion, 2003). The selection of the initial TLSA panel in 1989 used a three-stage equal probability random sampling design (Hermalin, Liang, & Chang, 1989). Because two individuals were randomly selected from each residential block, it was highly unlikely to have more than one person selected from the same household (Bureau of Health Promotion, 2007).

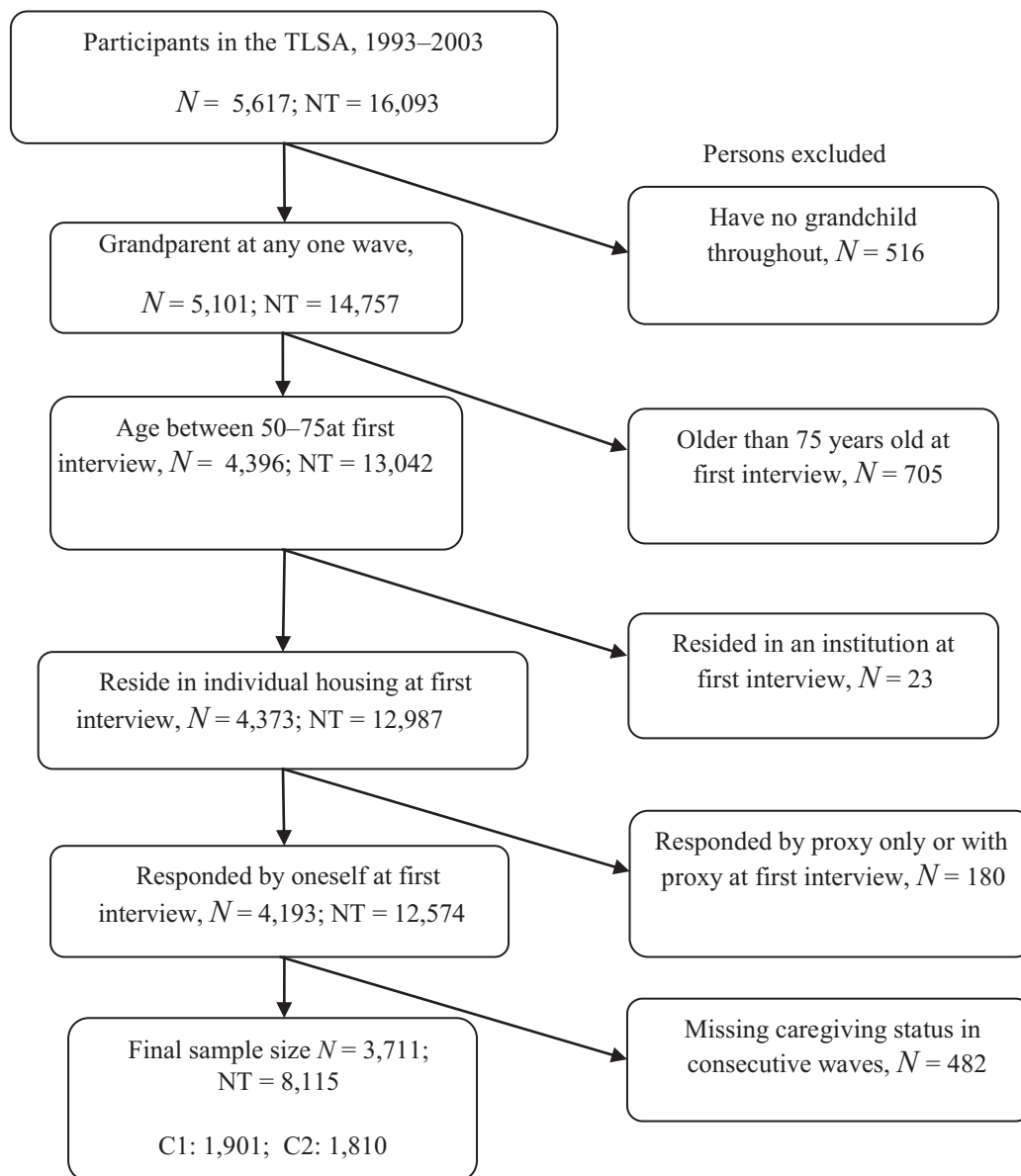
The analytical sample selected for this study included two cohorts of grandparents from four waves (1993, 1996, 1999, and 2003) because the survey questions on grandparent caregiving first appeared in 1993. Inclusion criteria were that the respondent must be

1. a grandparent in at least one of the four survey waves;
2. between 50 and 75 years old at their initial survey;
3. living in a noninstitutional setting at the initial survey;
4. a respondent (i.e., no proxy response) at the initial survey; and
5. a respondent in at least two consecutive survey waves.

