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Brenda C. Spillman  
Sharon K. Long

## Does High Caregiver Stress Predict Nursing Home Entry?

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*This study estimates how informal care, paid formal care, and caregiver stress or burden relate to nursing home placement. Data came from the 1999 National Long Term Care Survey and were merged with administrative data. Results show that stress is a strong predictor of entry over follow-up periods of up to two years, and physical strain and financial hardship are important predictors of high levels of caregiver stress. The estimates indicate that reducing these stress factors would significantly reduce caregiver stress and, as a result, nursing home entry. We conclude that initiatives to reduce caregiver stress hold promise as a strategy to avoid or defer nursing home entry.*

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Informal, primarily unpaid, care provided by family and friends is universally recognized to be the foundation of the long-term care system for older Americans. More than 90% of chronically disabled elders who remain in community residence and receive help with basic activities of daily living get some help from informal caregivers, primarily their spouses or children; nearly two-thirds receive all of such help from informal caregivers (Spillman and Black 2005). Recent reports have attempted to quantify the importance of informal caregivers by focusing on valuing the total hours of care they provide (Gibson and Houser 2007), and on the out-of-pocket costs they incur (Wagner 2007). Such estimates help characterize the scope of caregiving activities, but have fairly diffuse links with specific long-term care policy aims. In this study, we focus on a central issue in current long-term care policy—the relationship between informal caregiving and nursing home entry—and examine how a high level of stress

or burden from caregiving relates to the likelihood of potentially permanent placements.

A number of recent studies have examined the relationship between informal caregiving and the use of nursing homes among older people. These studies have found evidence that having family members who can serve as informal caregivers, actually receiving informal care, and the number of hours of informal care are associated with reduced nursing home entry (Charles and Sevak 2005; Lo Sasso and Johnson 2002; Van Houtven and Norton 2004; Waidmann and Thomas 2003). Other recent research indicates that various measures of stress or burden resulting from caring for elders with dementia predict nursing home entry (Gaugler et al. 2000; Gaugler et al. 2003, 2005; Brown, Potter, and Foster 1990).

In this study, we consider more broadly the role of caregiver stress in the nursing home entry decision. We focus on a nationally

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*Brenda C. Spillman, Ph.D., and Sharon K. Long, Ph.D., are senior fellows at the Urban Institute. This paper was supported by funding from the U.S. Department of Health and Human Services, Office of the Assistant Secretary for Planning and Evaluation (contract no. HHS-100-03-0011). Address correspondence to Dr. Spillman at the Urban Institute, 2100 M St., N.W., Washington, DC 20037. Email: BSpillman@urban.org*

representative sample of people age 65 or older with chronic disabilities who are receiving care in the community, using data on those elders and their primary informal caregivers. Our data come from the 1999 National Long-Term Care Survey (NLTCS). The data are unique in including not only detailed information on care recipients, but also information from caregivers about their caregiving experience and administrative data that allow us to observe both nursing home entry and duration of nursing home use over follow-up periods of up to five years. We estimate a comprehensive model of how formal care, informal care, and the caregiver's perceived stress from caregiving relate to future nursing home placement, among people with chronic disability and an established caregiving arrangement in the community. Evidence from such a model can contribute to a better understanding of where policy may best be able to intervene to provide support and incentives for informal caregivers, and the potential impacts of increased public caregiving supports on nursing home placement.

Specifically, we address the following questions:

- Does a high level of primary caregiver stress predict nursing home entry?
- What factors are associated with high levels of caregiver stress?
- What are the potential impacts on nursing home entry of reducing overall caregiver stress and specific factors associated with caregiver stress?
- How do impacts differ if reductions in stress and stress factors are more narrowly targeted to caregivers of people with substantial long-term care needs?

## Background

Understanding the role of informal caregiving in preventing or delaying nursing home entry is increasingly important for policy because of demographic trends in the next several decades that are likely to reduce the supply of informal caregivers and increase the demands on a smaller number of caregivers per elderly person with a disability. These

trends are the continued aging of the population and greater survival with chronic diseases than in the past, smaller family size and delayed childbearing among the baby boom generation, and increased labor force participation by women, who far outnumber men in caring for aging spouses and parents. Continued narrowing of the gender gap in longevity may increase the number of husbands available to provide care (Redfoot and Pandya 2002), but also may increase the number of elderly women providing care to their equally elderly spouses. In fact, in recent years, the age of both care recipients and their informal caregivers has increased, as has the level of disability among elders receiving care (Spillman and Black 2005).

The potential for greater demands on fewer caregivers has important implications for state and federal policies that increasingly are focused not only on preventing or deferring nursing home entry through increased Medicaid home and community-based services, but also on helping nursing home residents return to the community. The success of these efforts is likely to depend in large part on the willingness and ability of informal caregivers to maintain disabled elders in their homes.

All states have some programs aimed at supporting caregivers, including respite services to provide temporary relief from caregiving responsibilities. These programs are intended to provide direct benefits to caregivers or the care recipient, to reduce or delay institutionalization, and thereby to reduce costs. Careful evaluations demonstrating these outcomes on a large scale are rare (Zarit 2001). Besides respite, these programs may provide information; help in identifying and accessing available services; and offer counseling, training, and, in some cases, financial support through the federal Administration on Aging (AoA) National Family Caregiver Support Program (NFCSP), the Medicaid program, or state programs (Link et al. 2006). The level of support so far has been modest. The NFCSP provided about \$155 million in grants to states in fiscal 2005 and served about 700,000 family caregivers, an average of a little more than \$200 per caregiver served (AoA 2005; Greene 2008).

Although not intended primarily as a caregiver support, several state Medicaid programs include “Cash and Counseling” demonstration-type options, in which recipients with disabilities may receive a budget in lieu of traditional benefits and hire caregivers of their choice, including family members (Spillman, Black, and Ormond 2007).

The Lifespan Respite Care Act, enacted in 2006, provides for grants to states to enhance respite and other services for caregivers, but only recently has received any funding; several other bills have been introduced in recent years to provide federal tax credits for family caregivers, although none has yet been passed. At least 26 states and the District of Columbia have refundable or nonrefundable dependent care tax credits, generally ranging from \$500 to \$1,500 (NGA 2004), but access for elder care is limited because of the requirement that the care recipient be the taxpayer’s dependent.

In light of limited resources, most programs and proposals include some restrictions to target those with more severe disability. For example, respite services through the NFCSP are available only if the recipient has at least two personal care limitations or a cognitive impairment (AoA 2004). Proposals for federal caregiver tax credits typically limit the credits to caregivers of people requiring help with at least three activities of daily living (ADLs) (e.g., bathing or getting around indoors), or having severe cognitive impairment. This level of disability often is used to approximate functional eligibility for nursing home care and for home and community-based care waiver services under the Medicaid program.

**Methods**

Our model differs from many others in that we focus on older people with chronic disabilities who have an established caregiving arrangement in the community, and on the impact of a direct measure of caregiver stress. We assume, consistent with the predominant role of informal care in long-term care, that nursing home entry is a less preferred option for both care recipients and their caregivers, so long as community-based arrangements are tenable. We also assume that the sustainability of community care is

represented by the amount of care required and the level of stress experienced by the primary caregiver. We assume that the demand for nursing home care, as well as formal and informal care, is a function of the needs of the recipient, ability to pay for care, access to care providers, and the cost of care. Decisions about care arrangements are complex and dynamic, with the recipient and family making joint decisions about informal and formal care, which in turn affect decisions about nursing home care. Caregiver stress enters the model through its relationship with formal and informal care decisions and, we hypothesize, through its direct effect on the nursing home entry decision.

