
Articles

The Use of Formal and Informal Home Care by the Disabled Elderly

Peter Kemper

Using data from the Channeling experiment, this article analyzes the factors associated with the amount of formal and informal home care received by the disabled elderly. The amounts of formal and informal home care used increase with disability, as well as with other measures of need for care. The use of formal care increases, and the use of informal care decreases, with income. The availability of immediate family increases reliance on informal care and reduces reliance on formal care. The findings have implications for the design of proposed programs to expand publicly financed home care for the disabled elderly.

The aging of the population has raised questions among policymakers, the elderly, and their families about how to care for the growing numbers of disabled elderly. Most of the elderly prefer care at home rather than in a nursing home, and some see care at home as potentially less costly than nursing home care. Understanding the factors that determine the type and amount of home care used is important for predicting use in the future and developing long-term care policy. This article

An earlier version of this article was presented at the annual meetings of the Allied Social Science Associations in Atlanta, GA, on December 28-30, 1989. The views expressed in this work are those of the author. No official endorsement by either the Agency for Health Care Policy and Research or the U.S. Department of Health and Human Services is intended or should be inferred.

Peter Kemper, Ph.D. is Director, Division of Long Term Care Studies, Center for Intramural Research, AHCPR, Rockville, MD. Requests for reprints to AHCPR Clearinghouse, P.O. Box 8547, Silver Spring, MD 20907-8547. This article, submitted to *Health Services Research* on April 10, 1990, was revised and accepted for publication on January 13, 1992.

analyzes the determinants of the hours of formal and informal home care used by the disabled elderly.

PREVIOUS RESEARCH

A number of previously published studies have presented multivariate analyses of the determinants of the amount of formal and informal home care used. Because data on the receipt of care have been more readily available than data on the amount of care used, many studies have analyzed receipt of care. Studies of the amount of care have focused on either formal or informal care rather than on the total amount of care from all sources. Multivariate analyses of the use of home care can be classified into three groups: those concerning (1) receipt of formal or informal care among the entire population, (2) receipt and amount of formal care among the disabled population, and (3) receipt and amount of informal care among the disabled population.

Studies of Receipt of Care among the Entire Population

Branch et al. (1981); Branch and Jette (1983); Branch, Wetle, Scherr, et al. (1988); Coulton and Frost (1982); Evashwick et al. (1984); and McAuley and Arling (1984) examined the determinants of receipt of formal or informal home care (or in some cases, the number of services received) among the entire noninstitutionalized elderly population. They all found that disability as measured by limitations in activities of daily living (ADL), such as eating, getting in and out of a chair, bathing, and the like, was a strong predictor of receipt of formal care, informal care, or any home care, depending on the study. Other measures of need were also positively related to receipt of formal home care, as was age, which may reflect unmeasured need. Evidence on other factors is limited.¹

These studies analyze the entire noninstitutionalized elderly population, including the vast majority who do not need care. Consequently, they simultaneously predict both the need for care and the type of care received among those needing it. For some variables, the effects on need for care may dominate any effect on the type of care received.

Studies of Formal Care among the Disabled Population

Other studies restricted their analyses to the disabled elderly. McAuley and Arling (1984), Soldo (1985), Wan (1987), Greene (1983), and Soldo, Wolf, and Agree (1990) have analyzed receipt of formal care or measures closely related to it (number of formal services received and whether the primary caregiver was formal or informal). They all found a significant positive relationship between receipt of formal care and ADL disability. The effects of other measures of need for care were also generally positive. Availability of informal care, measured in a variety of ways, was generally associated with less reliance on formal care. Results for other factors were limited.² While useful for understanding the determinants of receipt of formal care, these studies do not provide information on the amount of care used.

Other studies analyzed the amount of home health care used. Manton and Hausner (1987) analyzed a national sample of the elderly using Medicare home health services. Their results suggest that expenditures for home health care are related to disability and medical conditions. Williams et al. (1990) found that the number of home health visits received was significantly related to diagnosis and prognosis. In limiting their analyses to home health care (nursing, therapy, and home health aide care) these studies excluded personal care (such as help bathing) and supportive services (such as housekeeping), which are extremely important types of home care.