Figure 1 shows the selection of our study sample of 3,711 grandparents from the pooled TLSA sample of 5,617 elders following the five criteria listed earlier. The first and main inclusion criterion was to limit our sample to those who had at least one grandchild in any wave of the survey. We excluded persons older than age 75 at their initial survey because the oldest old are unlikely to care for young grandchildren, and they are more likely to have health problems not attributable to caregiving (Hughes et al., 2007; Lin, 2009). Persons who resided in an institution or those who responded by proxy at their initial survey were excluded for similar reasons. After excluding observations missing caregiver status in consecutive waves (containing observations at first interview without prior data), our final study sample contained 3,711 grandparents with a total of 8,115 person-wave observations.

Measures

Grandparent caregiver status.—We utilized information about grandparents' living arrangements to define four types of grandparents: (a) MG household caregivers living with their grandchildren and the children's parents; (b) SG household caregivers living with their grandchildren but not



N: Number of unique persons; NT: Number of person-wave observations; C: Cohort

Figure 1. Study sample flowchart. Source: Taiwan Longitudinal Study on Aging (TLSA), 1993–2003.

the grandchildren's parents; (c) NR grandparent caregivers providing care for the grandchildren but not residing with grandchildren; and (d) noncaregivers. Categories were defined according to yes/no responses to three sets of survey questions asking whether the respondent helped care for grandchildren and whether he or she lived with either the adult children or the grandchildren (Table 1, panel A). The first question was used to separate caregivers from noncaregivers, and the second question categorized caregivers by coresidence with adult children. The third question further divided caregivers depending on whether the grandchild was living with the grandparent caregivers. If the grandparent was a caregiver for at least one grandchild but without

any adult child or grandchild living in the same household, we define this group as NR caregivers. Otherwise, they are considered as SG caregivers caring for a residential grandchild. Because we defined caregiver status per grandparent rather than per grandchild, the fact that the third question did not specify whether the grandchild in the household was cared for by the grandparent was not an issue. As long as the grandparents identified themselves as caregivers and were living with at least one grandchild, himself or herself does not meet the definition of NR caregivers used in our study.

To validate the caregiver status assignment, we further screened grandparent caregivers on three additional criteria: The respondents must have reported that (a) they were a

Table 1. Grandparent Caregiver Status: Definition and Distribution

	Grandparent caregiver status			
	MG caregivers	SG caregivers	NR caregivers	Noncaregivers
Panel A. Definition by survey questions				
(1) Do you currently provide assistance to babysit your grandchild(ren) of adult child ___?	Yes	Yes	Yes	No
(2) Do you live with adult child ___?	Yes	No	No	Yes/No
(3) Do you have a grandchild in the household?	Yes	Yes	No	Yes/No
Panel B. Distribution of caregiver status (NT = 8,115)				
Percentage of grandparents who were recent caregivers	6.5%	2.3%	2.5%	79.7%
Percentage of grandparents who were long-term caregivers	6.0%	2.0%	1.0%	

Notes. Yes/No indicates survey responses used to construct different categories of grandparent caregiver status. Question (1) defined a grandchild as being below high school age, whereas question (3) asked the grandparent respondent to identify any household member as a grandchild but did not limit age. MG = multigenerational households; SG = skipped-generation household; NR = nonresidential; NT = number of person-wave observations.

grandparent in the same wave of data collection that they reported caring for grandchildren; (b) they cared for grandchildren occasionally or frequently when asked about frequency of their caregiving activity; and (c) the youngest residential grandchild was aged 18 years or younger (ages were not known for NR grandchildren).

The distribution of grandparents under each caregiver status was calculated by applying the definition based on the survey questions and screening criteria discussed earlier (Table 1, Panel B). Among those who self-identified as caregivers in each of the three living arrangement types, we further used their caregiving status in two consecutive survey waves to separate two groups: (a) Recent caregivers were those who did not provide care in the prior survey, and (b) long-term caregivers were those who provided care in both the prior and the current survey. Grandparents who did not care for grandchildren in the current survey were the reference group in the models estimated. In total, we have seven categories of grandparent caregiver status, with noncaregivers as the reference group. These categories were measured at each survey, so sample members may have a different caregiver status at different time points.

The majority of person-wave observations in our pooled sample were noncaregivers (79.7%, NT = 6,469), but 6.5% of grandparents were recent caregivers and 6% were long-term caregivers in MG households. Grandparent caregivers who cared for their grandchildren without adult children in the household included 2.3% recent and 2% long-term SG caregivers. The percentages of NR caregivers were lowest: 2.5% were recent caregivers and only 1% were long-term caregivers (NT = 78).

