Race/Ethnic Differentials in the Health Consequences of Caring for Grandchildren for Grandparents

conditionally accepted at Journal of Gerontology: Social Sciences

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September 14, 2014

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Thee paper was presented at the 2012 Annual Meetings of the Gerontological Society of America at San Diego, California. Funding for the research comes from NICHD R03 HD068453. We thank Yingchun Ji for her help with the data analysis.

Feinian Chen is responsible for designing the research project and writing up the manuscript. Christine Mair plays a critical role in writing the paper as well as data analysis. Luoman Bao prepares the dataset and conducts the data analysis. Yang Yang provides essential advice on constructing the Frailty Index and other statistical issues.

Objectives. The phenomenon of grandparents caring for grandchildren is disproportionately observed among different racial/ethnic groups in the U.S.. This study examines the influence of childcare provision on older adults' health trajectories in the U.S. with a particular focus on racial/ethnic differentials.

Methods. Analyzing nationally-representative, longitudinal data on grandparents over the age of 50 from the Health and Retirement Study (1998-2010), we conduct growth curve analysis to examine the effect of living arrangements and caregiving intensity on older adults' health trajectories, measured by changing Frailty Index (FI) in race/ethnic subsamples. We use propensity score weighting to address the issue of potential nonrandom selection of grandparents into grandchild care.

Results. We find that some amount of caring for grandchildren is associated with a reduction of frailty for older adults, while coresidence with grandchildren results in health deterioration. For non-Hispanic Black grandparents, living in a skipped-generation household appears to be particularly detrimental to health. We also find that Hispanic grandparents fare better than non-Hispanic Black grandparents despite a similar level of caregiving and rate of coresidence. Finally, financial and social resources assist in buffering some of the negative effects of coresidence on health (though this effect also differs by race/ethnicity).

Discussion. Our findings suggest that the health consequences of grandchild care are mixed across different racial/ethnic groups and are further shaped by individual characteristics as well as perhaps cultural context.

Child caregiving, although traditionally performed by parents, may also be the responsibility of grandparents. Statistics from the American Community Survey suggest that around 7 million grandparents live with grandchildren younger than 18 and two out of five (39 percent) have primary caregiving responsibilities (US Census Bureau, 2011; National Center for Family & Marriage Research, 2012, 2013). Among them, African American and Hispanic grandparents are disproportionately more likely to care for grandchildren than White grandparents (National Center for Family & Marriage Research, 2012, 2013). However, research has not fully investigated race/ethnic differentials in the health consequences of such caregiving for grandparents. Results from a limited number of studies are inconsistent and inconclusive, partly due to the use of small, non-representative samples, but also largely due to the complex nature of the topic, with different mechanisms operating in opposing directions. For example, do the benefits of grandparenting (e.g., emotional reward and social support) outweigh the negative effects (e.g., stress, physical demand, and financial difficulty) or vice versa? Do minority grandparents' poorer health outcomes reflect their initial socioeconomic disadvantage, or does a lack of financial resources compound the stress of caregiving? Finally, could the strong norm of familism and support of kinship network among minority grandparents act as a buffer and thus increase resilience to strain?

In this paper, we aim to answer the above-mentioned research questions and explore the different mechanisms through which grandparents' caregiving influences health for different race/ethnic groups. By using a longitudinal, nationally representative dataset (Health and Retirement Study), we investigate the health implications of grandparents caring for grandchildren, with specific attention paid to race/ethnic differentials in health trajectories (with a composite measure of health, Frailty Index). Further, we situate the experience of grandparents'

caregiving in structural, cultural and economic contexts that are specific to different race/ethnic groups.

Theoretical Orientation: The Role of Grandparenthood in Different Racial/Ethnic Contexts

Role strain and role enhancement theories, two juxtaposing arguments regarding the social positions individuals occupy over their lifetime, provide some helpful insights to understand the health effects of grandparents caring for grandchildren (Rozario, Morrow-Howell, & Hinterlong, 2004). Essentially, these theories propose differential outcomes regarding social roles. Role strain theory argues that individuals will experience ill-effects from occupying multiple roles when conflicting role demands induce stress and take a toll on an individual's physical and psychological capacity (Goode, 1960; Pearlin, 1989; Mirowsky & Ross, 1986). "Off-time" parenting responsibility can create a great deal of stress and financial burden, leading to deteriorating health conditions. By simultaneously serving as grandparents, parents, and grandparents who parent, in addition to other social roles such as spouse, friend, co-worker, etc., they increase their risk of role strain.

Further, the hours of care provided by grandparents to grandchildren varies greatly (U.S. Census, 2000; Pebley & Rudkin, 1999; Goodman & Silverstein, 2006) and likely shapes role strain. For some, the grandparent role may include occasional babysitting and thus is not source of role overload. For grandparents who co-reside with grandchildren or who are solely responsible for parenting grandchildren, however, the expectations and responsibilities associated with that role increase and may interfere with other life activities. Households that include a grandparent, an adult child, and a grandchild are referred to as "multigenerational households." On the other hand, if the adult parents are not present in the household while

grandparents raise grandchildren, then the household is typically referred to as a "skipped generation household" (Fuller-Thomson, Minkler, & Driver, 1997). Each of these various household residential statuses may potentially represent a unique form of role strain.

On the other hand, role enhancement theory argues that engagement in multiple roles is associated with increased well-being as individuals gain satisfaction from their various social roles (Moen, Robison, & Dempster-McClain, 1995). The grandparent-grandchild relationship constitutes an important element of older adults' social support networks. Although the added responsibility of grandchild caregiving may increase grandparents' stress, increased interactions with one's social support network may help buffer the negative effects of stress and may indeed increase life satisfaction and well-being (Rozario et al., 2004; Szinovacz & Davey, 2006).

Previous empirical examinations of the effects of role strain and role enhancement on the health of grandparent caregivers yielded mixed results. Studies showed that grandparents, especially those who may have taken a hiatus from childcare while their own children were adults, may experience ill effects associated with intensive childcare responsibilities, including emotional stress, physical stress, financial strain, conflict with adult children, and role conflict (Burton, 1992; Mills, 2001; Minkler & Roe, 1996; Szinovacz, DeViney, & Atkinson, 1999). On the other hand, it is noteworthy that grandparenting was found to have positive consequences on the well-being of many grandparents. Many grandparents reported feelings of reward and satisfaction from the experience of caring for grandchildren (Pruchno & McKenney, 2002). Further, caregiving requires a grandparent to be physically active, which decreases health risks (King, Rejeski, & Buchner, 1998; Waldrop & Weber, 2001).