We use baseline care arrangements and level of caregiver stress among a sample of care recipients age 65 or older living in the community and receiving assistance from a primary caregiver to predict admissions to nursing homes for episodes of care that last at least 60 days within one year, 18 months, and two years after interview. The baseline situation reflects the outcome of past decisions, and the factors influencing these past decisions are assumed also to affect the future decision to use nursing home care. We cannot directly observe changes occurring after baseline in functional status of the care recipient, care arrangements, or other factors—such as death or illness of the primary caregiver—that may arise and affect future nursing home entry decisions. We assume, however, that for any individual chronically disabled care recipient, frailty and care needs increase over time, and with them comes an increased level of stress experienced by the primary caregiver. Caregiver stress at baseline also may indicate fragility of the care arrangement.

Specifically, our model can be expressed as follows:

$$\begin{aligned}
 \text{Long stay NH entry} = & a_0 + a_1X + a_2(\text{formal}) \\
 & + a_3(\text{informal}) \quad (1) \\
 & + a_4(\text{stress}) + \varepsilon
 \end{aligned}$$

$$\begin{aligned}
 \text{Formal} = & b_0 + b_1X + b_2(\text{informal}) \\
 & + b_3(\text{stress}) + \mu_F \quad (2)
 \end{aligned}$$

$$\begin{aligned} \text{Informal} = & c_0 + c_1X + c_2(\text{formal}) \\ & + c_3(\text{stress}) + \mu_I \end{aligned} \quad (3)$$

$$\begin{aligned} \text{Stress} = & d_0 + d_1X + d_2(\text{formal}) \\ & + d_3(\text{informal}) + \mu_S \end{aligned} \quad (4)$$

where  $X$  captures baseline health and other care recipient characteristics and local health care market and other characteristics, including the availability and cost of nursing home care;  $\text{formal}$  is the amount of formal care at baseline;  $\text{informal}$  is the amount of informal care at baseline; and  $\text{stress}$  is the level of stress the primary caregiver reports from all aspects of caregiving at baseline.

The challenge in estimating this model is that the amounts of informal and formal care are jointly decided, and these levels of care affect, and are affected by, caregiver stress, making them endogenous to the nursing home decision. For example, providing high levels of informal care that forestall the need for nursing home entry may both increase stress and result in the addition of formal care to either substitute for or supplement informal care; acute illness may increase the stress the caregiver feels, as well as the need for post-acute formal care. In addition, unobserved differences across individuals and families, reflected in the error terms  $\varepsilon$ ,  $\mu_F$ ,  $\mu_I$ , and  $\mu_S$ , may affect formal care, informal care, and caregiver stress, as well as nursing home entry. Failing to account for endogeneity and unobserved differences could bias estimates of the role of informal care, formal care, and caregiver stress in the nursing home entry decision.

To address these complexities, we estimate a system of equations using an instrumental variables (IV) model. The success of IV estimation relies on the ability to find good “instruments,” which are variables that are highly correlated with informal care, formal care, and stress, respectively, but not correlated with the error term in the nursing home entry equation (Wooldridge 2002). In practice, the model is statistically identified by variables that predict the three endogenous variables in the first stage of the estimation but have no direct effect on nursing home use

in the main equation (1). Our first-stage equations are as follows

$$\text{Formal} = b_0 + b_1X + b_2Z + \delta_F \quad (2a)$$

$$\text{Informal} = c_0 + c_1X + c_2Z + \delta_I \quad (3a)$$

$$\text{Stress} = d_0 + d_1X + d_2Z + \delta_S \quad (4a)$$

where  $\text{formal}$  is the number of formal care hours received in the prior week at baseline;  $\text{informal}$  is the number of informal care hours received from all informal caregivers in the prior week;  $\text{stress}$  is an indicator of high stress defined below in the data section; and  $Z$  is a vector of instruments selected to be correlated with formal care, informal care, and stress but uncorrelated with the error,  $\varepsilon$ , in equation 1.

Because of the relatively small sample size for the study (discussed later), we estimated parsimonious models, focusing on achieving identification with the minimal set of instruments to allow us to obtain consistent estimates of the impact of formal care, informal care, and caregiver stress on nursing home entry. We also estimated a richer, reduced-form model of caregiver stress to help us determine likely candidate measures for identification in the IV model, and to examine the potential impacts of policy interventions to address factors associated with higher stress.

The key challenge for IV models is finding instruments that meet the criteria of being strongly correlated with the instrumented regressors but uncorrelated with the error in the main equation. The challenge is greater in analyses such as this in which instruments are needed to discriminate among multiple endogenous regressors. As our instruments for the amount of formal care, we selected the local supply of home health agencies and whether the recipient lives in a community residential care setting,<sup>1</sup> both of which measure the availability of formal care providers. For the amount of informal care, our instruments are three variables associated with the availability and ease of access to informal caregivers, specifically whether the recipient lives alone, the number of daughters who live nearby, and whether the primary caregiver has minor children. The ability to

manage activities related to independent living clearly is correlated with the level of disability and, within the elderly population, whether a person lives alone is highly correlated with having a spouse as a potential caregiver, regardless of disability level. Our argument in this case is that after controlling for disability, as we do, both living alone and having nearby daughters primarily measure availability and ease of access to informal care, and child care responsibilities indicate a competing demand on the caregiver's available time.

As an instrument for both formal and informal care, we also include a measure of the recipient's need for assistance with independent living activities not associated with health or personal care needs—specifically, a count of limitations in managing money, taking medications, telephoning, and meal preparation.<sup>2</sup> We would expect limitations in the recipient's ability to perform these activities, which are associated with executive functioning abilities, to affect the hours of informal and/or formal care needed; however, we would expect no direct effect on nursing home entry after controlling for the recipient's personal care disabilities and explicit cognitive impairment (described later), both of which are ubiquitous in preadmission screening for nursing homes and therefore would be expected to have a direct relationship to nursing home entry (Tonner, LeBlanc, and Harrington 2001).

Finally, for caregiver stress we rely on two instruments: the primary caregiver's reports of frequent recipient behavior problems and of experiencing physical strain from providing care. We hypothesize that these factors increase the level of personal stress experienced from caregiving, but have no direct effect on nursing home entry (Gaugler et al. 2000; Zarit, Todd, and Zarit 1986).

Our choice of instruments rests on the assumption that after controlling for other covariates in the main equation, our instruments are not correlated with unobserved determinants of long-stay nursing home entry (Malkin, Broder, and Keeler 2000). We provide information on construction of our instruments in the data section and empirical tests for their validity in the results section,

where we also discuss other potential identifying variables we considered and rejected.

All of our estimates are obtained using the survey (svy) commands in Stata (StataCorp 2009), which are designed to produce standard errors corrected for complex survey design. We used the Stata svy: ivreg command to estimate our IV model, the svy: mean command to produce descriptive statistics, and the svy: probit command to estimate our reduced-form model of caregiver stress. Because tests of the IV model are not yet available for survey commands in Stata, we used weighted regression with a general correction for clustering under the ivreg2 command to perform those tests.

## **Data**

Our data are from the 1999 National Long-Term Care Survey and its Informal Care Supplement (ICS). The NLTCS is a nationally representative survey of Medicare beneficiaries age 65 or older and is designed to collect detailed information on the health, disability, long-term care, and living situation of the older population. The 1999 ICS interviewed people identified as the primary informal caregivers of community respondents who had a disability and were receiving informal help. ICS respondents were asked about a broad range of caregiving issues and experiences, in addition to the amount and types of care provided, basic demographic information, and information on the caregiver's living arrangements and family.