Other studies analyzed expenditures for all formal home care, including personal care and supportive services. Moscovice, Davidson, and McCaffrey (1988) found that expenditures on home care under Minnesota's Alternative Care Grants Program differed significantly by ADL disabilities and across communities. As part of an evaluation of the Channeling demonstration, Corson, Granneman, and Holden (1988) found that expansion of publicly financed home care greatly increased expenditures for formal home care; however, they did not analyze the effects of other variables. Reanalyzing the first six months of follow-up data from the Channeling demonstration, Liu, McBride, and Coughlin (1990) estimated the effect of other variables on expenditures for home health care and for personal care and housekeeping. They found that higher numbers of ADL disabilities, living alone, and a greater availability of home health services were positively associated with expenditures in both types of services; other variables affected the two types of services differently or were not statistically significant.³

Studies of Informal Care among the Disabled Population

Analyzing the number of services disabled elderly persons receive from informal caregivers, Greene (1983), in the study mentioned earlier, found that the number of informal services received increased with ADL disability and limitations in psychological and social functioning, and that they decreased with the number of formal services received. Analyzing follow-up data for a small sample of participants in formal service programs, Edelman and Hughes (1990) found that the best predictor of the number of informal services received at follow-up was the number received at baseline. Other variables showing a positive relationship with informal services in some (but not all) of the analyses were disability, being married, living with the caregiver, and receiving fewer formal services.

Others have analyzed the determinants of the hours of informal care received. Stoller (1983) analyzed care given by a small sample of sons and daughters who were primary caregivers of a disabled parent. She found that hours of care increased with the parent's level of disability and age, and decreased if the parent was married. (The parent's age and marital status were not statistically significant for sons.) Married children and sons who were employed or had children under age six gave less care. In the study noted earlier, Moscovice, Davidson, and McCaffrey (1988) also analyzed the relation between the hours of informal care received and the characteristics of the disabled person and the primary caregiver. They found that disability in activities of daily living (ADL) and instrumental activities of daily living (IADL), cognitive impairment, and male sex of the care recipient increased the hours of informal care received; however, none of the other characteristics of the care recipients or of the primary caregiver was statistically significant. Dwyer and Miller (1990) found that, in general, hours of care provided by the primary informal caregiver increased with ADL and IADL disability. The other independent variable included in their analysis, number of unpaid helpers, was significantly related to hours of care only in rural areas. In addition to these three studies, Christianson (1988) found as part of the evaluation of the Channeling demonstration that expansion of publicly financed home care did not substantially reduce the amount of informal care received.

Place of this Study in the Literature

This investigation builds on previous research by using a large sample of disabled elderly persons to analyze the determinants of the amount of home care used, including personal care and supportive services as

well as home health care. It differs from studies published previously in two respects. First, it focuses on all home care, including both formal and informal care. Three types of home care are analyzed separately: formal care, informal care from caregivers not living with the disabled elder, and informal care from resident caregivers. The results of these three analyses are also combined to analyze the determinants of the total amount of care used from all sources, formal and informal combined. Second, in analyzing the amount of home care used, determinants of the receipt of each type of care are distinguished from determinants of the amount of care used by those receiving it. As described later, this is done using the two-part model refined by Duan et al. (1983).

CONCEPTUAL FRAMEWORK

A disabled elderly person who lives at home and needs help with such basic activities as cooking, bathing, or eating can rely on care purchased in the formal market or on care provided informally by family and friends (or on both). Economic theory suggests that the amount of formal and informal care used depends on five factors. (See Kemper 1990 for the economic model of the demand for various types of home care that motivated this framework.) The greater the *need for care*, the more of both formal and informal care the disabled elderly are expected to use.