Other than the two theoretically plausible explanations described above, a third explanation is selection. In other words, grandparents who happen to be primary caregivers are

disproportionately "selected" into the caregiving experience and thus there may not be any causal linkage between caregiving and health. For example, Black and Hispanic grandparents who raise grandchildren are more likely to be less educated, impoverished, receive public assistance, and have functional limitations compared to non-caregivers (Minkler & Fuller-Thomson, 2005; Fuller-Thomson & Minkler, 2007; Luo, LaPierre, Hughes, & Waite, 2012). It is unclear, however, whether the health deficit of minority grandparents is caused by the caregiving experience or whether it reflects a selection bias due to a socioeconomically disadvantaged background. This selection explanation is consistent with cumulative inequality theory (CI) and the cumulative advantage/disadvantage perspective (CAD), which are deeply rooted in considerations of inequality in social systems, such as the intersections among race/ethnicity, class, and gender. These theoretical perspectives imply strong path dependence in the life course: early disadvantage accumulates and "constrains subsequent economic attainment and health maintenance" (O'Rand 2006, pp. 155; see also Dannefer, 2003; Ferraro, Shippee, & Schafer, 2009). This disadvantage could be first manifested as a selection effect in the analysis of grandparents' caregiving. That is, grandparents may be non-randomly selected into caregiving status by factors such as initial health status, socioeconomic status, needs of adult children, and sub-cultural norms, all of which vary significantly by race/ethnicity (Luo et al., 2012).

Finally, the role of grandparenthood must be understood within specific cultural contexts and normative family systems. In contrast to the norm of noninterference for White, middle-class families (Cherlin & Furstenberg, 1992), Black and Hispanic grandparents traditionally provide more extensive childcare for grandchildren. The "expected" nature of grandparenting could result in differential health effects. While low socioeconomic status and exposure to racism create a high level of stress among minority grandparents, ties to a social support network can

protect against the negative psychological and physical consequences (House, Umberson, & Landis, 1998). For example, researchers propose that certain features of Hispanic culture such as familism and religiosity may enhance health resiliency (Gallo, Penedo, Espinosa de los Monteros, & Arguelles, 2009).

Limitations of Empirical Research on Minority Grandparents

Despite the strengths of previous research on the well-being of grandparents who care for grandchildren, there remain significant limitations to previously published studies. First, although some empirical studies provide very detailed information on the experience and health implications of caregiving for minority grandparents, the samples are often selective and include only custodial grandparents (Balukonis, Melkus, & Chyun, 2008; Burnette, 1999; Burton & deVries, 1992; Goodman & Rao, 2007; Goodman & Silverstein, 2002; Jendrek, 1994; Letiecq, Bailey, & Kurtz, 2008; Minkler & Roe, 1993; Pruchno, 1999; Ross & Aday, 2006, also see reviews by Grinstead et al., 2003; Hayslip & Kaminski, 2005; Pruchno & Johnson, 1996). It is difficult to generalize from small non-representative samples, which often contain no proper comparison groups. In contrast, other studies using nationally representative data treat race/ethnicity as a control variable in the model, thus not providing any understanding of potentially different mechanisms through which grandparents' caregiving influences health for different racial/ethnic groups (see Blustein, Chan, & Guanais, 2004; Hughes et al., 2007). Using a longitudinal, nationally representative data (Health and Retirement Study), we attempt to examine how different mechanisms may intersect with each other and consequently influence race/ethnic disparities in health. In doing so, we address a key methodological disjunction in the literature on grandparents' caregiving with regard to internal and external validity.

Second, most studies of minority grandparents focus on Black grandmothers. Only a handful of studies are cross-racial/ethnic and include a direct comparison of Hispanic, White and Black grandparents (Bengtson, 1985; Goodman & Silverstein, 2005, 2006). Considering the growth rate of the Hispanic population in the U.S. and the pivotal role that Hispanic grandparents play in grandchildren's care, it is important to understand the process of grandparents' caregiving and the related health consequences for Hispanic grandparents. For example, recent studies suggest that Latina grandmothers derive higher life satisfaction from caring for grandchildren than White and Black grandmothers (Goodman & Silverstein, 2005, 2006). Although the reasons behind the Hispanic epidemiological paradox (i.e., in the U.S., the Hispanic population is healthier than the African American population despite similar socioeconomic disadvantages; Franzini, Ribble, & Keddie, 2001; Markides & Coreil, 1986; Markides & Eschbach, 2005) are still not fully understood, apart from migration selection, strong familism/kinship networks are often considered an underlying mechanism for the Hispanic advantage in the health literature. This hypothesis is worth testing in the context of grandparenting research.

Third, a majority of previous work uses cross-sectional indicators of health (Fuller-Thomson, Minkler, & Driver, 1997; Pruchno & McKenney, 2002; Sands & Goldberg-Glen, 2000; Szinovacz & Davey, 2006), or explores health change between two time points at best (Bachman & Chase-Lansdale, 2005; Blustein et al., 2004; Hughes et al., 2007; Szinovacz, DeViney, & Atkinson ,1999). Nonetheless, health change usually does not take place suddenly, but is often a gradual, interactive, and cumulative process. This paper is the first to examine the influence of grandparents' caregiving on health trajectories. For example, the amount of caregiving that grandparents provide may vary across time, depending on the needs of children. Grandparents' own life circumstances may change, including transitions in employment and

marital status. The synchronization of transitions in multiple roles and the timing of caregiving experience could have strong implications for grandparents' health.

Fourth and finally, existing studies mostly focus on one type of health outcome, such as depressive symptoms or functional limitations (for an exception, see Hughes et al., 2007). We use a composite measure of health, Frailty Index (FI), to capture the multidimensional nature of the aging process (Mitnitski et al., 2002; Rockwood et al., 2006). Quantified as the proportion of deficits present, including symptoms, disabilities, and disease classifications for a given person at a given time, the FI was recently conceptualized to capture the biological complexity of the comorbidity process, similar to the notion of "allostatic load" (Mitnitski, Song, & Rockwood, 2004; Rockwood et al., 2006). Rather than being just a count of deficits or a threshold classification of health, FI offers an estimation of the percentage of "frailty" present in any given individual by calculating the proportion of frail symptoms present in that individual. Recent studies consistently support FI as a robust, efficient, and systematic measure of health problems for older adults (Kulminski et al., 2008; Mitnitski et al., 2002; Woo et al., 2008). A recent study by Yang and Lee (2010) constructs the FI with 30 questions across waves from the Health and Retirement Study (HRS) and provides further evidence for the usefulness of the FI as a major health indicator that captures variability in individual rates of biological aging.

Research Hypotheses

The extent of help that grandparents provide for their grandchildren can vary considerably from one to the other. Some grandparents may engage in only occasional babysitting, while other grandparents spend intensive hours helping with childcare. In addition, family structure, such as non-coresident, multigenerational, or skipped generation households, is

also associated with different extents of care. In this paper, we examine the effects of two types of grandparenting indicators—amount of hours of caregiving and living arrangements (family structure). Our first hypothesis is that grandparents living in skipped generation households are likely to have the lowest level of health, followed up by multigenerational households, and then non-coresident households.

The effect of caregiving amount on health is harder to predict due in part to opposing theorizations of role strain, which hypothesize the potential for "role overload," stress, and health deterioration versus role enhancement, buffering of stress, and improved health. Therefore, limited hours of grandparent caregiving may provide fulfillment and benefit health, yet there also exists the possibility that network interactions in the context of caregiving are not explicitly positive or negative in nature but function in a balance of benefits and costs. Therefore, our second hypothesis is that caregiving amount has a gradient-like effect. We predict that limited hours of caregiving will be associated with better health while no caregiving at all or more intense hours of caregiving will be associated with worse health.