Grandparent health.—We examined four measures of grandparents' physical and mental health. *Self-rated health* was measured using a 1–5 ordinal scale based on the following question: “Regarding your state of health, do you feel it is: excellent, good, average, not so good, or poor?” *Satisfaction with life* was adopted from the Life Satisfaction Index A (LSIA) (Neugarten, Havighurst, & Tobin, 1961). We

selected the common four items included in the 1993 survey in which the respondent was asked about whether he or she agreed or disagreed with four statements on feeling about life (e.g., better life than most other people, satisfied with life), adding up to a summary score ranging from 0 (*not satisfied*) to 4 (*most satisfied*). *Mobility limitations* were measured as a count of reported limitations in the following six activities: standing continuously for 15 min, lifting or carrying 11–12 kg, squatting, reaching over one's head, grasping with one's fingers, and running or jogging a short distance (20–30 m). A mobility limitation was defined as having some or more difficulty performing each task; the aggregated number of limitations was used as the measure of mobility limitation. *Depressive symptoms* were measured using a 10-item Chinese version of the original 20-item Center for Epidemiological Studies Depression (CES-D) Scale (Radloff, 1977), which has been validated in Chinese elderly populations with a reliability range of 0.84 to 0.86 (Cheng & Chan, 2005; Krause & Liang, 1992; Seplaki, Goldman, Weinstein, & Lin, 2006). For each of the 10 CES-D items, respondents were asked to rate the frequency of their experience of each depressive symptom on a four-point scale (none [0 point], 1 day [1 point], 2–3 days [2 points], and over 4 days [3 points]). All items were summed up to a total score ranging from 0 (*not depressed*) to 30 (*most depressed*).

Control variables.—To account for potential confounding of the caregiving–health relationship by factors that might differ between caregivers and noncaregivers, we controlled for a number of measures of grandparents' social, demographic, social support, and health-related variables. Social and demographic variables included age, gender, marital status, years of education, geographic location, work status, and economic status. Four types of social support measuring intergenerational transfers were included: emotional support, instrumental support (received help with household chores), financial support received from any adult children, and financial support provided to any adult children. It is also important to control for disease status likely to affect caregivers' reported

health. Chronic diseases were defined using measurements from each wave, including the following nine indicators collected during the entire study period: high blood pressure, diabetes, heart disease, stroke, cancer, respiratory ailment, arthritis or rheumatism, gastric ulcer, and liver or gall bladder disease. Finally, a set of wave indicators accounted for any time trend effects throughout the study period.

Analysis

Description of grandparent caregivers.—To estimate the prevalence of grandparent caregiving among Taiwan elders and to describe the characteristics of grandparent caregivers, we examined data from the full sample of 3,711 grandparents who responded in at least two consecutive survey waves. We compared health and demographic characteristics of grandparents in different caregiver status, using chi-square tests for categorical variables and one-way analysis of variance tests for continuous variables.

Estimation of caregiving effects on health.—To determine the health impact of grandparent caregiving, we fit generalized estimation equation (GEE) multivariate regression models to predict each of the four health outcomes as a function of grandparent caregiving status and other covariates:

$$HO_{it} = \alpha + \beta_1 GC_{it} + \beta_2 X_{it} + \varepsilon_{it},$$

where HO represents one of the four health outcomes for grandparent i at time t , GC is a measure of grandparent caregiving status in seven categories (noncaregiver is the reference group), X is a vector of social and demographic covariates, and ε is the error term. As caregiving may bring both positive and negative effects on any health outcome, the coefficient vector β_1 represents the sum of those two opposing effects of grandparent caregiving. We expect the net effect estimate β_1 to be positive for measures of good health such as self-rated health and negative for measures of poor health such as mobility limitations.

An important concern with estimating the health effect of grandparent caregiving is reverse causality, in which unhealthy grandparents are less likely to provide child care. Previous research on grandparent caregivers in the United States and in Europe has shown evidence of reverse causality although the direction of the bias seemed to differ by country. For instance, grandparents in the United States had poor health even before they started caregiving, whereas grandparents in the Europe were less likely to provide care when their health was compromised (Hank & Buber, 2009; Scommegna & Mossaad, 2011). Thus, we included the corresponding health outcome measured at each respondent's first interview as a covariate to control for health at the baseline in each model. Although we considered using a time-lagged design, we are concerned that the outcome measures are too far behind the caregiving period to identify an effect, given

that our data had 4-year intervals. We used caregiving status and health outcome measured in the same survey year as we expect the psychological benefits of caregiving are more likely to occur during the same period of caregiving, but we tested the lagged effect of caregiving in our sensitivity analysis. We also conducted fixed effects analyses as part of our sensitivity analysis to control for bias resulting from time-invariant unobserved factors that differ between grandparent caregivers and noncaregivers. Examples of time-invariant unobserved factors that could be controlled in person fixed effects models include genetic makeup and the quality of family relationships that do not vary over overtime.