In addition to the survey data, we merged our NLTCS file with several types of individual-level administrative data, including Minimum Data Set (MDS) assessments, Medicare fee-for-service claims, Medicare denominator files, and vital statistics files. Most importantly, the MDS assessments allow us to observe all nursing home admissions, regardless of payment source, between the 1999 interview date and July 2004.<sup>3</sup> The Medicare fee-for-service claims, which cover the years 1991 through 2005, allow us to construct controls for recent events, such as hospitalizations, that help us better characterize the health of care recipients; the Medicare denominator files for the same

period allow us to identify recipients who also were eligible for Medicaid and those enrolled in Medicare managed care. Fee-for-service claims are not available for any periods during which recipients were enrolled in managed care. The vital statistics provide reliable information on whether and when care recipients die, allowing us to control for censoring because of death. County-level data from the Area Resource File allow us to characterize local nursing home and home health market characteristics, as well as more general health system characteristics such as the local supply of hospital beds and physicians. We also merged state-level data on average Medicare nursing facility reimbursement per diem, Medicare home health reimbursement per visit, and median hourly wage for personal care and home care aides in 2000 (AARP 2002).

Our analysis sample consists of approximately 1,000 chronically disabled people age 65 or older living in the community and receiving help with at least one of six ADLs and eight instrumental activities of daily living (IADLs). ADL limitations are personal care activities usually associated with greater levels of physical disability, while IADLs refer to complex activities associated with the ability to live independently. The six ADLs are eating, transferring, getting around inside, dressing, bathing, and toileting. The eight IADLs are light housework, laundry, meal preparation, shopping, getting around outside, managing money, taking medicines, and telephoning. We define “chronically disabled” as having a disability that has lasted at least 90 days at baseline, which excludes those in our analysis who had only a short period of disability before recovery or death. To focus on a more targeted population of recipients at higher risk for nursing home entry and more likely to be functionally eligible for benefits under most programs and proposals, we also identified the subsample of recipients with at least three ADL limitations or identified as cognitively impaired and receiving help with at least one ADL. We hereafter refer to this subset, which comprises about two-thirds of our sample, as having “substantial” disability.

### *Disability Help and Caregiver Characteristics*

The main NLTCS creates a roster of all household members, all children living outside the household, and all people providing help with ADLs or IADLs. The sampled elder and/or a proxy is the respondent for the main survey. Information collected for roster members includes basic information, such as age, gender, and relationship to the sampled elder and, for each person providing help for a disability, the number of hours of care provided in the last week and whether the caregiver was a paid formal caregiver<sup>4</sup> or an informal caregiver. The main survey information on total hours of each type of care from all caregivers provides the dependent variables for the formal and informal care equations (equations 2 and 3) in our IV model.

The informal caregiver who provided the greatest number of hours of care in the last week is selected for the ICS interview. The ICS elicits more detail directly from the selected caregiver about a broad array of objective characteristics and subjective assessments of the caregiving experience, generally covering the range of factors identified in the most commonly used indices in the literature (Zarit, Reever, and Bach-Peterson 1980; Robinson 1983). We use the overall level of stress the caregiver reports experiencing from caregiving responsibilities, which is reported on a scale of 1 to 10, as our stress outcome measure (equation 4). In our model, we identify highly stressed caregivers as those rating their overall stress as 6 or higher.<sup>5</sup>

In our supplemental richer reduced-form model predicting high caregiver stress, we focused primarily on more objective measures. These include basic characteristics, such as gender, relationship to care recipient, and whether the caregiver also has minor children; special conditions of caregiving, such as the frequency of problem behaviors by the care recipient in the last week, how long the recipient can be left alone, and the frequency with which the caregiver’s sleep is disturbed by caregiving responsibilities; and supports such as help or a break from caregiving that the caregiver reports needing. The caregiver also is asked to rank on a scale of 1 to 5, the level of physical strain and the level of financial hardship caregiving causes,

where 1 is no physical strain or financial hardship and 5 is “very much” strain or hardship. We included indicators of a high level of physical strain and a high level of financial hardship in the reduced-form model of stress, in each case defined as a reported level of 3 or higher.

### *Nursing Home Entry*

We constructed our measure of nursing home entry from the MDS assessments merged with the 1999 NLTCS sample. Our interest in this analysis is in longer nursing home episodes that may be or become permanent placement, rather than short-term post-acute stays. We therefore considered only episodes lasting at least 60 days and occurring within follow-up periods of up to five years after the interview date.<sup>6</sup> We found that for all follow-up periods, about 85% of the episodes meeting this 60-day criterion lasted more than 90 days, and about half lasted at least one year. For simplicity, we refer to the entry into these long-stay episodes as “nursing home entry” in the remainder of the paper.

Nursing home entry is a relatively rare event, even among our sample of chronically disabled elders. In choosing among the feasible follow-up periods, we considered the trade-off between the number of eligible admissions, which increases as the length of the follow-up period increases, and the likelihood that the predictive power of baseline characteristics would diminish as the follow-up period increased. For example, only 4% of our sample had an episode of at least 60 days beginning within the six months following interview, compared with 22% within five years. In the end, we selected follow-up periods of one year, 18 months, and two years. For the full sample, the rate of nursing home entry rose from about 7% within one year to about 13% within two years. Nursing home entry was significantly higher for the 19% of sample members whose caregivers reported high stress. These sample members had a nursing home entry rate of 11% within one year and 17% within two years, 4.5 percentage points and 5.5 percentage points higher, respectively, than the rates for care recipients whose caregivers reported low to moderate stress.

### *Variables Included in the Estimation*

Table 1 provides sample means for formal and informal care hours and the proportion of caregivers reporting high stress, as well as the variables that we use to identify the model. Our sample members were receiving an average of about seven hours of formal care and 35 hours of informal care from all sources in the prior week at baseline. Nineteen percent of caregivers reported high stress.

Table 2 summarizes the remaining variables included in our model to control for other factors that affect nursing home entry, including characteristics of the care recipient and the local health care market. In addition, we include whether the care recipient had a proxy respondent, and to control for differential exposure by care recipients who died, we include the logged number of months survived within each follow-up period (i.e., one year, 18 months, two years). Eighty-five percent of the sample survived for at least one year, 79% survived at least 18 months, and 73% survived at least two years.

The measures of disability are a key set of explanatory variables in the equation for nursing home entry. We hypothesize that three aspects of disability play important roles in the nursing home entry decision: the extent of the elder’s physical limitations, the extent of cognitive limitations, and the duration of disability. We measure physical limitations as: 1) a count of the total number of ADL limitations faced by the elder, and 2) an indicator of whether the elder needs assistance most or all of the time with getting in or out of bed (including being bedfast) or getting around inside his or her house. We measure cognitive impairment as a survey report of Alzheimer’s disease, mental retardation, senility, or “mental problems” as the reason for having a proxy respondent to one or more sections of the interview. Finally, we measure the duration of disability using indicators of whether the disability has lasted between one and five years or five years or longer at baseline, with disability lasting less than one year as the omitted category.

### **Results**

Table 3 reports the results of our IV estimation of the impacts of formal care hours,

**Table 1. Formal care, informal care, and high caregiver stress and their identifying variables for the IV model**

	Mean
<b>Endogenous regressors</b>	
Total formal care hours recipient received last week <sup>a</sup>	7.10
Total informal care hours recipient received last week <sup>a</sup>	34.59
Caregiver reports high caregiving-related stress <sup>b</sup>	.19
<b>Instruments for endogenous regressors</b>	
Formal care	
Home health agencies per 1,000 persons 65+ in county of residence <sup>c</sup>	.24
Recipient lives in community residential care	.04
Number of executive function-related limitations recipient has (out of four) <sup>d</sup>	1.75
Informal care	
Recipient lives alone	.22
Number of daughters living within one hour of recipient <sup>a</sup>	.77
Caregiver has minor children	.10
High caregiver stress	
Caregiver reports caregiving is a physical strain <sup>e</sup>	.31
Recipient had behavior problems 3+ times last week	.35
<b>Sample size</b>	1,006

Source: Tabulations of data from the 1999 NLTCs and companion ICS.