A higher *price* of formal home care is expected to decrease use of formal care and increase use of informal care. As a practical matter, however, lack of data on prices prevents testing these hypotheses, forcing the empirical analysis to test instead for the effect of several proxies for the availability of home care.

Higher *income* is expected to lead to use of more formal care and—because higher income permits the “purchase” of more informal caregiver time for activities other than care giving, such as paid work, home production, or leisure—use of less informal care.

Finally, greater *availability of family* is expected to lead to use of less formal care and more informal care. The empirical analysis uses whether the person is married or not and has children or not as an indicator of the availability of family, although information on the opportunity cost of potential caregivers’ time, their attitudes toward caregiving, and other characteristics would also be desirable.

In addition to these variables, tastes undoubtedly play a role in the use of home care. *Sociodemographic characteristics* are included to control

for differences in tastes. However, these same variables are also likely to be proxies for unmeasured variables; for example, age is likely to be a proxy for unmeasured frailty and loss of friends and family as persons age.

Living arrangement is not included as an independent variable even though it is clearly related to care arrangements. A disabled elderly person can live alone (with the caregiver visiting to provide care) or with a caregiver. Sharing households makes it easier to give care and saves time. When living together, no time is spent traveling back and forth between two households, and there are economies in home production when two households are combined—for instance, cleaning one house, preparing one meal, and so on, instead of two. Consequently, the amount of formal and informal care used and living arrangement are jointly determined; any factor that affects one also affects the other. Because living arrangement is endogenous, it is not included as an independent variable in the reduced-form model estimated here.

Because the empirical analysis uses cross-section data, however, living arrangements may not be in equilibrium. For example, persons with a recent increase in their need for care are less likely to rely on resident informal care than persons with similar needs who have had time to move in with a caregiver. The analysis therefore includes, as explanatory variables, recent changes that might lead to disequilibrium in living arrangements.

Based on this framework, the empirical analysis estimates the relationship between hours of home care and need for care, availability of formal care (proxies for price), income, availability of family, demographic characteristics, and any recent changes in need that might affect living arrangements. The dependent variables are the hours of three types of home care used: formal care provided by paid caregivers living outside the household (or in a few cases by helping organizations using volunteers); informal care provided by family or friends living outside the household; and informal care provided by family or friends residing with the disabled elderly person. Due to the lack of hours data, this article does not analyze hours of resident formal care (that is, care provided by paid, live-in helpers).

DATA

Data were collected as part of the Channeling experiment, a ten-site test of whether public financing of home care would reduce long-term

care costs by substituting care at home for care in nursing homes. (See Kemper, Brown, Carcagno, et al. 1988 for a description of the demonstration, its evaluation, and findings; Carcagno, Applebaum, Christianson, et al. 1986 for analysis of Channeling's implementation; and Phillips, Stephens, and Cerf 1986 for detailed documentation of the data collection process.)

The sample consisted of disabled elderly persons who had applied to Channeling or were referred by hospitals, home health agencies, or other health or social service providers and who met two main eligibility criteria: disability and unmet need. For disability, one of three specific criteria had to be met: (1) moderate disability in two or more activities of daily living (bathing, dressing, toileting, transfer, and eating—plus continence); (2) three severe impairments in instrumental activities of daily living (housekeeping, shopping, meal preparation, taking medicine, transportation, telephoning, and managing finances); or (3) two severe IADL impairments and one severe ADL disability. Cognitive or behavior problems affecting the ability to perform activities daily could count as one of the severe IADL impairments. For unmet need, either the applicant had to have at least two unmet needs for ADL or IADL help expected to continue for at least six months, or the informal caregiver system had to be sufficiently "fragile" that family and friends were no longer able to continue to give the amount of help that they had been giving. Applebaum (1988) estimates that about 5 percent of the elderly population would meet the Channeling eligibility criteria.