Each respondent may have contributed from one up to three person intervals in the data, so the observations are not stochastically independent. The GEE method is chosen because it accounts for correlation between repeated measures on the same respondent (Liang & Zeger, 1986). This method has also been applied in a previous study on the health effects of grandparent caregiving (Hughes et al., 2007). As our health outcome measures have limited response categories, we selected different functional forms for our GEE models based on the distribution of each dependent variable. For ordinal measures including self-rated health and life satisfaction, we chose the ordered logistic specification; for mobility limitations and depressive symptoms with distribution patterns similar to count data, we chose the negative binomial specification. Due to the differences in regression specification, the coefficient estimates from the order logistic models are shown as odds ratios (ORs), whereas the coefficient estimates from the negative binomial models are interpreted as rate ratios (RRs). We performed complete case analyses, and the number of observations in each regression varied because the percent of missing in each health outcome varied. For missing data, the GEE method can estimate the working correlation parameters using all nonmissing pairs of data (Hardin & Hilbe, 2007). This estimation method uses data more efficiently because our estimation drops only the observations from a particular wave that contained a missing value; it does not drop all observations for a person with any missing value.

RESULTS

Table 2, which presents summary statistics by grandparent caregiver status, shows that about 20% of our pooled grandparent sample identified themselves as caregivers for their grandchildren between 1993 and 2003. The percentage of caregiver subgroups such as NR caregivers (3.5%) or SG caregivers (4.3%) was relatively low in our sample, and MG caregivers were the dominant group (12.5%). However, the percentage of grandparents who ever responded as a caregiver (regardless of living arrangement) during our 10-year study period was quite high at 43.5%. Unadjusted comparisons show that grandparent caregivers reported better self-rated health, greater satisfaction with life, fewer mobility limitations, and fewer depressive symptoms compared with

Table 2. Descriptive Statistics of Study Sample^a by Caregiver Status

	Noncaregivers (79.7%)	MG caregivers (12.5%)	SG caregivers (4.3%)	NR caregivers (3.5%)	<i>p</i> Value ^b
	Mean/% (SD)	Mean/% (SD)	Mean/% (SD)	Mean/% (SD)	
Health outcomes ^c					
Self-rated health (0–5)	3.0 (1.1)	3.2 (1.1)	3.2 (1.0)	3.3 (1.0)	<.001
Life satisfaction scale (0–4)	2.6 (1.3)	2.7 (1.2)	2.6 (1.3)	2.8 (1.2)	.004
Mobility limitations (0–6)	1.6 (1.8)	1.1 (1.5)	0.9 (1.3)	1.0 (1.5)	<.001
CES-D ^d (0–30)	5.7 (6.1)	4.8 (5.5)	4.8 (5.5)	4.6 (5.6)	<.001
Social and demographic variables					
Age	70.3 (7.1)	66.4 (6.8)	66.3 (6.8)	68.2 (6.7)	<.001
Female	48.1%	55.8%	51.4%	43.9%	<.001
Marital status					<.001
Married	67.7%	72.9%	80.6%	81.8%	
Divorced/separated/widowed/single	32.3%	27.1%	19.4%	18.2%	
Education years					<.001
0 years	32.8%	34.8%	28.9%	25.7%	
1–6 years or literate	46.3%	48.7%	46.6%	41.8%	
≥7 years	20.9%	16.4%	24.6%	32.5%	
Location					<.001
Rural	55.6%	51.8%	51.7%	40.4%	
Urban	44.4%	48.2%	48.3%	59.6%	
Working currently					.24
Yes	19.4%	17.8%	16%	17.6%	
No	80.6%	82.2%	84%	82.4%	
Economic status					<.001
Have difficulty	27.3%	28.5%	29.4%	22.9%	
Have enough money	58.7%	63.6%	60.9%	63.2%	
Have plenty of money	8.4%	6.0%	7.1%	12.1%	
Missing	5.7%	1.9%	2.6%	1.8%	
Social support					
Emotional support					<.001
Unsatisfied—Average	18.9%	16.0%	18.9%	16.8%	
Satisfied	41.9%	47.0%	46.3%	42.9%	
Very satisfied	33.3%	34.9%	31.4%	37.9%	
Missing	6.0%	2.1%	3.4%	2.5%	
Receive support with chores	65.9%	66.4%	60.3%	52.5%	<.001
Financial support to children	4.9%	4.9%	6.9%	5.4%	.42
Financial support from children	55%	67.2%	69.7%	62.1%	<.001
Disease indicators					
High blood pressure	36.1%	33.3%	30.7%	27.1%	.002
Diabetes	15.5%	14.6%	15.8%	10.7%	.16
Heart disease	20.2%	16.7%	15.8%	18.9%	.02
Stroke	6.5%	4.2%	2%	3.6%	<.001
Cancer	2.6%	2.7%	3.7%	3.2%	.63
Respiratory ailment	12.1%	12.6%	11.5%	10%	.68
Arthritis or rheumatism	21.7%	23.8%	20.3%	20.4%	.35
Gastric ulcer	18.9%	18.8%	19.5%	20%	.96
Liver or gall bladder disease	7.5%	8.3%	6.9%	10.4%	.26

Notes. MG = multigenerational households; NR = nonresidential; SG = skipped-generation households; NT = number of person-wave observations.