Because we expect the effect of grandparenting to differ by racial/ethnic group, we will also conduct subsample analysis. African American and Hispanic grandparents are disproportionately disadvantaged in the socioeconomic ladder and often have poorer health conditions regardless of their caregiving status. Heavy childcare involvement may induce additional stress and take an extra toll on their health. Therefore, our third hypothesis is that socioeconomic status affects racial/ethnic disparity in grandparents' health in several distinctive ways. However, socioeconomic status may affect health through a number of pathways. The influence may be direct as socioeconomic status affects one's life style and health behaviors, exposing one to different levels of stress, hazard, and risk, and is often associated with unequal

access to health care. And/or, socioeconomic status could also reflect selection, as grandparents in the lower socioeconomic strata are more likely to have adult children caught in troubled circumstances (e.g., drug abuse or divorce), and are therefore forced to take over the parenting role. Finally, socioeconomic status could have a moderating effect on grandparents' health. Financial deficits could compound the stress brought by off-time parenting, while more economic resources could help grandparents meet the demands of childcare. To address the various pathways of socioeconomic status in our analysis, we control for the direct effects of socioeconomic resources, use a propensity score weighting method in the analysis to control for selection into grandparenting, and examine interaction effects with socioeconomic measures.

In addition to socioeconomic status, cultural differences often exist across racial/ethnic groups in terms of norms and expectations about caring for grandchildren. It is not known whether such racial/ethnic differences in subcultural norms about grandparenting result in differential health effects. For example, the strong tradition of familism in Hispanic subcultures could mean that caring for grandchildren may induce less stress than in a cultural context where such caregiving is considered off-time and non-normative. Similarly, the kinship care network of African American families could provide essential social support to grandparents caring for grandchildren and serve as a buffer for adverse socioeconomic conditions. Therefore, our fourth hypothesis is that the health consequences of grandparent caregiving are conditioned by social resources (such as marital status and friend/kin ties). The key support systems for grandparents living with grandchildren may help offset the negative effects of the caregiver burden.

Finally, health change usually does not take place suddenly, but is likely a gradual, interactive, and cumulative process. Further, cumulating disadvantages associated with socioeconomic status, race/ethnicity, and gender also accumulate over time. CI and CAD

perspectives emphasize the importance of considering inequality across the life course and its effect on health, specifically highlighting the risk women, minorities, and those from lower socioeconomic positions face. Using panel data spanning twelve years, we are in an excellent position to capture the immediate and long term consequences of grandparent caregiving and how it may intersect with socioeconomic status, race/ethnicity, and gender to influence one's health trajectory. Our fifth and final hypothesis is that persistent exposure to caregiving, such as in the form of intense caregiving over a longer period of time, may worsen health. We test for this hypothesis only in the non-Hispanic Black grandparent sample, given its disproportional over-representation in the skipped generation households and its association with the strongest negative health deficit.

Data and Measurement

We test these hypotheses by using the Health and Retirement Study (HRS 1998, 2000, 2002, 2004, 2006, 2008, and 2010), a nationally representative, longitudinal panel study of older adults (aged 50 and over) in the United States. Racial/ethnic minorities (Blacks and Hispanics) are oversampled in the HRS. The sample contains 13,283 White (non-Hispanic) respondents, 2,546 Black (non-Hispanic) respondents, and 1,649 Hispanic respondents who are grandparents during the period between 1998 and 2010. From this point forward, the term "White" refers to White, non-Hispanics and "Black" refers to Black, non-Hispanics. We delete grandparents reporting "Other" race/ethnicity (264 in 1998, 257 in 2000, 243 in 2002, 289 in 2004, 271 in 2006, 260 in 2008, and 240 in 2010) from the sample to keep the comparison simple and to focus our research on the theorized White, Black and Hispanic comparison. Our overall sample includes 10,312 individuals in 1998, 9,804 individuals in 2000, 10,001 individuals in 2002,

10,741 individuals in 2004, 10,106 individuals in 2006, 10,189 individuals in 2008, and 8,515 individuals in 2010. Altogether, 17,478 noninstitutionalized individuals are included in the sample and each individual is observed 4.0 times on average from 1998 to 2010. Within this sample, 4,615 individuals died between 1998 and 2010. This yields a person-period dataset of 69,668 total observations (see Table 1)[1].

Key variables of interest are grandparents' living arrangements and amount of caregiving they provide for their grandchildren. We choose these two separate measures to reflect our conceptualization of grandparent care. Hours of caregiving and residential status are separate, but overlapping concepts. Specifically, not all coresidential grandparents in our sample provide a high level of care to grandchildren and, likewise, a sizable proportion of non-coresidential grandparents in our sample are also heavily involved with grandchildren care. This conceptual difference is particularly important when focusing on race/ethnicity, as different norms and practices about grandchild care exist across racial-ethnic groups.

As seen in Table 1, most grandparents in the HRS sample do not live with their grandchildren (93.8%). At the same time, there are substantial differences by racial/ethnicity in grandparents' coresidential patterns. Three times as many Black (11.4%) and Hispanic

[1] Only 0.07 percent of the sample is missing on the dependent variable and the rest are missing on various independent variables, ranging from 0.1 percent to 7.8 percent. Most of the variables have less than 2 percent missing, with the exception of hours of caregiving (7.8 percent) and average of frequency of interaction (4.6 percent). The overall working sample excludes missing values on any variable included in the analysis (averaged around 1,836 individuals across waves, excluding death, loss to follow-up, and missing information about grandchild care). We conducted sensitivity tests using mean imputation and dummy variable adjustment (including a dummy variable suggesting missingness in the model). The results are robust, so we treat them as missing at random. Because the hours of caregiving variable has the highest missing cases and about 10 percent of coresidential grandparents are missing on this variable, we take extra precaution by alternatively coding the variable in all possible values of caregiving hours. Again the results are insensitive to different specifications.

grandparents (13.1%) live in multigenerational households compared to White grandparents (3.3%). Further, Black grandparents have the highest rate of skipped generation residency (5.3%), followed by that of Hispanic grandparents (3.3%) and White grandparents (1.0%).

-Table 1 about here-

HRS respondents were also asked whether they had spent 100 hours or more taking care of grandchildren in the previous two years. If respondents answered yes, they were then asked how many hours they had spent on grandchild care. Based on this question, we construct a three-category variable that captures the amount of caregiving provided by grandparents: 0-99 hours in two years, 100-499 hours, and 500+ hours. Similar to the distribution of living arrangements, a majority of grandparents provide extremely low hours of care to grandchildren (68.2% in the 0-99 hours category). At the same time, about 14.1% of grandparents provide over five hundred hours of care to grandchildren.

Dependent Variable: Frailty Index

The dependent variable is the Frailty Index. We follow Yang and Lee (2010) in their construction of the FI using the HRS data, by including 30 questions on chronic illnesses, disabilities in activities of daily living (ADL), disabilities in instrumental activities of daily living (IADL), depressive symptoms, self-reported health, and obesity (body mass index ≥30). The FI is defined as a count of deficits divided by the total number of possible deficits. It is thus a proportion, with values typically ranging from 0 to 1. To aid the interpretation of the coefficients, we multiply it by 100 and thus change it into a percentage measure. While all these measures are based on self reports, studies comparing respondents' reports and physician evaluations of morbidity have found considerable evidence for the accuracy of the respondents' reports when

comparing survey data with data gathered from medical records, medical tests, and physician interviews (Ford et al., 1990; Guralnik et al., 1996; Harlow & Linet, 1989).