The eligibility determination process included a screening interview with the applicant, family members, or care providers. This short interview (usually carried out by telephone) covered, among other things, disability, income, living arrangement, cognitive impairment, behavior problems, and demographic characteristics. About a week and a half later, on average, eligible applicants were assessed in person. If an applicant was not capable of responding to the interview because of cognitive impairment or illness, or for some other reason, the interview was conducted with a proxy respondent. Proxies were the sole respondents in about 30 percent of the cases, and they helped the disabled elderly person answer questions in an additional 30 percent of the cases. In addition to more detail on many of the same variables, the baseline assessment contained information on (1) the hours of care received regularly in the home from formal and informal caregivers who did not live with the disabled elderly person and (2) whether care was provided by anyone living in the household.

Separate baseline interviews were conducted with the primary

informal caregivers of a random subsample of those disabled elderly persons who had been screened and found eligible for Channeling between November 1982 and May 1983. The primary caregiver was defined as the family member or friend who, according to the disabled person, helped the most to take care of him or her or to do things around the house. The informal caregiver interview obtained, among other things, information on the hours spent on care by informal caregivers living in the same household. To distinguish time spent helping the disabled elderly person from that which would be spent anyway, the informal caregiver was asked to estimate the percentage of time spent helping with IADL that was "extra time over and above what you would have spent if the person helped weren't ill or disabled." Estimating this percentage is clearly difficult, especially when living arrangements or other circumstances have changed so that no frame of reference exists for estimating the amount of time that is extra. Moreover, respondents may differ with respect to what they consider extra time. For example, male and female caregivers may differ about whether time spent preparing meals or doing housework is extra time or if the time would be spent pursuing those activities whether the family member was disabled or not. Consequently, resident informal hours are undoubtedly subject to measurement error. To the extent that errors in estimates of the percentage of time that is extra are systematically related to the independent variables in the analysis, the conclusions identifying the factors associated with the amount of resident informal care received could be biased. To the extent that measurement error is random, however, such error simply increases the variance of the estimates of the effects on resident informal hours presented later in this article.

The analysis used the three sources of baseline data to conduct a cross-section analysis at the time of enrollment. Table 1 defines the variables used in the analysis. Because the data are for the period *before* the experimental intervention took place, no distinction is made between the treatment and control groups.

The initial sample of persons who passed the eligibility screen numbered 6,326. From this sample, observations were excluded whenever information on a dependent variable was not present for any of four reasons: (1) the disabled elderly person or a proxy respondent could not be located or refused to respond to the baseline interview ($N = 700$); (2) the sampled person lived in a personal care home or with a paid live-in caregiver ($N = 76$) (because the interview did not collect information on hours of care received from staff of personal care homes or paid live-in caregivers); (3) the sampled person had been in a hospital or nursing home for more than two months before the inter-

Table 1: Definitions of Variables

| <i>Variable</i> | <i>Definition</i> |
|-------------------------|---|
| Formal hours | Hours per week of in-home assistance with medical treatments and ADL and IADL limitations provided regularly by helpers who do not live with the disabled elderly person and who help as part of their paid or volunteer work (Based on reports of the disabled elderly person or their proxies) |
| Informal visiting hours | Same as formal hours except provided by friends, neighbors, or family members |
| Resident informal hours | Hours per week of extra help with medical treatments and ADL and IADL limitations due to illness or disability, that is provided regularly by family members or friends living with the disabled elderly person (Based on reports of the primary informal caregiver) |
| ADL disability | The number of activities of daily living with which the disabled elderly person received help from another person (including staying in the room in case help is needed). These activities include eating, getting out of bed or chair, getting to the bathroom or using the toilet, dressing, bathing, or none |
| Incontinence | Received help from another person in changing a catheter or colostomy bag; or if no help was received, patient accidentally wet or soiled self during the past week |
| Cognitive impairment | Displayed disorientation, confusion, impairment of judgment, or memory loss that affected ability to perform activities nearly every day or necessitated supervision to ensure personal safety (Excludes those who also display inappropriate behavior) |
| Inappropriate behavior | Displayed inappropriate behavior that affected ability to perform activities nearly every day or necessitated supervision to ensure personal safety (Includes those who also have cognitive impairment) |
| Home medical treatment | Regularly received help with medical treatment such as changing a dressing, taking vital signs, providing physical therapy, etc. at home from a formal or informal caregiver |
| State home care program | Patient lived in one of four sites that had a state home care program at the time of baseline interview |
| Medicaid eligible | Patient was eligible for Medicaid based on interview report confirmed by Medicaid agency records |
| City size | Residence by size of city: large (250,000 or over), medium (50,000–250,000), small (less than 50,000), or rural |