^aPooled grandparent sample from Taiwan Longitudinal Study on Aging (NT = 8,115).

^bBivariate comparisons using χ^2 test for categorical variables and analysis of variance test for interval variables.

^cRange of health outcome measure in parentheses.

^dCES-D: Center for Epidemiological Studies Depression scores.

noncaregivers. Caregivers also differed from noncaregivers in terms of demographic and social characteristics; caregivers were younger by about 2–4 years, and they were more likely to be married, to be in better economic status, to be satisfied with the level of emotional support provided by family and friends, and to receive financial assistance from their adult children.

A comparison of the three types of caregivers showed that NR caregivers were different from the others in several aspects: More grandfathers than grandmothers were NR caregivers, and the majority of them lived in the urban area. The education level of NR caregivers seemed to be the highest in the grandparent sample, with 32.5% receiving at least 7 years of education. The percentage of NR caregivers

who reported their economic status as “having plenty of money” was the highest among all, whereas a high percentage of caregivers in SG households reported having financial difficulty.

The results of grandparent caregiving on the outcomes of self-rated health and life satisfaction from ordered logistic GEE models are shown in Table 3. Using noncaregivers

as the comparison group, we found that MG caregivers were more likely to report higher self-rated health, regardless of their caregiving history. Similar results were observed for long-term NR caregivers (OR = 1.55), holding the other covariates constant. However, no significant difference in self-rated health was found between recent NR caregivers and noncaregivers or between recent SG

Table 3. GEE Regression of Caregiver Status on Grandparents' Self-rated Health and Life Satisfaction

Variables	Self-rated health		Life satisfaction	
	Odds ratio ^a	(95% confidence interval)	Odds ratio ^a	(95% confidence interval)
Caregiver status (Ref: Noncaregivers)				
Long-term MG caregivers	1.38***	(1.15, 1.65)	1.18	(0.99, 1.42)
Recent MG caregivers	1.42***	(1.20, 1.66)	1.03	(0.86, 1.24)
Long-term SG caregivers	1.32	(1.00, 1.74)	0.84	(0.61, 1.16)
Recent SG caregivers	0.96	(0.73, 1.26)	0.88	(0.66, 1.19)
Long-term NR caregivers	1.55*	(1.10, 2.18)	1.13	(0.77, 1.66)
Recent NR caregivers	1.03	(0.79, 1.35)	1.09	(0.83, 1.42)
Covariates				
Age	0.97***	(0.97, 0.98)	1.00	(0.99, 1.00)
Female	0.73***	(0.65, 0.83)	1.04	(0.92, 1.18)
Married ^b	1.04	(0.94, 1.16)	1.28***	(1.14, 1.44)
Education (Ref: 0 year)				
1–6 years or literate	1.19**	(1.07, 1.34)	1.29***	(1.14, 1.46)
≥7 years	1.44***	(1.23, 1.68)	1.58***	(1.35, 1.85)
Location (Ref: Rural)				
Urban	1.27***	(1.15, 1.39)	1.14*	(1.03, 1.26)
Working	1.43***	(1.27, 1.62)	0.87*	(0.76, 0.98)
Economic status (Ref: Have difficulty)				
Have enough money	1.81***	(1.63, 2.02)	2.97***	(2.65, 3.32)
Have plenty of money	3.10***	(2.56, 3.75)	4.26***	(3.56, 5.11)
Emotional support (Ref: Unsatisfied to average)				
Satisfied	1.67***	(1.49, 1.87)	2.20***	(1.94, 2.50)
Very satisfied	2.11***	(1.86, 2.40)	3.80***	(3.31, 4.35)
Receive support with chores	0.78***	(0.70, 0.87)	1.01	(0.91, 1.13)
Financial support to children	0.92	(0.76, 1.12)	0.83	(0.69, 1.01)
Financial support from children	0.98	(0.90, 1.07)	0.97	(0.89, 1.07)
Lagged health outcomes				
Self-rated health	1.51***	(1.44, 1.59)		
Life satisfaction			1.15***	(1.11, 1.19)
Disease indicators				
High blood pressure	0.78***	(0.71, 0.86)	1.01	(0.91, 1.13)
Diabetes	0.52***	(0.46, 0.60)	0.83	(0.69, 1.01)
Heart disease	0.56***	(0.50, 0.63)	0.97	(0.89, 1.07)
Stroke	0.26***	(0.21, 0.34)	0.95	(0.86, 1.06)
Cancer	0.43***	(0.31, 0.61)	0.99	(0.86, 1.12)
Respiratory ailment	0.56***	(0.48, 0.64)	0.90	(0.80, 1.01)
Arthritis or rheumatism	0.72***	(0.65, 0.80)	0.47***	(0.38, 0.57)
Gastric ulcer	0.66***	(0.59, 0.74)	0.72*	(0.54, 0.95)
Liver or gall bladder disease	0.58***	(0.49, 0.69)	0.84*	(0.72, 0.96)
Wave indicator (Ref: 1996)				
1999	1.03	(0.92, 1.14)	1.02	(0.91, 1.15)
2003	1.11	(1.00, 1.25)	1.14*	(1.02, 1.29)
Persons	3,612		3,294	
NT	7,575		6,868	