We find that grandparents with no grandchildren living in the house have a lower level of frailty than those who live with grandchildren (Figure 1.1). There is not a clear difference between those who live in multigenerational households and skipped generation households, except for the Black sample, where grandparents living in skipped generation households have the highest frailty level. At the same time, those who provide the least amount of care to grandchildren have the highest frailty level across different racial/ethnic groups (Figure 1.2).

-Figure 1.1 and 1.2 about here-

Bivariate analysis of grandparents' living arrangements and amount of caregiving clearly suggests that grandparent involvement is associated with varied level of Frailty Index scores. Further, the pattern differs by racial/ethnic group. Nonetheless, caregiving for grandchildren does not occur at random, but rather reflects individuals' characteristics, family context, and cultural choices. Does the bivariate relationship we observe hold up after taking these contextual factors into account? In the following section of the paper, we describe our research strategy and findings from the multivariate analysis.

Growth Curve Analysis

We analyze these data using growth curve models or hierarchical linear models (HLM), which allow us to examine the effects of grandparent caregiving on health (Frailty Index) initially and over time, and to incorporate other time varying and time invariant predictors

(Raudenbush & Bryk, 2002). We specify two-level hierarchical linear models to estimate age trajectories of health and heterogeneity in these trajectories by grandparent caregiving:

Level-1 Model:

$$y_{ti} = \beta_{0i} + \beta_{1i} Age_{ti} + \beta_{2i} Age_{ti}^{2} + e_{ti} \quad (1)$$

Level-2 Model:

Model for the intercept:

$$\beta_{0i} = \gamma_{00} + \gamma_{01} X_{1i} + \gamma_{02} X_{2i} \ldots + \gamma_{0q} X_{qi} + u_{0i} \quad (2)$$

The level-1 model characterizes within-individual change of Frailty Index over time or individual growth trajectory with age. In this model of repeated measurement within individuals, the response variable y_{ti} (Frailty Index) for person i at time t is modeled as a function of linear and quadratic terms of age for person i at time t. The coefficients β_{0i}, β_{1i}, and β_{2i} represent the intercept or mean level, the linear rate of change, and the quadratic rate of change in Frailty Index with age, respectively. The error term e_{ti} is assumed to be independently and normally distributed with a mean of 0 and a constant variance of σ^2.

The goal of the level-2 analysis is to detect heterogeneity in change across individuals and to determine the association between predictors and the shape of each person's growth trajectory in Frailty Index. Individual is the unit of analysis and modeling is performed to capture how characteristics of the individual alter β_{0i}, a parameter in the level-1 analysis (see equation 2). The growth curve (HLM) model allows data to be unbalanced across time because it includes all persons when estimating trajectories, irrespective of attrition status or number of waves in a person-period dataset (Raudenbush & Bryk, 2002). In preliminary analysis, we model β_{1i} and β_{2i} respectively, but do not include them in the final analysis because of the lack of significant

results for our key grandparenting variables. Thus, our growth curve model is essentially a random intercept model.

The key independent variables for the analysis are grandparenting variables, measured in two ways: coresidence status and amount of caregiving, as described in above univariate and bivariate analysis. They are time-varying and measured at the same waves over time as the dependent variable (FI). For the Black sample, we also consider history of being in a skipped generation household in supplementary analysis. Among the Black grandparents who have ever lived in skipped generation households, about eighty-six percent of them having such a living arrangement for 1-3 waves, while the rest lived in skipped generation households for 4 waves or more. Control variables are entered at level-1 for time-varying covariates (such as socioeconomic status, social support) and at level-2 for time-constant covariates (such as gender, attrition status). Descriptive statistics of all the variables are presented in Table 2. In addition to standard demographic variables such as age (years), sex, and nativity (foreign born versus not), we include measures for socioeconomic status (SES) and social support. Measures of SES include education (number of years of education), household income (natural log), and the net value of all financial non-housing wealth (divided by 100,000). We also include additional measures of SES that are more specific to the economic resources and needs of older populations, including whether or not the respondent indicates that he/she has long term care insurance, whether or not the respondent is currently receiving a pension, and whether or not the respondent is currently working for pay. Measures of social support include whether or not the respondent is married or partnered, has a relative living nearby, has a friend living nearby, and the frequency of interaction (number of times gets together with someone) per week.

Following statistically significant interactions with race/ethnicity (results not shown), we run separate analyses by the sub-samples of race/ethnicity. In preliminary analysis we conduct separate analysis for grandmothers and grandfathers, but did not find any significant difference in the subsamples. We use restricted maximum likelihood estimation to obtain the parameter estimate, using the "Proc Mixed" procedure in SAS (which estimates hierarchical linear models in SAS) as well as Akaike information Criterion (AIC) and Bayesian Information Criterion (BIC) to assess goodness of fit of the model (Singer & Willett, 2003).

-Table 2 about here-

Further, we take additional cautionary steps in addressing potential issues of sample selection. First, longitudinal data analysis is often prone to sample attrition by loss to follow up and mortality. We control for the potential influence of selection in all models by entering dummy variables indicating the deceased and non-respondents in the level 2 models to yield unbiased estimates, a relatively straightforward and intuitive approach to account for non-random-selection through attrition (see also Yang & Lee, 2010; Chen & Liu, 2012). Second, we use propensity score weighting to account for non-random selection, because intensive care is most likely to be selective in nature, as compared to occasional babysitting (Guo & Fraser, 2009). We first estimate a logistic regression to determine the conditional probability of child care provided by the grandparents (500 hours or more versus not), using covariates including household structure (multigenerational, skipped-generation, no grandchild), demographic characteristics (such as age, gender, race/ethnicity, foreign born status), SES measures (such as employment and income), health conditions, as well as measures capturing the potential needs for childcare by adult children (such as whether children experience marital or partnership disruption in the last two years, whether new grandchildren were born in the last two years,

whether providing financial help to children or grandchildren in the last two years, whether paying for adult children's education, number of adult children working full-time, whether adult children live within ten miles, whether adult children are in school) (results available upon request). We then calculate a weight measure based on the predicted probabilities generated from the models (the propensity scores) using the following formula (Hirano & Imbens, 2001):

$$w(t,x) = \frac{t}{\hat{e}(x)} + \frac{1-t}{1-\hat{e}(x)}$$

where $\hat{e}(x)$ represents the estimated propensity scores and t stands for treatment (whether provided 500 hours or more of childcare in the past two years). The propensity score weight is then included in all growth curve models as a sampling weight (Guo & Fraser, 2009). Comparison of models using the weight versus not shows that the magnitude of the grandparenting variables are smaller than those without the adjustment, suggesting potential selection effects were captured by using propensity score weighting (results not shown).

Results and Findings

Results of the growth curve analyses are presented in Tables 3-4. Because the effect of grandparent caregiving differs greatly and statistically significantly from one racial/ethnic group to the other, we split the samples to three subgroups: non-Hispanic Whites, non-Hispanic Blacks, and Hispanics. We begin with a model including age, squared age, gender, whether one is foreign born, and most importantly, our key independent variables, categories of grandparent caregiving hours and grandparents' coresidence status. We then add indicators of socio-economic status, various measures of social support, and attrition status. The effects of the grandparenting variables remain robust across models, so we present only the full models in Table 3.