Continued

Table 1: Continued

| <i>Variable</i> | <i>Definition</i> |
|------------------------|---|
| Income (logarithm) | Natural logarithm of dollars of individual income + 25. A married couple's income was divided by the ratio poverty income for elderly couples to that of singles (1.26). Income of a married couple not living together was divided in half |
| Family availability | Elderly person has a surviving spouse (excluding spouses not living with the disabled elderly person) or children |
| Age | Age in years (approximated as midrange of five-year age categories) |
| Female | Female |
| Race | African American (non-Hispanic), Hispanic, or white/other (non-Hispanic) |
| Completed high school | Completed at least a high school education |
| Recently hospitalized | Hospitalized during the past two months |
| Health worsened | Disabled elderly person's illness or health condition first became a problem or became much worse during the past year |
| Loss of caregiver | Reason for disabled elderly person's referral was permanent loss of caregiver, or disabled elder was widowed, separated, or divorced during the past year |
| Time frame discrepancy | Interview was conducted while the disabled elderly person was in a hospital or nursing home. In these cases, hours information refers to the time before admission; in all other cases the information is for the time of the interview |

view ($N = 153$) (because the interview did not collect hours data in this case); or (4) items necessary to construct the dependent variables obtained from the baseline interview (receipt of formal, visiting informal, and resident informal care, and hours data of formal and visiting informal care) were missing ($N = 247$). The resulting sample size for the analysis of the probability of receiving each of the three types of care was 5,150 (81 percent of those screened). Of these, 3,117 received formal visiting care and 3,339 received visiting informal care, and these cases were used in the analyses of hours received among those receiving each type of care.

One evident problem posed by the sample design of the evaluation is that resident informal hours are available only for the subsample that also has data from interviews with informal caregivers. To make maximum use of the data on the full sample, the analysis distinguishes

between resident and visiting informal care and estimates separate relationships for them. Only the analysis of hours of resident informal care among those receiving that type of care was restricted to the smaller subsample (see the discussion of estimation methodology further on).

Of the applicants eligible for Channeling who were in the subsample selected to have their primary informal caregiver interviewed, a total of 2,484 had a complete disabled elderly person baseline interview that was analyzed in the Channeling evaluation. Of these cases, observations were excluded for any of four reasons: (1) the disabled elderly person lived in a personal care home or with a paid live-in caregiver ($N = 32$); (2) the disabled elderly person was in a hospital or nursing home for more than two months before the interview ($N = 52$); (3) information on receipt of resident informal care was missing in the disabled elderly person's baseline interview ($N = 1$); or (4) the disabled elderly person reported receiving resident informal care, but the caregiver information on resident informal care was inconsistent or missing (due to interview or item nonresponse) ($N = 369$). Of the remaining 2,030 observations, 1,039 persons received care from an informal caregiver living in the same household. (The others received visiting informal care and, in some cases, formal visiting care.) These 1,039 cases were used in the analysis of hours of resident informal care among those receiving it.

The analysis had to address two data problems: item nonresponse and a time frame discrepancy. Item nonresponse affected less than 2.6 percent of the analysis sample for all independent variables except education, which was missing 6.6 percent of the time. Missing items were assigned the modal or mean value of the known cases, except for income, which was imputed using a hot deck imputation procedure. Dummy variables indicating that the variable had been imputed were included in the multivariate models. Few differences between cases that had been imputed and those that had not were statistically significant. (These coefficients are not reported in the tables.)