<sup>a</sup> Value is logged in models.

<sup>b</sup> Caregiver rating is 6 or higher on a scale of 1 to 10.

<sup>c</sup> Data from Area Resource File.

<sup>d</sup> Included activities are managing money, taking medications, telephoning, and meal preparation.

<sup>e</sup> Caregiver rating is 3 or higher on a scale of 1 to 5.

informal care hours, and high caregiver stress on nursing home entry within the three follow-up periods. Ordinary least square (OLS) estimates are provided in Appendix Table 1. The OLS estimates, which ignore the endogeneity of formal care, informal care, and caregiver stress, indicate that only formal care hours at baseline significantly affect nursing home admission, slightly *increasing* the likelihood for all three follow-up periods. Although both informal care hours and caregiver stress have the expected signs, with informal care reducing and caregiver stress increasing the likelihood of nursing home entry, neither is significant or of consequential magnitude.

The IV results in Table 3 are considerably different. With controls for endogeneity, caregiver stress becomes an important and significant predictor of nursing home entry. Having a highly stressed caregiver at baseline increases the likelihood of nursing home entry within one year by 13.4 percentage points, and by 17.5 percentage points for the two-year follow-up. This result is consistent

with our hypothesis that caregiver stress is persistent and cumulative over time, and that high stress at baseline is likely to indicate fragility of care arrangements. As noted, however, we do not observe health and other events that occur after baseline and may contribute to this finding—for example, whether highly stressed primary caregivers are more likely to suffer health declines that make it difficult or impossible to continue providing care.

With controls for endogeneity, the coefficients on the number of informal care hours provided at baseline maintain their expected negative sign, are far larger than in the OLS estimation, and are significant for the 18-month and two-year follow-up periods. In the IV specification, baseline formal care hours are not significantly related to nursing home entry in any time period.

The reliability of these results rests on the validity of our instruments. To assess the validity of our instruments, we first examined their predictive power and signs in the first-stage formal care, informal care, and care-

**Table 2. Explanatory variables included in the IV model**

	<b>Mean</b>
<b>Recipient characteristics</b>	
Age	80.04
Female	.68
White race	.86
High school graduate	.23
Some college	.20
Enrolled in Medicaid	.20
HMO enrollee any month in the last six	.12
Number of ADL disabilities (out of six) <sup>a</sup>	3.16
Receives help with transfer/mobility most of the time	.55
Disability has lasted one to five years	.48
Disability has lasted five years or longer	.37
Cognitively impaired	.37
Obese	.20
Total inpatient hospital spending last six months (\$) <sup>b</sup>	2,122
<b>Nursing home market and area characteristics</b>	
Nursing home beds per 1,000 persons 65+ (county of residence) <sup>c</sup>	52.90
State Medicare nursing facility reimbursement per diem/median <sup>d</sup>	1.01
Physicians per 1,000 persons (county of residence) <sup>c</sup>	1.99
Hospital beds per 1,000 persons (county of residence) <sup>c</sup>	3.47
Area is in an MSA	.71
<b>Proxy respondent and survival</b>	
Respondent is a proxy for recipient	.37
Months recipient survived within follow-up period <sup>b</sup>	
One-year follow-up	11.20
18-month follow-up	16.13
Two-year follow-up	20.64
<b>Sample size</b>	<b>1,006</b>

Source: Tabulations of data from the 1999 NLTCs and companion ICS.

<sup>a</sup> Included ADLs are eating, getting in/out of bed, getting around inside, dressing, bathing, and toileting.

<sup>b</sup> Value is logged in models.

<sup>c</sup> Data from Area Resource File.

<sup>d</sup> Constructed from CMS data reported in AARP (2002).

giver stress equations and their partial  $R^2$  in each equation, both of which indicate that the instruments are strongly correlated with those outcomes. The first-stage results and these tests are provided in Appendix Table 2.

Among the set of instruments, there is at least one strong significant predictor of each first-stage outcome that is not a predictor of the remaining two outcomes. Specifically, the availability of home health agencies significantly predicts greater hours of formal care, being a caregiver with minor children significantly reduces informal hours, and frequent recipient behavior problems significantly increases the likelihood of high stress. Living in community residential care and living alone both are positively related to formal care hours and negatively related to informal care

hours, whereas physical strain is associated both with more informal hours and a greater likelihood of high stress. The number of limitations in activities related to executive functioning is significantly associated with higher values of all three first-stage outcomes, but is a far more important predictor of greater hours of both types of care than of high stress.

The  $F$ -statistic for the partial  $R^2$  in the informal care and high stress equations was well above 10, often suggested as a rule-of-thumb value below which weak identification is suspected in cases with a single endogenous regressor (Staiger and Stock 1997), and the  $F$ -statistic in the formal care equation was more than 8. In all cases, the  $p$ -value was less than .001. We note, however, that Shea's partial  $R^2$

**Table 3. Instrumental variable estimation of admission to a nursing home episode of 60 days or longer**

	Within one year		Within 18 months		Within two years	
	Coefficient	<i>P</i> >   <i>t</i>	Coefficient	<i>P</i> >   <i>t</i>	Coefficient	<i>P</i> >   <i>t</i>
<b>Endogenous regressors</b>						
Number of formal care hours recipient received last week <sup>a</sup>	.000	.96	.008	.49	.008	.60
Number of informal care hours recipient received last week <sup>a</sup>	-.025	.26	-.045	.05 **	-.048	.06 *
Caregiver reports high caregiving-related stress <sup>b</sup>	.134	.03 **	.168	.01 **	.175	.01 **
<b>Recipient characteristics</b>						
Age	.004	.00 **	.005	.00 **	.005	.00 **
Female	-.023	.26	-.036	.13	-.033	.21
White race	.019	.49	.012	.74	.014	.75
High school graduate	.058	.02 **	.045	.08 *	.034	.23
Some college	.008	.74	-.001	.97	-.025	.46
Enrolled in Medicaid	.025	.41	.013	.70	.036	.42
HMO enrollee any month in the last six	.059	.03 **	.075	.01 **	.054	.10 *
Number of ADL disabilities (out of six) <sup>c</sup>	.005	.52	.003	.73	.004	.71
Receives help with transfer/mobility most of the time	.016	.46	.014	.60	.031	.29
Disability has lasted one to five years	.035	.11	.031	.27	.031	.33
Disability has lasted five years or longer	.039	.05 *	.033	.24	.040	.23
Cognitively impaired	.052	.02 **	.062	.03 **	.063	.05 **
Obese	.023	.34	.006	.80	-.015	.60
Total inpatient hospital spending last six months <sup>a</sup>	.003	.09 *	.003	.12	.003	.16
<b>Nursing home market and area characteristics</b>						
Nursing home beds per 1,000 persons 65+ (county of residence) <sup>d</sup>	.001	.00 **	.001	.01 **	.001	.01 **
State Medicare nursing facility reimbursement per diem/median <sup>e</sup>	-.028	.67	.013	.86	-.012	.90
Physicians per 1,000 persons (county of residence) <sup>d</sup>	.009	.38	.009	.42	.008	.56
Hospital beds per 1,000 persons (county of residence) <sup>d</sup>	.000	.99	.005	.47	-.001	.86
Area is in an MSA	-.038	.15	-.040	.16	-.019	.56
<b>Proxy respondent and survival</b>						
Respondent is a proxy for recipient	.015	.53	.018	.47	.032	.22
Months recipient survived within follow-up period <sup>a</sup>	.063	.00 **	.068	.00 **	.073	.00 **
Constant	-.472	.00	-.534	.00	-.533	.00
<i>R</i> <sup>2</sup>	.053		.038		.049	