Notes. Regressions using ordered logistic generalized estimation equation (GEE) models. MG = multigenerational households; SG = skipped-generation households; NR = nonresidential; NT = number of person-wave observations.

^aExponentiated coefficients are shown as odds ratio.

^bReference category is divorced/separated/widowed/single.

* $p < .05$. ** $p < .01$. *** $p < .001$.

caregivers and noncaregivers. There was also no significant difference between caregiver status and noncaregivers in satisfaction with life. Other important factors associated with better self-rated health and higher life satisfaction included more education, higher economic status, having satisfactory emotional support, and fewer chronic health conditions.

The results of grandparent caregiving on the outcomes of mobility limitations and depressive symptoms from negative binomial GEE models are shown in Table 4. The incident rate of mobility limitations for recent MG caregivers was 0.95 times the incidence rate for the noncaregivers, holding the other covariates constant. Lower RRs of limitations were also observed for recent SG caregivers (RR = 0.83)

Table 4. GEE Regression of Caregiver Status on Grandparents' Mobility Limitations and Depressive symptoms

	Mobility limitations		Depressive symptoms	
	Rate ratio ^a	(95% confidence interval)	Rate ratio ^a	(95% confidence interval)
Caregiving status (Ref: Noncaregivers)				
Long-term MG caregivers	0.97	(0.92, 1.03)	0.97**	(0.96, 0.99)
Recent MG caregivers	0.95*	(0.90, 1.00)	1.00	(0.98, 1.01)
Long-term SG caregivers	0.92	(0.82, 1.04)	1.00	(0.98, 1.03)
Recent SG caregivers	0.83**	(0.74, 0.94)	0.98	(0.96, 1.00)
Long-term NR caregivers	0.76*	(0.60, 0.96)	0.97	(0.92, 1.02)
Recent NR caregivers	0.97	(0.90, 1.06)	1.00	(0.98, 1.02)
Covariates				
Age	1.01***	(1.01, 1.02)	1.00*	(1.00, 1.00)
Female	1.13***	(1.10, 1.17)	1.02***	(1.01, 1.03)
Married ^b	1.00	(0.98, 1.03)	0.99***	(0.98, 0.99)
Education (Ref: 0 year)				
1–6 years or literate	0.99	(0.97, 1.01)	0.99**	(0.98, 1.00)
≥7 years	0.90***	(0.86, 0.94)	0.96***	(0.95, 0.98)
Location (Ref: Rural)				
Urban	0.98	(0.97, 1.00)	1.00	(1.00, 1.01)
Working	0.65***	(0.61, 0.70)	0.97***	(0.96, 0.98)
Economic status (Ref: Have difficulty)				
Have enough money	0.94***	(0.92, 0.96)	0.95***	(0.94, 0.96)
Have plenty of money	0.87***	(0.82, 0.92)	0.90***	(0.88, 0.92)
Emotional support (Ref: Unsatisfied to average)				
Satisfied	0.98	(0.96, 1.00)	0.96***	(0.96, 0.97)
Very satisfied	0.94***	(0.92, 0.97)	0.92***	(0.91, 0.93)
Receive support with chores	1.07***	(1.04, 1.09)	1.00	(0.99, 1.01)
Financial support to children	1.02	(0.97, 1.07)	1.00	(0.99, 1.01)
Financial support from children	1.00	(0.98, 1.02)	1.01	(1.00, 1.01)
Lagged health outcomes				
Mobility limitations	1.05***	(1.04, 1.05)		
Depressive symptoms			1.00***	(1.00, 1.00)
Disease indicators				
High blood pressure	1.00	(0.98, 1.02)	1.01***	(1.00, 1.02)
Diabetes	1.05***	(1.03, 1.08)	1.01***	(1.01, 1.02)
Heart disease	1.06***	(1.04, 1.08)	1.03***	(1.02, 1.03)
Stroke	1.18***	(1.15, 1.21)	1.04***	(1.03, 1.05)
Cancer	1.09***	(1.04, 1.14)	1.02**	(1.01, 1.03)
Respiratory ailment	1.06***	(1.04, 1.09)	1.02***	(1.01, 1.02)
Arthritis or rheumatism	1.09***	(1.07, 1.12)	1.01***	(1.01, 1.02)
Gastric ulcer	1.00	(0.98, 1.02)	1.01***	(1.01, 1.02)
Liver or gall bladder disease	1.02	(0.99, 1.06)	1.02***	(1.01, 1.03)
Wave indicator (Ref: 1996)				
1999	1.05**	(1.02, 1.08)	0.99*	(0.99, 1.00)
2003	1.06***	(1.03, 1.09)	0.99**	(0.98, 1.00)
Persons	3,613		3,576	
NT	7,577		7,469	