The second problem concerned the time to which questions referred. In addition to the basic disability and unmet need criteria for eligibility, applicants had to be living in the community, or if they were hospitalized or in a nursing home, certified as likely to be discharged within the next three months. If the baseline interview was conducted in a hospital or nursing home, the time frame for the dependent variables was before admission rather than at the time of the interview, as it was for the rest of the sample. Eleven percent of the sample had such a time frame discrepancy. The models estimated further on included a

dummy variable indicating when such a time frame discrepancy existed, to control for this discrepancy. It was associated, as expected, with significantly lower probabilities of using formal care and of using resident informal care, and with using more hours of formal and informal visiting care among those receiving each of these types of care. (These results are not shown in the tables.)

CHARACTERISTICS OF THE SAMPLE

Table 2 shows the means and standard deviations of the independent variables. As expected for applicants eligible for a home care program, the sample exhibited a high level of need for care. The eligible applicants were old and frail—the average age was 80, and 87.3 percent had some disability in the activities of daily living of bathing, dressing, toileting, transferring in or out of bed or chair, and eating. Indeed, 22.5 percent were so seriously disabled that they needed help with all five activities. Almost half of the sample had been hospitalized in the last two months. The sample was poor: average income was just under \$500 per month. Over two-thirds were not married, and one-fifth had neither a spouse nor a child as a potential caregiver.

Because persons in the sample had applied to a home care program, they presumably were more likely to use home care and less likely to have equilibrium care and living arrangements than similar people who had not applied. In addition, given Channeling's eligibility criteria, eligible applicants may have had more unmet needs for care than is typical of persons with similar disabilities. For these reasons, the sample should not be expected to be nationally representative. Indeed, Applebaum (1988) found that, compared with the national elderly population with similar disabilities, the Channeling sample was less likely to be married and was much more likely to live alone. It was also much more likely to have had a recent hospital stay and to be receiving formal home care than was the national reference group. Thus, although the results of the analysis are presumably generalizable to eligible applicants of other home care programs like Channeling, they cannot be generalized to persons who meet the eligibility criteria but do not apply to the program, or to the entire disabled elderly population.

Table 3 presents the means and standard deviations of the three dependent variables. Consistent with their need for care, virtually all persons in the sample received at least one of the three types of home

Table 2: Means and Standard Deviations of Independent Variables (Proportions, except for Income and Age)

| | <i>Mean</i> | <i>Standard Deviation</i> |
|-----------------------------|-------------|-------------------------------|
| ADL Disabilities* | | |
| Five | .225 | .418 |
| Four | .240 | .427 |
| Three | .116 | .320 |
| Two | .134 | .340 |
| One | .158 | .364 |
| Incontinence* | | |
| Accident, last week | .477 | .500 |
| Catheter or colostomy | .099 | .299 |
| Cognitive/Behavior problem* | | |
| Cognitive impairment | .310 | .463 |
| Inappropriate behavior | .157 | .364 |
| Home medical treatment | .407 | .491 |
| State home care program | .419 | .494 |
| Medicaid eligible | .224 | .417 |
| City size* | | |
| Large city/suburb | .658 | .474 |
| Medium city/suburb | .160 | .367 |
| Income (dollars per month)† | 482 | 271 |
| Availability of family* | | |
| Married, has child | .249 | .432 |
| Married, no child | .065 | .246 |
| Not married, has child | .486 | .500 |
| Age (years) | 80 | 8 |
| Female | .715 | .452 |
| Race* | | |
| African American | .223 | .416 |
| Hispanic | .036 | .187 |
| Completed high school | .416 | .476 |
| Recently hospitalized | .482 | .500 |
| Health worsened | .823 | .379 |
| Loss of caregiver | .063 | .242 |
| Time frame discrepancy | .110 | .313 |

*Omitted categories are: "none" under ADL disability, "continent" under incontinence, "none" under cognitive or behavior problem, "not married, no children" under family availability, "small town or rural" under city size, and "white or other" under race.