**Table 3. (continued)**

	Within one year		Within 18 months		Within two years	
	Coefficient	<i>P</i> >   <i>t</i>	Coefficient	<i>P</i> >   <i>t</i>	Coefficient	<i>P</i> >   <i>t</i>
<b>Tests of IV model specification</b>						
Hansen's <i>J</i> ( $H_0$ : instruments are uncorrelated with the error term and correctly excluded from the main equation.)	1.66	.89	2.18	.82	2.63	.76
Weak identification test statistic: Cragg-Donald (N-L)*minEval/L2 <i>F</i> -stat <sup>f</sup>	9.07		9.04		9.02	
Davidson-MacKinnon test of endogeneity ( $H_0$ : instrumented variables are exogenous in the main equation)	1.52	.21	2.68	.05 *	2.23	.09 *

Source: Stata survey ivreg procedure estimation using the 1999 NLTCSS and companion ICS.

<sup>a</sup> Value is logged.

<sup>b</sup> Caregiver rating is 6 or higher on a scale of 1 to 10.

<sup>c</sup> Included ADLs are eating, getting in/out of bed, getting around inside, dressing, bathing, and toileting.

<sup>d</sup> Data from Area Resource File.

<sup>e</sup> Constructed from CMS data reported in AARP (2002).

<sup>f</sup> This value exceeds the critical value of 9.01 for rejecting the null hypothesis of weak identification in a test suggested in Stock and Yogo (2002) for models with three endogenous regressors and eight instruments. Rejection at this level indicates that the IV bias (from weak instruments) is no more than 10% of the OLS bias (from endogeneity).

\*\*(\*) Significant at the 5%(10%) level in a two-tailed test.

statistic, which takes into account intercorrelations among the instruments, is sometimes recommended when there are multiple endogenous regressors, with a rule of thumb that a large partial  $R^2$  but a small Shea's partial  $R^2$  indicates that the instruments do not explain all the endogenous regressors (Baum, Shaffer, and Stillman 2003). For all three endogenous variables, the Shea's partial  $R^2$  is reasonably similar in magnitude to the conventional partial  $R^2$ . In Table 3, we also show the results of a test for weak instruments using a statistic recommended by Stock and Yogo (2002) that compares the IV bias (from weak instruments) relative to the OLS bias (from endogenous regressors) in cases with multiple endogenous regressors. The value of this test for all equations exceeds the critical value indicating that the IV bias is no more than 10% of the OLS bias. The Anderson canonical correlation statistic, reported below the results in Table 3, also indicates that we can reject the null hypothesis that the model is underidentified.

To examine the second condition for valid instruments—that they be uncorrelated with the error process in the main equations—we rely first on Hansen's *J* tests, also shown below the IV results in Table 3. The Hansen's *J* test is a test of the joint null hypothesis that the instruments are valid instruments (i.e., uncorrelated with the error term in the nursing home entry equation), and that the instruments are correctly excluded from the nursing home equation. We could not reject this null hypothesis for any of the models. These tests suggest that the influence of the instruments is only through their effect on formal care, informal care, and caregiver stress and not through any direct effect on nursing home entry. As a further test of the instruments, we used the orthog option in Stata to assess the exogeneity of each set of instruments and each instrument individually using the “difference in Sargan” or *C* statistic (Baum, Shaffer, and Stillman 2003). Again, we found no case in which we could reject the null hypothesis that the instrument or instruments were valid at any conventional level of significance.

We also found that our IV results for the impact of high caregiver stress, the primary

focus of the study, were qualitatively and generally quantitatively robust to sensitivity analyses in which we used alternative sets of instruments for formal care, informal care, and caregiver stress. Alternative specifications that we tested and rejected included adding the local home care wage rate and substituting this variable for community residential care; omitting whether the recipient lived alone; substituting fair or poor caregiver health for physical strain; and substituting the need for near-continuous supervision for frequent recipient behavior problems. In all cases in which we added instruments, partial  $R^2$  values were similar or smaller, and  $F$ -statistic values fell, suggesting that the additional instruments added little or no additional information, possibly due to high correlation with the original instruments.<sup>7</sup>

Results for the impacts of informal and formal care on nursing home entry are more sensitive to the set of instruments used in the analysis, although relative to OLS estimation, all IV specifications we tried resulted in larger, albeit often insignificant, negative impacts for informal care hours and smaller and insignificant impacts for formal care hours. We were not able to identify alternative instruments to those reported here that would satisfy the conditions for strong identifying variables in the IV model with multiple endogenous regressors. Because the results for high stress were largely unaffected by different specifications, and the results for formal and informal care hours were qualitatively similar across specifications, we present the model that performed best in the various tests, but we are more confident of the estimates for caregiver stress than for informal and formal care hours.

We also conducted Davidson-MacKinnon tests of the endogeneity of formal care, informal care, and caregiver stress in the nursing home equation (Wooldridge 2002). The null hypothesis is that they are exogenous, in which case ordinary least squares would be consistent and fully efficient. We do find evidence to support the endogeneity of formal care, informal care, and caregiver stress for each of the follow-up periods modeled. The findings from the test are

sensitive, however, to the instruments included in the model. This is likely due to our relatively small sample size and the presence of multicollinearity and relatively large standard errors in our analysis (Wooldridge 2002). In our reported models, the null hypothesis of exogeneity is rejected for the 18-month and two-year follow-up periods.

#### *Simulated Impacts of Reducing Stress*

The estimates in Table 3 provide strong evidence that high caregiver stress increases the likelihood of nursing home entry. To quantify the magnitude of potential impacts from reducing caregiver stress, we simulated the impacts of a hypothetical intervention that reduced stress among all caregivers below the high-stress threshold, leaving all other characteristics as they actually were within the sample. To examine impacts for an intervention targeted only to people caring for elders with greater long-term care needs, we also simulated the impact if the stress reduction was limited to those caring for people with substantial disability.<sup>8</sup> About two-thirds of all caregivers in our sample and 83% of highly stressed caregivers were caring for people with substantial disability (not shown).

The results, shown in Table 4, suggest that if such a hypothetical intervention could eliminate high stress among all caregivers, it could significantly reduce the rate of admission over all time periods. Over two years, the admission rate among the 19% of elders with highly stressed caregivers would be reduced from about 27% to 9.5% (not shown), yielding the overall reduction in the admission rate of 3.3 percentage points among all care recipients shown in Table 4. This reduction in nursing home entry from 12.6% of all elders receiving informal care to 9.2% over the two-year follow-up period represents 73,895 people, slightly more than one in four nursing home admissions expected within two years with no intervention.<sup>9</sup> If the hypothetical stress reduction intervention were to be targeted more narrowly to those caring for elders with substantial disability, the impact on nursing home entry would be less, but still substantial. Under the more limited intervention, the likelihood of nursing home admis-

**Table 4. Simulated reduction in nursing home entry from eliminating high caregiver stress**

	Predicted entry		
	Within one year	Within 18 months	Within two years
Number of care recipients	2,207,884	2,207,884	2,207,884
Nursing home entry with current levels of caregiver stress			
Number of entrants	150,873	214,319	277,626
Percent of care recipients	6.8	9.7	12.6
Simulated impact of intervention eliminating high stress			
Targeted to all caregivers			
Percent entering nursing homes after intervention	4.3	6.5	9.2
Reduction in nursing home entry (percentage points)	2.6	3.2	3.3
Targeted to caregivers for those with substantial disability <sup>a</sup>			
Percent entering nursing homes after intervention	4.7	7.0	9.8
Reduction in nursing home entry (percentage points)	2.1	2.7	2.8

Source: Analysis of data from the 1999 NLTCs and companion ICS.