-Table 3 about here-

The results clearly suggest that provision of care for grandchildren as well as coresidence status affects the FI of grandparents from different racial/ethnic groups in distinctive ways. First, caregiving for grandchildren has a protective effect on Frailty Index (FI), although the intensity of care does not seem to matter a great deal. White and Black grandparents experience decreases in frailty when providing moderate (100-499 hours in the last two years decreases frailty by 0.549 and 0.747, respectively) and high amounts of caregiving (500 hours or more in the last two years decreases frailty by 0.481 and 0.714, respectively) compared to grandparents who provide minimal caregiving (0-99 hours in the last two years). For the Hispanic sample, a moderate level of caregiving (100-499 hours in two years) does not have a statistically significant effect, but a higher level of caregiving decreases FI by 1.220, an effect that is more than twice as strong as that of non-Hispanic White grandparents. In other words, a high level of caregiving in the last two years reduces frailty in this sample by about one half to a little over one percent at any given time, depending on the race/ethnicity of the grandparent.

At the same time, while providing care for grandchildren is negatively associated with FI for the Non-Hispanic White and Black samples, the effect of coresidence status is in the opposite direction. Non-Hispanic White grandparents who live in multigenerational households have a level of frailty that is 0.572 higher, or about a half percent higher, than those who do not live with grandchildren. Interestingly, Black grandparents who live in multigenerational households are not worse off in terms of frailty compared with those who do not live with grandchildren. However, Black grandparents who live in skipped generation households are much higher in their FI (2.027 units) than those who do not live with grandchildren. In other words, Black grandparents in skipped generation households are two percent more frail than those who do not

live with grandchildren. In contrast, coresidence has no significant effect on the level of frailty for Hispanic grandparents, and the coefficients are even in the opposite direction compared with the other two race/ethnic subsamples.

Because Black grandparents are overrepresented in skipped generation households and also experience the strongest negative health deficit from this household structure, we further examine the history of living arrangements on FI to explore the effect of long-term skipped generation household residence. We summarize the key findings in Figure 2, instead of presenting an additional table, because the effects of the other variables in the model are consistent from those in Table 3. The additional analysis suggests that Black grandparents who live in skipped generation households any time between 1-3 waves are 3.256 higher in FI, or three percent more frail, than those who never live in skipped generation households during this 12 year interval. Such a health deficit is more than doubled (8.030) when they live in skipped generation households for 4 waves of the study. In other words, after controlling for a range of selection factors and other characteristics over time, Black grandparents who lived in a skipped generation household for about 8 years are eight percent more frail than Black grandparents who have never resided in a skipped generation household. We note that the effect of being in skipped generation households in 5-7 waves is in the opposite direction, which could suggest a potentially beneficial effect of long-term stability in family living arrangements. However, the effect is non-significant and very few grandparents lived in skipped generation households for more than 4 waves. Thus, we refrain from making any generalized interpretation of this effect.

-Figure 2 about here-

All the control variables behave in the expected directions across different racial and ethnic groups. For example, grandmothers tend to have a higher level of frailty, with Black

grandmothers suffering from the largest number of health deficits compared to Black grandfathers. Higher income, higher level of education, receiving a pension, and currently working is associated with lower level of FI across different racial/ethnic samples. Social support also matters. Married grandparents are less frail than unmarried grandparents, regardless of race/ethnicity. Having friends living nearby reduces frailty in both the non-Hispanic White and Black sample. Frequency of interaction with friends and relatives also has a significant negative effect on FI for the non-Hispanic White sample.

We further test the hypotheses of whether the *negative* health effects of grandparent-grandchildren coresidence are moderated by socioeconomic resources and social support for different racial/ethnic subsamples. We did not test for interaction effects with the caregiving hours variable, because we find the main effects to be protective (opposite in direction of the effect of coresidence). While we expect that better socioeconomic resources and social support may ameliorate the adverse effect of coresidence, we do not hypothesize or find any evidence that they will enhance the beneficial effect of providing some amount of caregiving. We interact the coresidence variables with all measures of socioeconomic resources and social support. The statistically significant findings are presented in Table 4[2]. Because the main effects of coresidential status are not statistically significant for the Hispanic subsample, we do not include this group in Table 4. For non-Hispanic White grandparents who live in skipped generation households, the health deficit is reduced, for those with higher education and higher net wealth. Similarly, for the non-Hispanic Black grandparents, higher household income reduces the negative effect of a skipped generation living arrangement. At the same time, frequent interaction

[2] We dropped two sets of interaction terms (household structure*income in the White subsample, and household structure* net wealth in the black subsample, out of concern for collinearity and model parsimony.

with friends and relatives appears to buffer the negative health consequences rendered by skipped generation living arrangements for both non-Hispanic White and Black grandparents.

-Table 4 about here-

Discussion and Conclusion

Our results suggest that grandparent caregiving affects health through a complex process of role strain and role enhancement, filtered through a cumulative inequality/disadvantage lens, for grandparents of different race/ethnicities. First, it is important to recognize the influence of selection in grandparent caregiving. Not all grandparents are equally likely to provide care for grandchildren or to live in the same household with them. In our analysis, we explicitly take into account a possible selection effect by using propensity score weighting in our growth curve models. Guided by the cumulative inequality perspectives (Dannefer, 2003; Ferraro et al., 2009), we find that providing care for grandchildren is not a random process, but instead is driven by the needs of adult children as well as the characteristics of grandparents (such as race/ethnicity, SES, and health). Indeed, using propensity score weighting appears to attenuate the negative effects of coresidence and the positive effects of caregiving, underscoring the importance of considering positive and negative selection into grandparent caregiving.

Second, some of the observed consequences of grandparent involvement (both positive and negative) remain strong after adjustment for propensity score weighting, suggesting a clear independent effect of grandparent caregiving on health. In addition, health consequences of grandparent caregiving clearly differ by racial/ethnic groups. First, consistent with our first hypothesis, coresidence is associated with negative health consequences, but only for non-Hispanic White and Black grandparents. For non-Hispanic White grandparents, living with grandchildren has adverse consequences for overall health. Black grandparents who live in a

skipped generation household experience the highest level of health deficit. If we assume that grandparents who live with grandchildren without the presence of adult children are custodial grandparents, it seems that these grandparents are the most adversely affected group. Our descriptive statistics as well as previous literature illustrate that Black grandparents' economic position is precarious, even before accounting for grandchild care. Thus, consistent with the role strain theory (Goode, 1960; Rozario et al., 2004), Black grandparents who coreside with grandchildren in skipped generation households likely face additional financial, mental, and physical challenges, the combination of which translate into the worst overall health. Although it is possible that household stability reduces harm over the extreme long-term, we find that lengthy coresidence in a skipped generation household leads to further health deterioration particularly for African American grandparents. This finding is consistent with cumulative inequality and cumulative disadvantage theory (Dannefer, 2003; Ferraro et al., 2009) and highlights the health risks faced by African American custodial grandparents in the U.S..