†The natural logarithm of income plus 25 was used in the multivariate analysis.

Table 3: Percent Receiving Care and Hours of Care Received, by Type of Care

| | <i>Formal Care (s.d.)</i> | <i>Visiting Informal Care (s.d.)</i> | <i>Resident Informal Care (s.d.)</i> | <i>Total (s.d.)</i> |
|------------------------|-----------------------------------|--|--|-------------------------|
| Percent receiving care | 60.5 (48.9) | 64.8 (47.8) | 60.3 (48.9) | 97.8* (14.7) |
| Hours per week | | | | |
| Entire sample | 7.3 (17.2) | 11.9 (26.0) | 27.0† (32.7) | 46.4† (43.0) |
| Users only | 12.0 (20.8) | 18.3 (30.4) | 44.8† (31.3) | 47.5† (44.3) |

*Percent receiving *any* of the three types of care.

†Estimated for the subsamples ($N = 2,030$ and $N = 1,927$) for which data on resident informal hours and all three types of hours, respectively, are available. These samples were weighted to match the distribution of the larger sample with respect to the percent receiving each type of care.

care. About three-fifths of the sample received visiting formal care, a slightly higher proportion received visiting informal care, and three-fifths received resident informal care. Many received combinations of care—indeed, 93.1 percent received some form of informal care from those either in or outside the household, and about one-fifth received all three types of care (not shown). As stated earlier, the selected nature of the sample implies that receipt of formal care is greater and receipt of resident informal care is less than for the elderly nationwide with similar disabilities.

The amount of care received was large, 46.4 hours per week on average. Most of the care was provided informally by family and friends, 27.0 hours by caregivers living in the same household and 11.9 hours by those living apart. Although formal care accounts for less than one-sixth of total hours, it is large absolutely; the average, 7.3 hours, amounts to almost a day a week. Among those receiving each type of care, the average amount, of course, is even greater. Those receiving visiting informal care, for example, get the equivalent of over two eight-hour days a week on average.

The variation around the mean is extremely high. For the entire sample, the ratio of the standard deviation to the mean ranges from 0.9 for total hours to 2.4 for formal hours. Like those of other forms of health care, the distributions of the amounts of care used are highly skewed. The top 10 percent of users of formal care accounted for 63 percent of all the formal care used. The same was true of visiting

informal care. For resident informal care, the top 10 percent used 41 percent of all care used. Finally, for total hours, the top decile used 31.7 percent of the care (not shown).

ESTIMATION METHODOLOGY

The analysis uses the two-part method developed by Duan et al. (1983) in the RAND Health Insurance Experiment for distributions that, like these, are skewed and have many zero values. First, a probit model is used to estimate the probability of using each of the three types of care as a function of the independent variables:

$$\text{Prob}(H > 0) = F(X\beta) \quad (1)$$

where F is the cumulative standard normal distribution, H is hours of care, X is the vector of independent variables, and β is the vector of probit coefficients to be estimated. Second, for cases with positive hours, ordinary least squares regression is used to estimate the natural logarithm of hours as a function of the same variables:

$$\ln(H) = X\gamma + \epsilon \quad (2)$$

where γ is the vector of regression coefficients to be estimated.

Thus, a pair of equations is estimated for each of the three types of home care, one estimating the probability of receiving care and the other estimating the logarithm of hours of care conditional on receiving care. Because the amounts of the three types of care are jointly determined, the errors are correlated across the three types of care. This will lead to consistent but inefficient parameter estimates compared with joint estimation for all three types of care. No adjustment has been made to correct for this inefficiency, because the sample size is relatively large and joint estimation of the two-part model for three types of care would be cumbersome. Consequently, significance levels will be somewhat underestimated.