<sup>a</sup> Defined as three or more ADL limitations or cognitive impairment and help with at least one ADL.

sion within two years would fall by 2.8 percentage points, to 9.8%. This represents a reduction in admissions of 61,212 people, or a little more than one in five expected admissions without the intervention.

*Factors Associated with High Stress*

Our simulations of potential reductions in nursing home entry do not consider how a reduction in caregiver stress might be accomplished. In this section, we examine the factors associated with high caregiver stress, with a focus on those that have the largest impacts and may be most amenable to policy interventions.

In exploring the factors associated with high caregiver stress, we estimated a richer probit model that included both the factors included in the model underlying Table 4 and

additional measures intended to capture other dimensions of caregiver stress discussed earlier. Table 5 provides the marginal effects of significant predictors from that model, in order of the magnitude of their effect on caregiver stress. We added an array of caregiver and caregiving characteristics sequentially to a base model including recipient and local health care market characteristics, and our instruments for formal and informal care hours. We found that recipient and local area characteristics that were significant predictors of high stress before caregiving characteristics were added became insignificant as the more targeted caregiver and caregiving characteristics entered the model.

Physical strain from caregiving is by far the strongest predictor, raising the likelihood that

**Table 5. Marginal effects of caregiver and caregiving characteristics on the likelihood that the primary caregiver is highly stressed**

	Marginal effect	P >  z
Caregiver reports caregiving is a physical strain <sup>a</sup>	.222	.00
Caregiver sleep disturbed 3+ times last week	.118	.03
Recipient had behavior problems 3+ times last week	.101	.00
Caregiving is a financial hardship <sup>a</sup>	.087	.06
Caregiver is recipient's child	.082	.02
Caregiver is in fair or poor health	.059	.11
Number of executive function-related limitations recipient has (out of four) <sup>b</sup>	.024	.07

Source: Analysis of data from the 1999 NLTCs and companion ICS.

<sup>a</sup> Caregiver rating is 3 or higher on a scale of 1 to 5.

<sup>b</sup> Included activities are meal preparation, managing money, taking medications, and telephoning.

a caregiver is highly stressed by 22 percentage points (Table 5). Frequently having sleep disturbed by caregiving responsibilities or dealing with a recipient's problem behaviors increase the likelihood of high caregiver stress by about 12 percentage points and 10 percentage points, respectively; financial hardship due to caregiving and being the recipient's child are only slightly less important, increasing the likelihood by eight to nine percentage points. We also show the impact of fair or poor caregiver health, which increases the likelihood of high stress by about six percentage points. Although the marginal effect of being in fair or poor health is not quite significant at the 10% level ( $p = .11$ ), the probit coefficient is. We note, however, that the estimated impact of fair or poor caregiver health is large and highly significant prior to the addition of physical strain from caregiving to the equation, suggesting that stress is more likely to result from a mismatch between health and caregiving demands than from fair or poor health alone. Although the number of limitations in activities associated with executive functioning is significantly associated with high stress, its impact is relatively modest.

#### *Simulated Reductions in Stress from Eliminating Stress Factors*

To illustrate potential reductions in caregiver stress from reducing factors associated with stress, we focused on physical strain and financial hardship, two factors perhaps most obviously associated with specific interventions, such as caregiver training, direct formal services, home modifications, assistive devices, or financial aid. We simulated reductions in stress from reducing physical strain and financial hardship individually and the combined effect of reducing both (not shown). An individual was assumed to experience physical strain or financial hardship if he or she reported a level of three or higher on a scale of 1 to 5, where 1 is no physical strain or financial hardship. As in the earlier simulations for nursing home entry, all other characteristics were held at their actual levels, and we repeated the simulation assuming that reductions were limited to people caring for elders with substantial disability.

Physical strain has the greatest association with high stress. The likelihood that caregivers reporting physical strain are highly stressed is about 47%, compared with about 19% for all caregivers. Broad-based interventions that could reduce physical demands of caregiving below the threshold we use to identify physical strain would reduce the likelihood of high stress to 18.8% among caregivers reporting physical strain, and to 10.2% among all caregivers, an overall reduction of 8.7 percentage points. The impact of reducing only financial hardship is more modest. For the group reporting financial hardship, the likelihood of high stress would be reduced from about 42% to 30%, and the overall reduction in the likelihood of high stress would be about three percentage points. The combined impact of hypothetical interventions addressing both physical strain and financial hardship among all caregivers would be to reduce the likelihood of high stress to 8%, a reduction of about 11 percentage points. If the interventions were targeted to people caring for recipients with substantial disability, most of the impact still would be realized. The combined impact of the more targeted interventions would be to reduce the likelihood of high stress to about 10% of all caregivers, a little more than half the likelihood with no intervention.

#### *Simulated Impacts on Nursing Home Entry from Eliminating Stress Factors*

As a final simulation, we traced the effects of these levels of stress reduction on nursing home use. To do so, we used our nursing home model and the predicted likelihoods of high caregiver stress after interventions to eliminate physical strain and financial hardship. If both physical strain and financial hardship were eliminated for all caregivers, the share of caregivers who were highly stressed would be reduced to about 8%, and as a result, nursing home entry would be reduced by about two percentage points at the end of two years (Table 6). The reduction in admissions from addressing these two sources of high stress among all caregivers represents 42,930 people. This is a little more than 15% of all expected nursing home

**Table 6. Simulated reduction in nursing home entry from reducing sources of caregiver stress**

	Predicted entry		
	Within one year	Within 18 months	Within two years
Number of care recipients	2,207,884	2,207,884	2,207,884
Nursing home entry with current levels of caregiver stress			
Number of entrants	150,873	214,319	277,626
Percent of care recipients	6.8	9.7	12.6
Simulated percentage-point reduction in nursing home entry from eliminating stress factors			
Targeted to all caregivers			
Eliminate physical strain <sup>a</sup>	1.2	1.5	1.6
Eliminate financial hardship <sup>a</sup>	.4	.5	.6
Eliminate both physical strain and financial hardship	1.5	1.9	1.9
Targeted to caregivers for those with substantial disability <sup>b</sup>			
Eliminate physical strain <sup>a</sup>	1.0	1.3	1.3
Eliminate financial hardship <sup>a</sup>	.3	.4	.4
Eliminate both physical strain and financial hardship	1.2	1.6	1.6

Source: Analysis of data from the 1999 NLTCs and companion ICS.

<sup>a</sup>Caregiver rating is 3 or higher on a scale of 1 to 5.

<sup>b</sup>Defined as three or more ADL limitations or cognitive impairment and help with at least one ADL.

entrants, or nearly 60% of the reduction if high stress could be eliminated. The reduction in admissions from addressing these two sources of high stress among only caregivers to people with substantial disability would reduce admissions by 35,819, or 13% of all admissions. Of course, this simulation, like the earlier simulations, estimates only the direct effect of a change in the stress factors, leaving all other characteristics as they occur in the sample. Given the complexity of the relationships between caregiver stress and nursing home entry, it may well be that interventions that could eliminate physical strain or financial hardship also could have indirect effects on nursing home entry through other routes.