Counter to our first hypothesis, we do not find any negative health effects of coresidence with grandchildren for Hispanic grandparents. This finding is particularly meaningful considering that Hispanic grandparents coreside with grandchildren more than White grandparents. On the other hand, consistent with previous literature (Fuller-Thomson et al., 1997), Hispanic grandparents in our analysis are far less likely than Black grandparents to live in skipped generation households. These caregiving and residential circumstances reveal distinguishing details about Hispanic grandparents. Like African Americans, Hispanic Americans likely have a stronger cultural emphasis on more traditional familistic values and family roles related to increased desire for and benefit from, the caregiving role for grandchildren (Fuller-Thomson et al., 1997; Gallo et al., 2009). Despite adverse life circumstances, emphasis on social

resources and familism may enhance health resiliency for Hispanic grandparents caring for grandchildren. This is a plausible explanation given that more than half of the Hispanic grandparents in our sample are foreign born. However, Hispanic grandparents are also more likely than Black grandparents to have adult children present in the household, which may provide a key buffer that enhances their health resiliency. In other words, the structural vulnerability of Hispanic grandparents may be moderated by their emphasis on familism. For Hispanic grandparents, strong familism may function as part of a cultural tool kit that diversifies family caregiving strategies and nullifies the negative effects of coresidence on health (see Swidler, 1986).

In addition to role strain mechanisms, we also find evidence for role enhancement theory and partial support for our second hypothesis regarding the benefits of limited hours of caregiving. Controlling for coresidency status, grandparent caregiving is beneficial for health. We observe similar effects across race/ethnic groups, with even stronger effects for Hispanic grandparents. Although healthier grandparents are more likely to care for grandchildren, our propensity score weight adjustment accounts for previous health status thereby reducing the possibility that this finding is due solely to selection bias. Therefore, despite variation in household structure, social resources, and socioeconomic resources, it appears as though moderate amounts of caregiving are not detrimental to grandparents' health in the U.S.. It is possible that some degree of care to grandchildren may enhance physical activity, provide a healthy amount of role fulfillment, and benefit grandparents.

Our analysis also offers preliminary support for our third and fourth hypotheses. Socioeconomic status partially explains racial/ethnic disparities in grandparent health, but potentially in complex ways that point to the significance of several moderating mechanisms that

also differ by race/ethnicity. Consistent with previous research (House et al., 1998; O'Rand, 2006; Rozario et al., 2004; Szinovacz & Davey, 2006), we find that better economic resources (e.g., income, education) and social ties (e.g., frequent social interactions) seem to offset some of the negative effects of a potentially stressful event such as coresidence. Because Hispanic grandparents do not experience health declines associated with coresidence, the buffering effect of these resources applies only to White and Black grandparents, yet the effects differ. For example, White grandparents experience this buffer only when in skipped generation households, yet very few of them live in this type of household structure and it is not directly related to poor health. In contrast, the health of Black grandparents is buffered in both skipped and multigenerational households. For both groups, higher education and frequency of interaction are important, but wealth is more important for White grandparents and income is more important for Black grandparents. These varying effects delineate differential profiles of life course resource and risk accumulation among White, Black, and Hispanic grandparents (Dannefer, 2003; Ferraro et al., 2009). Not only do White, Black, and Hispanic grandparents perform different types of care, but they also likely rely on different forms of resources to cope with the stress of caregiving. Therefore, although the moderating effects of these social and economic resources are small, they provide some example of potential buffers to cumulative disadvantage. Finally, resource buffers are particularly important for Black grandparents in skipped generation households who, consistent with our fifth hypothesis as well as previous research (Bachman & Chase-Lansdale, 2005; Minkler & Fuller-Thomson, 2005; Pruchno & McKenney, 2002; Ross & Aday, 2006; Szinovacz et al., 1999), are at the highest risk for the negative health consequences of caring for grandchildren.

Despite this contribution, our study is not without limitations. First, our measure of amount and intensity of grandchild caregiving is rather crude. By measuring amount in terms of raw hours cared over two years, we may be missing key details in transitions and variation within that two-year window. In addition, the differences between 0-99 hours, 100-499, and 500 or more hours may be rather subjective, considering the difficulty of self-assessing raw hours cared over two years as well as the fact that 500 or more hours over two years still represents a relatively moderate amount of care. In terms of coresidence, we examine the presence of a grandchild and the presence of an adult child. In HRS data, the adult child present may or may not be the parent of the grandchild. Future research should continue to explore multiple measures for grandchild care amount and intensity, as well as the selection and buffering effects of social and economic resources. Taken together, these various factors offer important new information about the long-term trajectories of grandparents' health change and underscore differential risk in those trajectories by race/ethnicity.