Notes. Regressions using negative binomial generalized estimation equation (GEE) models. MG = multigenerational households; SG = skipped-generation households; NR = nonresidential; NT = number of person-wave observations.

^aExponentiated coefficients are shown as rate ratios.

^bReference category is divorced/separated/widowed/single.

* $p < .05$. ** $p < .01$. *** $p < .001$.

and long-term NR caregivers ($RR = 0.76$), in comparison with the noncaregivers. The results for depressive symptoms showed more variations than mobility limitations, with the only significant difference found for long-term MG caregivers. Controlling for other factors, we observed lower rates of depressive symptoms among that group than the noncaregivers ($RR = 0.97$). Other important factors associated with fewer mobility limitations and depressive symptoms included being men or married, higher economic status, having satisfactory emotional support, and fewer chronic health conditions.

DISCUSSION

We compared the physical and mental health of Taiwanese grandparent caregivers in different types of living arrangement using data from a nationally representative longitudinal study of Taiwanese elders. Results showed that grandparent caregiving was positively associated with self-rated health and mobility improvements, after controlling for baseline health and other social and demographic factors. Other health outcomes of life satisfaction and depression showed no association with caregiving. These findings were similar to a longitudinal study of older Chileans, which concluded that helping grandchildren has benefits for grandparents' mental health (Grundy et al., 2012). Similar to that study, we also consider cultural context and coresidence patterns to be important in explaining our results.

Caring for grandchildren was most beneficial for grandparent caregivers in MG households in which adult children were present, especially for the long-term MG caregivers. These results were different from the literature based in the United States. Prior findings on the health effects of caregiving among MG families in the United States were mixed: Musil and Ahmad reported that MG caregivers were more likely to be depressed than noncaregivers, but another longitudinal study on depression by Blustein and colleagues did not reach the same conclusion; Hughes and colleagues found that MG caregivers reported no significant health difference with noncaregivers in measures including self-rated health, functional limitation, or depression (Blustein et al., 2004; Hughes et al., 2007; Musil & Ahmad, 2002). We attribute our positive finding to the influence of Chinese culture of intergenerational exchanges, which is indicative of a collectivist culture where MG caregivers presumably had the support and involvement of the parents of the grandchildren (Kitayama, 2002).

However, our finding on MG caregivers also seemed to differ from the study by Chen and Liu, which concluded that grandparents living in MG households experienced a faster rate of health decline than those living without grandchildren (Chen & Liu, 2012). Yet, their results are not directly comparable to our findings because their analysis modeled rates of changes and thus is different from our analytical approach, which did not focus on trajectories.

To our knowledge, no previous study has formally examined the effect of caring for NR grandchildren in the Chinese elderly population, but results from a large longitudinal study in the United States showed that grandmothers who started or who continued to babysit reported better self-rated health than grandmothers who did not provide care (Hughes et al., 2007). Similar to grandparents from Japan and Singapore, Taiwanese grandparents who were NR caregivers living on their own enjoyed relatively good health and had higher education and income. These findings provide indirect support to our assumption that compared with other caregivers, NR caregivers have more resource to participate in multiple roles besides a caregiver for grandchildren. Our results were also consistent with the Baker and Silverstein (2008) study because we found that long-term babysitting had a positive association with self-rated health and a negative association with mobility limitation. In other words, we found that being a caregiver for grandchildren seemed to be beneficial for a grandparent among many roles that the older adult may assume.