**Discussion and Conclusions**

Our analysis provides support for initiatives to reduce caregiver stress among people caring for chronically disabled elders as a strategy to reduce or defer nursing home entry and perhaps to underpin current efforts to return nursing home residents to community-based alternatives. After addressing the possibility of biases in the estimates that can occur when regressors are endogenous, we

found that elders with highly stressed primary caregivers were more likely than their counterparts with less stressed caregivers to have a long-term nursing home placement over follow-up periods of up to two years. If a day in a nursing home is assumed to cost \$100, the reduced nursing home entry rate we estimate over two years would imply a savings of \$7.4 million per nursing home day avoided if high stress were eliminated among all caregivers, and \$6.1 million if high stress were eliminated among only those caring for elders with substantial disability. While these estimates do not account for the costs of eliminating caregiver stress or the health and social implications of delayed nursing home entry, they do provide a sense of the potential for nursing home savings if high caregiver stress could be eliminated.

Physical strain from caregiving was by far the most important predictor of high levels of stress, but indicators of the disruptive aspects of caregiving—frequently disturbed sleep and recipient problem behaviors—also were important, as was financial hardship. Reducing such stress factors would significantly reduce caregiver stress and, as a result, nursing home use for chronically disabled elders. Strategies for reducing caregiver stress could include

greater availability of respite care; caregiver training and increased access to devices, such as chair and bed lifts, that might reduce the physical toll from strenuous tasks; assistance in managing disruptive recipient behaviors that increase the physical and emotional strain of caregiving; and/or financial assistance.

It is important to bear in mind several limitations of our study. First, although the IV estimates address the potential endogeneity of formal and informal care and caregiver stress in the nursing home entry decision, the model that is estimated may not capture all relevant unobserved factors, such as changes in elder and caregiver circumstances over time. Thus, the estimates still may be biased, although less so than estimates from models that do not control for the possibility of such endogeneity.

Second, we have modeled high caregiver stress stylistically as a threshold, and simulated hypothetical interventions that are able to bring caregiver stress levels below that threshold. In real programs, impacts on the underlying causes of caregiver stress and stress levels clearly would be more complex and incremental.

Third, as noted, we have not considered the cost of programs to relieve caregiver stress, which would offset potential savings from reduced nursing home use. The amount, type, and cost of support that would be required to accomplish a given level of stress reduction, as well as potential cost savings in a general population, remain undetermined. In the case of respite, evidence suggests that the quantity, quality, regularity, and timing of respite care are essential to realizing the intended impacts on nursing home entry and caregiver stress (Zarit 2001). Costs also would depend on how support programs would be targeted. For example, the substantially disabled population in our simulation of targeting was one-third smaller than the full population of primary caregivers and accounted for about

three-quarters of predicted admissions over two years. Again, however, the simulation is highly stylized. Targeting to those at highest risk of nursing home entry in an actual program would be more difficult. Potential behavioral responses to a support program also could affect costs.

Finally, although the reported estimates represent our best point estimates, our relatively small sample size for this complex analysis yields relatively large standard errors around those estimates. Nevertheless, our analysis confirms for a nationally representative sample of chronically disabled elders the strong link between caregiver stress and nursing home entry found in studies of elders with cognitive impairment and their caregivers (Gaugler et al. 2000; Gaugler et al. 2003, 2005; Brown, Potter, and Foster 1990).

Better understanding of the role of caregiver stress in the nursing home entry decision is important to ensure that disabled elders are able to remain in the community as long as possible. Additional research is needed to explore the potential paths by which policies that support caregiving could reduce caregiver stress and, by doing so, nursing home entry and other adverse outcomes. Studies using small samples have found that caregiver counseling, support groups, and training or health education programs can be effective in reducing sources of caregiver stress, delaying institutionalization of dementia patients, and reducing use of other health services (Morycz 1985; Brodaty and Peters 1991; Brodaty et al. 1993; Mittelman et al. 1996; Peak, Toseland, and Banks 1995; Toseland and Smith 2006). Studies examining the impact of caregiver stress on a broader set of outcomes, including hospitalization rates and use of other health services, in a national population could provide more important evidence to assess the potential benefits of support programs on the well-being of caregivers and recipients and on health care costs.

## Notes

*Results from an earlier version of this paper were presented at the AcademyHealth Annual Research Meeting in June 2007.*

- 1 Community residential care primarily includes people identified by themselves or interviewers as being in “assisted living” (70%), but also people in other community group care settings, including foster and family care homes, group homes, or community residential facilities. A detailed description of residential setting in the NLTCs and the coding of this variable is available in Spillman and Black (2006).
- 2 The four activities are a subset of those commonly referred to as instrumental activities of daily living (IADLs), which generally are considered to be more cognitively complex activities than personal care disabilities (Lawton and Brody 1969; Spector and Fleishman 1998). Three of the activities included in our measure, managing money, taking medications, and telephoning, however, are associated most strongly with executive functioning, which is the cognitive capacity to plan and carry out complex activities and respond flexibly to changing situations. They have been found to predict future onset of cognitive impairment and functional decline (Ng et al. 2006; Peres et al. 2008; Johnson, Lui, and Yaffe 2007). Shopping also often is considered closely associated with executive functioning. In the NLTCs, however, grocery shopping is specifically defined as going to the store, selecting items, and getting them home, and thus includes a substantial physical component, as well as reflecting access to transportation options. We instead included meal preparation because it requires some of the same elements of organization, planning, and time orientation skills considered elemental to shopping (Ranzani et al. 2007). Although these types of activities are sometimes used in pre-admission screening, they are more commonly used in assessment for community-based services, which would reinforce our hypotheses of their direct relationship with hours of care, especially formal care (Tonner, LeBlance, and Harrington 2001).
- 3 Although the 2004 NLTCs is available and also includes a caregiver supplement, the MDS records necessary to observe nursing home use over a follow-up period are not available.
- 4 These formal caregivers include all nonfamily caregivers who are paid either publicly or privately—that is, they are not limited to home health workers paid through Medicare or Medicaid. Although recipients, some state Medicaid programs, and some private long-term care insurance policies pay family members for caregiving, the NLTCs does not ask whether relatives are paid. Thus, in our analysis all relatives providing care are considered informal caregivers.
- 5 The basic findings are not sensitive to using a slightly higher or slightly lower cut-off.
- 6 We define an episode as a period of nursing home residence with no intervening periods of 30 days or more outside the nursing home.
- 7 In the case of local home care wages, in all specifications adding or substituting it for other potential instruments for formal care hours, we also found that the variable was not significant in the first-stage regressions and failed the test for exogeneity in the nursing home entry estimation for the 18-month and/or two-year follow-up periods. We believe this result likely reflects the close relationship between wages in the home care and nursing home markets.
- 8 Defined as having at least three ADL limitations or being cognitively impaired and receiving help with at least one ADL.
- 9 Although the reported estimates represent our best point estimate of impacts, because of the relatively small sample size, even significant impacts have relatively large standard errors. The 95% confidence interval around the high stress coefficient of .175 in our IV model for the two-year follow-up period is .036-.313. The implied range for reduction in nursing home entry within two years of eliminating stress among all caregivers would be 7% to 39% of all admissions without the intervention, compared with about 27% based on the point estimate. This range implies reduction in entries over two years of about 15,000 to 130,000, compared with the 74,000 reported in the text of the paper.