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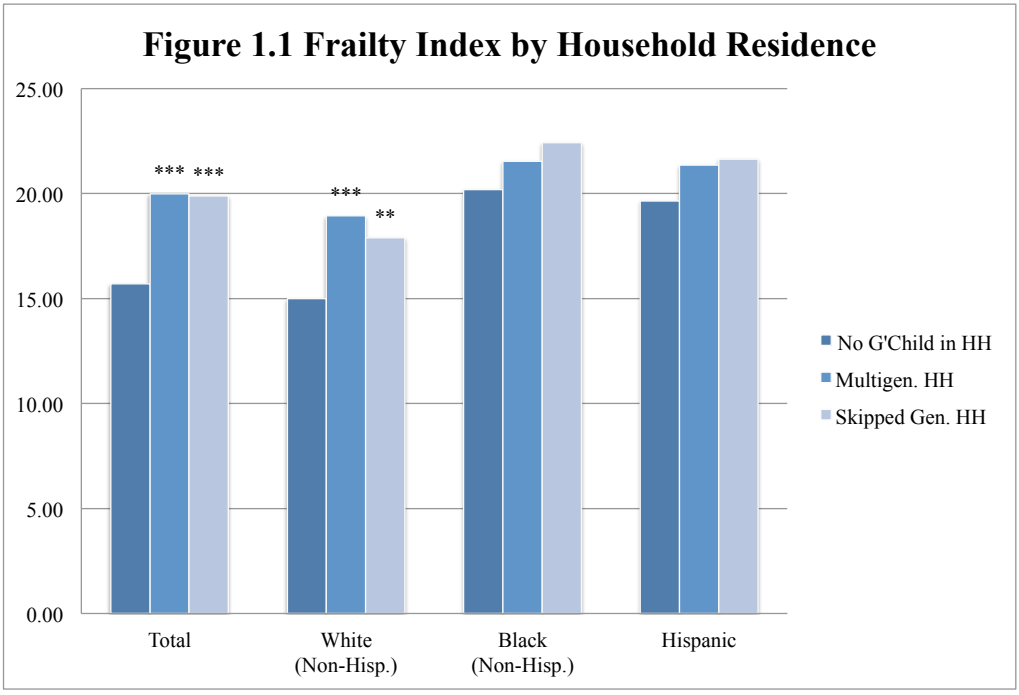
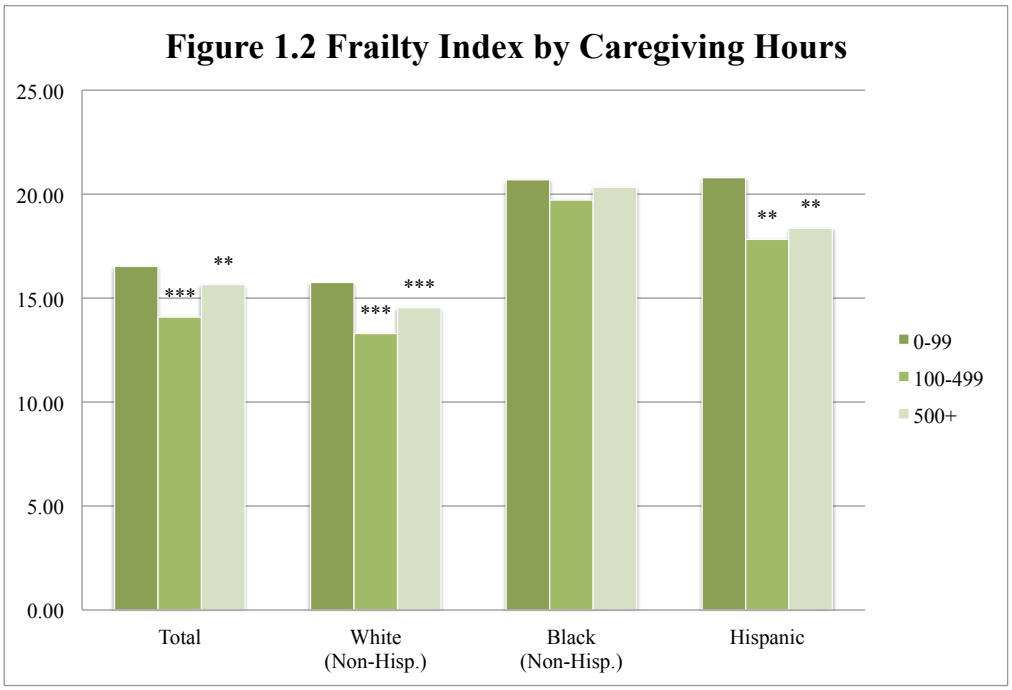
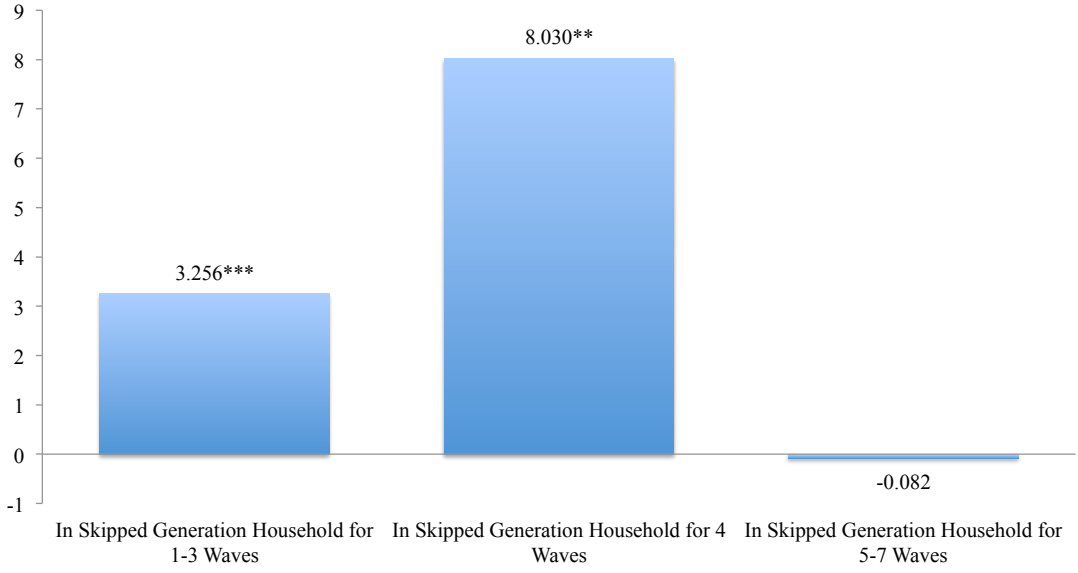


*p<0.05; **p<0.01; ***p<0.001
Notes: Data are weighted to represent the U.S. population, using HRS wave-specific weight.
No G'Child in HH is the reference group in bivariate analyses.



*p<0.05; **p<0.01; ***p<0.001
Notes: Data are weighted to represent the U.S. population, using HRS wave-specific weight.
0-99 is the reference group in bivariate analyses.

Figure 2. Effects of Household History for Non-Hispanic Black Grandparents in Skipped Generation Households



*p<0.05; **p<0.01; ***p<0.001

Notes: N=9,484 obs. The reference category is never being in a skipped generation household. In Skipped Generation Household for 1-3 Waves=1,176 obs., In Skipped Generation Household for 4 Waves=78 obs., In Skipped Generation Household for 5-7 Waves=113 obs. The model includes individual-level covariates (age, age squared, female, foreign-born, caregiving hours, skipped generation household history, education, income, net wealth, has long-term care insurance, currently receiving pension, currently working for pay, married/partnered, relative living nearby, friend living nearby, frequency of interaction, deceased, loss to follow up). Results adjusted for propensity score weighting respectively for the black non-hispanic subgroup.

Table 1. Caregiving Hours and Household Residence for Total Sample and Race/Ethnic Subgroups

	Total Sample (N=69,668 obs.)	**White, Non-Hispanic** (N=54,178 obs.)	**Black, Non-Hispanic** (N=9,484 obs.)	**Hispanic** (N=6,006 obs.)
Residence				
% No Grandchild in Household	93.76	95.76	83.31	83.62
% Multigenerational Household	4.68	3.25	11.35	13.06
% Skipped Generation Household	1.56	1.00	5.33	3.32
Grandparent Caregiving				
% Caring 0-99 Hours/2 Yrs.	68.23	68.76	63.66	67.96
% Caring 100-499 Hours/2 Yrs.	17.68	18.15	15.89	14.33
% Caring 500+ Hours/2 Yrs	14.09	13.08	20.44	17.72

Notes: Data are weighted to represent the U.S. population, using HRS wave-specific weight.

Table 2. Mean Statistics for Total Sample and Race/Ethnic Subgroups

	Total Sample (N=69,668 obs.)	**White, Non-Hispanic** (N=54,178 obs.)	**Black, Non-Hispanic** (N=9,484 obs.)	**Hispanic** (N=6,006 obs.)
Frailty Index (%)	15.972	15.146	20.462	19.938
	(0.178)	(0.169)	(0.401)	(0.521)
Age	67.008	67.508	64.620	64.162
	(0.178)	(0.213)	(0.261)	(0.535)
Female (Yes=1, No=0)	0.589	0.581	0.650	0.604
	(0.004)	(0.004)	(0.010)	(0.015)
Foreign Born (Yes=1, No=0)	0.074	0.040	0.055	0.515
	(0.005)	(0.003)	(0.006)	(0.023)
Socioeconomic Status				
Education (Years)	12.505	12.913	11.541	8.855
	(0.074)	(0.049)	(0.101)	(0.342)
Income (Ln)	10.456	10.597	9.848	9.574
	(0.022)	(0.018)	(0.030)	(0.069)
Net Wealth (/100,000)	1.282	1.497	0.171	0.163
	(0.087)	(0.102)	(0.028)	(0.024)
Has Long-Term Care Insurance (Yes=1, No=0)	0.118	0.130	0.068	0.037
	(0.005)	(0.005)	(0.005)	(0.004)
Currently Receiving Pension (Yes=1, No=0)	0.277	0.296	0.217	0.128
	(0.006)	(0.007)	(0.011)	(0.013)
Currently Working for Pay (Yes=1, No=0)	0.383	0.383	0.398	0.364
	(0.006)	(0.007)	(0.013)	(0.014)
Social Support				
Married/Partnered (Yes=1, No=0)	0.678	0.709	0.441	0.628
	(0.005)	(0.005)	(0.013)	(0.017)
Relative Living Nearby (Yes=1, No=0)	0.298	0.296	0.332	0.285
	(0.006)	(0.007)	(0.014)	(0.010)
Friend Living Nearby (Yes=1, No=0)	0.670	0.681	0.616	0.604
	(0.005)	(0.006)	(0.013)	(0.014)
Frequency of Interaction/Week	1.831	1.810	2.146	1.665
	(0.030)	(0.034)	(0.078)	(0.079)
Attrition Status				
Deceased (Yes=1, No=0)	0.155	0.158	0.150	0.122
	(0.004)	(0.004)	(0.010)	(0.011)
Loss to Follow Up (Yes=1, No=0)	0.005	0.006	0.002	0.004
	(0.001)	(0.001)	(0.001)	(0.001)