Although we found some evidence of SG caregivers being healthier than the noncaregivers in the descriptive analysis, there was little difference in the regression results except that recent SG caregivers had fewer mobility limitations. Because there was no negative health effect associated with SG caregivers, this finding is similar to previous research on elders in China (Chen & Liu, 2012; Silverstein et al., 2006). On the other hand, the lack of significant associations for long-term skipped generation caregivers could be due to small sample size. We had limited power to detect statistically significant associations between self-rated health and caregivers in that subgroup (We calculated our power to be 0.7.).

Our results of fewer mobility limitations among grandparent caregivers across living arrangement settings are similar to the findings by Hughes and colleagues (2007) who also examined functional limitations in forms of ambulation (e.g., walking a block and climbing a flight of stairs). In their study, grandmothers who began babysitting 200–500 hr of care per year reported fewer functional limitations. Given that physical exercise can be correlated with both caregiving and mobility, we tested whether physical exercise is a mediator by excluding and including it in our analytical model. If exercise is a mediator between caregiving and mobility, we would expect that the effect size of the caregiving coefficient to decrease after including the exercise variable. However, we found no evidence to support the mediator hypothesis, and the effect of grandparent caregiving on mobility reduction remained significant after controlling for their participation in exercise. This finding suggests that the association between caregiving and mobility reduction may have occurred due to increased physical activity from interacting with grandchildren, even though the grandparents may not consider such activities as regular exercise.

By defining our caregiving measure to include prior caregiver status, our objective was to look for empirical

evidence in the debate about the effects of caregiving duration. Adaptation to the caregiver role among grandparents over an extended period has been linked to a return to prior levels of well-being (Hughes et al., 2007; Szinovacz, DeViney, & Atkinson, 1999). However, our findings were mixed with regard to the adaptation theory because the health effects for long-term caregivers were more pronounced than for those recent caregivers in some living arrangement and health outcomes but not in others. For instance, two out of the three significant health effects identified for mobility limitations were for recent caregivers. Therefore, our results did not bring us to a definite conclusion on either hypothesis about caregiving duration.

Although we did not use a lagged design in our main analysis due to concern of long intervals between two surveys, in a sensitivity analysis we tested the lagged effect of caregiving by using caregiving status measured in the previous wave to make sure that our estimates do not suffer from potential reverse causality. We found that being either a MG caregiver or a SG caregiver was associated with better self-rated health than a noncaregiver 3 or 4 years later. These effects were found after controlling for temporal order and baseline health status and supported our hypothesis that caregiving in a MG household seems to be the most beneficial setting for grandparents. Results from our second sensitivity analysis using person fixed effects showed that although the effects of MG caregiving from the GEE models remained largely unchanged, the estimates of babysitting attenuated and lost statistical significance in the fixed effects models. This finding suggests that positive selection may have occurred among NR caregivers but not among MG caregivers, as healthier grandparents were more likely to be NR caregivers than to be in other caregiving arrangements. We did not present our results with fixed effects models because this method used only within-subject variation, and less than one third of grandparents in our sample ever changed their caregiver status. Studies using samples with greater variation in caregiving status may consider this analytical approach to address unobserved heterogeneity.

Because the TLSA is not a survey focused on caregiving or grandparenting, several important data limitations should be noted for this study. First, there was no standard definition of grandparent caregiving, and the caregiver status variable based on the grandparent's answer to whether he or she helped care for a grandchild was subjective. There were no data available to quantify the level of caregiving (e.g., the number of hours per day or per week spent with grandchildren) nor do we know the details of the activities performed during caregiving. Second, we did not have some context-specific variables, such as measures of the burden or stress reported by grandparent caregivers. We also did not know the different situations of SG caregiving, for instance, whether the parent of the grandchild was deceased or away for work. Third, the survey lacked grandchildren-related information. For example,

the number or the age of grandchildren cared by the grandparent was unknown. Given that caring for a grandchild who is a toddler versus a teenager involves quite different demands on the grandparents, future studies on grandparent caregiving should collect information on the age of the care recipient. Despite these limitations, the TLSA had a population-based sample with repeated observations, and because our research interest was related to living arrangement and caregiving duration, we were able to examine caregiving status and health outcomes for a large sample of grandparents in Taiwan.

In conclusion, our study contributes to the international literature on grandparent caregivers by providing evidence from Taiwan. We have built upon the current literature on the health effects of Chinese grandparents by reporting findings from NR caregivers and have shown that caregiving was beneficial for those grandparents in terms of self-rated health and mobility. We have also tested for the cumulative effects of caregiving and found they exist especially in long-term caregivers in MG families. Although this study adds to the diversity of study populations for research on grandparents caring for grandchildren, future research should consider using data from multiple countries to formally test the moderating effect of cultural differences on the health consequences of grandparent caregiving.

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