**Appendix Table 1. OLS estimation of admission to a nursing home episode of 60 days or longer**

	Within one year		Within 18 months		Within two years	
	Coefficient	P >  t	Coefficient	P >  t	Coefficient	P >  t
<b>Endogenous regressors</b>						
Number of formal care hours recipient received last week <sup>a</sup>	.008	.03 **	.009	.02 **	.013	.01 **
Number of informal care hours recipient received last week <sup>a</sup>	-.002	.74	-.005	.56	-.006	.52
Caregiver reports high caregiving-related stress <sup>b</sup>	.020	.41	.019	.48	.025	.43
<b>Recipient characteristics</b>						
Age	.004	.00 **	.005	.00 **	.005	.00 **
Female	-.025	.17	-.031	.17	-.029	.23
White race	.018	.52	.014	.69	.014	.75
High school graduate	.055	.02 **	.044	.08 *	.032	.26
Some college	.008	.72	.008	.75	-.019	.50
Enrolled in Medicaid	.021	.42	.014	.66	.033	.41
HMO enrollee any month in the last six	.056	.03 **	.061	.04 **	.042	.16
Number of ADL disabilities (out of six) <sup>c</sup>	.002	.69	.001	.91	.000	.96
Receives help with transfer/mobility most of the time	.012	.55	.012	.63	.028	.31
Disability has lasted one to five years	.039	.06 *	.033	.22	.034	.26
Disability has lasted five years or longer	.037	.06 *	.027	.32	.035	.30
Cognitively impaired	.048	.02 **	.060	.02 **	.058	.03 **
Obese	.027	.24	.009	.70	-.010	.71
Total inpatient hospital spending last six months <sup>a</sup>	.003	.08 *	.004	.05 **	.004	.10
<b>Nursing home market and area characteristics</b>						
Nursing home beds per 1,000 persons 65+ (county of residence) <sup>d</sup>	.001	.00 **	.001	.00 **	.001	.01 **
State Medicare nursing facility reimbursement per diem/median <sup>e</sup>	-.035	.57	-.010	.89	-.027	.74
Physicians per 1,000 persons (county of residence) <sup>d</sup>	.008	.46	.007	.58	.006	.68
Hospital beds per 1,000 persons (county of residence) <sup>d</sup>	.001	.77	.006	.35	.000	.99
Area is in an MSA	-.034	.20	-.033	.25	-.013	.69
<b>Proxy respondent and survival</b>						
Respondent is a proxy for recipient	.020	.37	.025	.30	.039	.13
Months recipient survived within follow-up period <sup>a</sup>	.062	.00 **	.068	.00 **	.073	.00 **
<b>Constant</b>	-.450	.00 **	-.586	.00 **	-.567	.00 **
<b>R<sup>2</sup></b>	.093		.090		.094	

Source: Stata survey ivreg procedure estimation using the 1999 NLTCs and companion ICS.

<sup>a</sup>Value is logged.

<sup>b</sup>Caregiver rating is 6 or higher on a scale of 1 to 10.

<sup>c</sup>Included ADLs are eating, getting in/out of bed, getting around inside, dressing, bathing, and toileting.

<sup>d</sup>Data from Area Resource File.

<sup>e</sup>Constructed from CMS data reported in AARP (2002).

\*\*\* (\*) Significant at the 5% (10%) level in a two-tailed test.

Appendix Table 2. First-stage regressions from IV model

	First-stage regressions								
	Formal hours			Informal hours			Stress		
	Coefficient	P >  t	P >  t	Coefficient	P >  t	P >  t	Coefficient	P >  t	P >  t
<b>Recipient characteristics</b>									
Age	.011	.41	.57	.003	.003	.43	-.001	.001	.43
Female	.322	.14	.09 *	-.137	.003	.91	.003	.003	.91
White race	.110	.68	.63	.058	.013	.72	.013	.013	.72
High school graduate	.281	.32	.87	-.016	.019	.54	-.019	.019	.54
Some college	.681	.02 **	.62	-.049	.047	.24	.047	.047	.24
Enrolled in Medicaid	.645	.10	.02 **	.232	.030	.38	.030	.030	.38
HMO enrollee any month in the last six	-.449	.11	.00 **	.331	.012	.74	.012	.012	.74
Number of ADL disabilities (out of six) <sup>a</sup>	.257	.00 **	.00 **	.095	.002	.80	.002	.002	.80
Receives help with transfer/mobility most of the time	.250	.32	.07 *	.153	.017	.55	.017	.017	.55
Disability has lasted one to five years	-.208	.58	.26	.120	.026	.50	.026	.026	.50
Disability has lasted five years or longer	-.317	.39	.34	.104	.011	.77	-.011	.011	.77
Cognitively impaired	.292	.24	.52	.057	.020	.49	-.020	.020	.49
Obese	-.291	.28	.83	.023	.029	.38	.029	.029	.38
Total inpatient hospital spending last six months <sup>b</sup>	.077	.00 **	.27	.009	.002	.34	.002	.002	.34
<b>Nursing home market and area characteristics</b>									
Nursing home beds per 1,000 persons 65+ (county of residence) <sup>c</sup>	.006	.26	.61	-.001	.001	.25	.001	.001	.25
State Medicare nursing facility reimbursement per diem/median <sup>d</sup>	-1.418	.09 *	.77	.084	.055	.58	-.055	.055	.58
Physicians per 1,000 persons (county of residence) <sup>c</sup>	-.088	.20	.05 **	.069	.001	.90	-.001	.001	.90
Hospital beds per 1,000 persons (county of residence) <sup>c</sup>	-.183	.00 **	.90	-.003	.001	.92	-.001	.001	.92
Area is in an MSA	.261	.35	.45	-.084	.007	.86	.007	.007	.86
<b>Proxy respondent and survival</b>									
Respondent is a proxy for recipient	-.099	.67	.34	-.082	.004	.91	.004	.004	.91
Months recipient survived within follow-up period <sup>b</sup>	-.199	.47	.86	.020	.018	.67	-.018	.018	.67
<b>Controls for omitted endogenous variables</b>									
Formal care hours									
Home health agencies per 1,000 persons 65+ (county of residence) <sup>c</sup>	1.570	.01 **	.40	.135	.017	.78	-.017	.017	.78
Recipient lives in community residential care	1.850	.01 **	.00 **	-.755	.075	.13	-.075	.075	.13
Number of executive function-related limitations recipient has (out of four) <sup>e</sup>	.371	.00 **	.00 **	.202	.035	.00 **	.035	.035	.00 **

Appendix Table 2. (continued)

	First-stage regressions					
	Formal hours		Informal hours		Stress	
	Coefficient	$P >  t $	Coefficient	$P >  t $	Coefficient	$P >  t $
Informal care hours						
Recipient lives alone	1.651	.00 **	-.795	.00 **	.018	.60
Number of daughters living within one hour of recipient <sup>b</sup>	-.002	.97	.032	.07 *	.001	.78
Caregiver has minor children	-.257	.45	-.325	.02 **	.066	.15
High caregiver stress						
Caregiver reports caregiving is a physical strain <sup>f</sup>	.069	.76	.255	.01 **	.310	.00 **
Caregiver reports recipient had behavior problems 3+ times last week	-.175	.48	.071	.37	.142	.00 **
<b>Constant</b>	-3.954	.02 **	1.832	.00 **	.100	.61
<b>Test of excluded instruments</b>		$P > F$		$P > F$		$P > F$
Partial $R^2$	.10		.19		.21	
$F(6,98)$	8.47	.00 **	37.55	.00 **	18.73	.00 **
Shea's partial $R^2$	.08		.13		.16	
$R^2$	.26		.33		.29	

Source: Stata survey ivreg procedure estimation using the 1999 NLTCS and companion ICS.

<sup>a</sup>Included ADLs are eating, getting in/out of bed, getting around inside, dressing, bathing, and toileting.  
<sup>b</sup>Value is logged.

<sup>c</sup>Data from Area Resource File.

<sup>d</sup>Constructed from CMS data reported in AARP (2002).

<sup>e</sup>Included activities are managing money, taking medications, telephoning, meal preparation.

<sup>f</sup>Caregiver rating is 3 or higher on a scale of 1 to 5.

\*\* (\*) Significant at the 5% (10%) level in a two-tailed test.

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