Notes: Data are weighted to represent the U.S. population, using HRS wave-specific weight.
Standard error of means are presented in parentheses.

Table 3. Growth Curve Models Predicting Frailty Index for Race/Ethnic Subgroups

	White (Non-Hisp.) (N=54,178 obs.)	Blacks (Non-Hisp.) (N=9,484 obs.)	Hispanics (N=6,006 obs.)
FIXED EFFECTS			
Intercept	28.389 ***	29.725 ***	28.561 ***
	(0.659)	(1.354)	(1.438)
Linear Growth Rate: Age	0.191 ***	0.087 **	0.047
	(0.011)	(0.030)	(0.039)
Non-Linear Growth Rate: Age^2	0.011 ***	0.011 ***	0.007 *
	(0.001)	(0.002)	(0.003)
Female	0.708 ***	4.165 ***	3.519 ***
	(0.195)	(0.560)	(0.706)
Foreign Born	-0.876	-1.883	-0.530
	(0.473)	(1.117)	(0.709)
Caregiving Hours			
100-499 Hours/2 Yrs.	-0.549 ***	-0.747 *	-0.846
	(0.109)	(0.329)	(0.475)
500+ Hours/2 Yrs.	-0.481 ***	-0.714 **	-1.220 **
	(0.105)	(0.276)	(0.380)
(Ref. Cat.=0-99 Hours/2 Yrs.)			
Household Residence			
Multigenerational Household	0.572 **	0.162	-0.224
	(0.220)	(0.378)	(0.499)
Skipped Generation Household	0.125	2.027 ***	-0.453
	(0.279)	(0.457)	(0.727)
(Ref. Cat.=No G'Child in Household)			
Socioeconomic Status			
Education (Years)	-0.818 ***	-0.793 ***	-0.493 ***
	(0.038)	(0.085)	(0.081)
Income (Ln)	-0.124 **	-0.201 *	-0.346 ***
	(0.044)	(0.093)	(0.093)
Net Wealth (/100,000)	-0.005	-0.263	-0.206
	(0.005)	(0.136)	(0.264)
Has Long-Term Care Insurance	-0.376 **	0.253	1.214
	(0.140)	(0.435)	(0.789)
Currently Receiving Pension	-0.479 ***	-1.332 ***	-1.531 **
	(0.112)	(0.313)	(0.531)
Currently Working for Pay	-2.488 ***	-3.706 ***	-4.525 ***
	(0.107)	(0.299)	(0.425)
Social Support			
Married/Partnered	-2.723 ***	-1.336 **	-2.910 ***
	(0.155)	(0.410)	(0.553)
Relative Living Nearby	0.181 *	0.289	0.534
	(0.088)	(0.250)	(0.337)
Friend Living Nearby	-0.706 ***	-0.823 ***	-0.466
	(0.086)	(0.244)	(0.306)
Frequency of Interaction/Week	-0.015 **	0.022	0.009
	(0.005)	(0.011)	(0.033)
Attrition Status			
Deceased	3.630 ***	5.012 ***	4.736 ***
	(0.239)	(0.637)	(0.938)
Loss to Follow Up	-1.910 **	1.071	-6.439
	(0.735)	(3.224)	(3.932)
RANDOM EFFECTS			
Level 1: Within-Person	75.812 ***	108.610 ***	127.120 ***
Level 2: In Intercept	0.265 **	0.927 **	1.806 ***
In Linear Growth Rate	0.357 ***	0.441 ***	0.393 ***
GOODNESS OF FIT			
AIC	332017.800	58631.900	37704.600
BIC	332047.800	58655.200	37726.200

*p<0.05; **p<0.01; ***p<0.001

Notes: Results adjusted for propensity score weighting respectively for each race/ethnic subgroup.

Table 4. Growth Curve Models Predicting Frailty Index for Race/Ethnic Subgroups with Statistically Significant Interaction Effects

	White (Non-Hisp.) (N=54,178 obs.)	Blacks (Non-Hisp.) (N=9,484 obs.)
FIXED EFFECTS		
Intercept	28.297 ***	29.219 ***
	(0.660)	(1.417)
Household Residence		
Multigenerational Household	0.166	0.232
	(1.113)	(2.349)
Skipped Generation Household	9.469 ***	11.843 ***
	(1.398)	(3.259)
(Ref. Cat.=No G'Child in Household)		
Socioeconomic Status		
Education (Years)	-0.807 ***	-0.748 ***
	(0.038)	(0.088)
Income (Ln)	-0.124 **	-0.202 *
	(0.044)	(0.103)
Net Wealth (/100,000)	-0.005	-0.258
	(0.005)	(0.136)
Social Support		
Frequency of Interaction/Week	-0.049 ***	0.021
	(0.009)	(0.014)
INTERACTION EFFECTS		
Multigen.HH*Education (Years)	0.020	-0.354 **
	(0.088)	(0.127)
Skip.Gen.HH*Education (Years)	-0.721 ***	-0.014
	(0.114)	(0.163)
Multigen.HH*Income (Ln)		0.399
		(0.221)
Skip.Gen.HH*Income (Ln)		-0.912 **
		(0.312)
Multigen.HH*Net Wealth	0.162	
	(0.125)	
Skip.Gen.HH*Net Wealth	-0.342 **	
	(0.124)	
Multigen.HH*Freq. of Interaction	0.047 ***	0.016
	(0.011)	(0.024)
Skip.Gen.HH*Freq. of Interaction	-0.196 **	-0.234 **
	(0.072)	(0.088)
RANDOM EFFECTS		
Level 1: Within-Person	75.787 ***	108.070 ***
Level 2: In Intercept	0.272 **	0.919 **
In Linear Growth Rate	0.356 ***	0.439 ***
GOODNESS OF FIT		
AIC	331949.000	58619.800
BIC	331979.000	58643.200

*p<0.05; **p<0.01; ***p<0.001

Notes: All models include individual-level covariates (age, age squared, female, foreign-born, caregiving hours, household residence, education, income, net wealth, has long-term care insurance, currently receiving pension, currently working for pay, married/partnered, relative living nearby, friend living nearby, frequency of interaction, deceased, loss to follow up). Results adjusted for propensity score weighting respectively for each race/ethnic subgroup. Results for Hispanic sample is not presented because no significant interaction effect is found.