To simplify interpretation of the results, the coefficients estimated for Equation 1 and Equation 2 are transformed into natural units (probabilities and hours). First, the derivative of the probability of using the type of care with respect to any independent variables, X_i , is given by:

$$\frac{\partial \text{Prob}(H > 0)}{\partial X_i} = f(X\hat{\beta})\hat{\beta}_i \quad (3)$$

where f is the standard normal density function. This is calculated for each observation using its value for the vector of independent variables, X , together with the estimated probit coefficients, and is then averaged across the full sample. Second, the derivative of expected hours is calculated for each observation with positive hours according to:

$$\frac{\partial E(H|H > 0)}{\partial X_i} = \exp(X\hat{\gamma})\hat{\gamma}_i\Phi \quad (4)$$

where Φ is what Duan et al. (1983) term the "smearing factor":

$$\Phi = \frac{1}{n} \sum \exp(\hat{\epsilon}_j) \quad (5)$$

where $\hat{\epsilon}_j$ is the observed residual of the j th observation, and the sum is over the cases with positive hours. The derivative given by (4) is averaged over all cases with positive hours. These two sets of estimates show the separate effects of each independent variable on the probability of receiving care and on the hours of care conditional on receiving care.

To obtain an estimate of the unconditional effect on hours, taking into account the effects on both receipt of care and on hours among those receiving the care, the derivative of expected hours (not conditional on receipt) is estimated for each observation according to:

$$\frac{\partial E(H)}{\partial X_i} = [f(X\hat{\beta}) \hat{\beta}_i + F(X\hat{\beta}) \hat{\gamma}_i] [\exp(X\hat{\gamma}) \Phi] \quad (6)$$

and then averaged over the full sample. These derivatives of expected hours for the three types of care were then summed to get the effect of the independent variables on total hours of care.

The two-part model has a special advantage for this data set. Information on the receipt of resident informal care is available for the full sample, but as already stated, data on hours of resident informal care were collected only for a subsample. The equation for the log of resident informal hours must be estimated using the smaller subsample, but the two-part model permits the use of the full sample to estimate the equation for receipt of resident informal care.

Making estimates of effects on the probability of receiving care separately from effects on the amount received among those receiving it also allows variables to affect receipt and amount of care in opposite directions. Although this generally did not happen, three variables did have statistically significant effects on receipt and hours that were in opposite directions (see the Results section for the effects of receipt of

home medical treatments on formal care; effects of disability on visiting informal care; and effects of recent changes on resident informal care). As in an analysis of acute care, then, a separate analysis of receipt and amount is useful because they are not always affected in the same way. The results of previous research on home care, which has been dominated by analyses of receipt of care, may not be indicative of the determinants of the amount of home care used.

RESULTS

Table 4 presents the estimates of the effects of each of the independent variables on the probability of receiving each type of care (given by Equation 3) and the hours received *among those receiving care* (given by Equation 4). Table 5 presents the result of combining these two effects to obtain the effect on hours *among the entire sample*, including those who do not receive that type of care (given by Equation 6). Results from Table 4 and from Table 5 are discussed together for each independent variable. Thus, in addition to results on the probability of receiving care, two types of hours results are discussed: hours conditional on receipt (from Table 4) and hours not conditional on receipt (from Table 5). (Although it does not usually happen, the conditional and unconditional hours results can be in opposite directions. This is because the unconditional effect on hours combines the effect on hours conditional on receipt with the effect on the probability of receiving care. The effect on probability can be in the opposite direction from, and can outweigh the effect on, hours conditional on receipt.)

The effect of each variable on the total hours of care received from all three sources of care is the sum of the effects on the three types of hours (shown in the right-hand column of Table 5). These effects on total hours are not conditional on receiving care although, as shown above, almost everyone in the sample receives some care. "Total hours" is used without qualification to refer to these estimates. (Estimates of effects on total hours conditional on receiving some care are not presented.)

All of the independent variables except income and age are categorical variables. Estimates show the difference in the dependent variable between the group indicated in the row and the omitted group, controlling for the effect of other variables. (The omitted groups are indicated in a footnote to the table.) To make the results simpler to interpret, they are reported in natural units, probability (in percent), and hours, rather than in likelihood ratios or logarithms of hours.

Table 4: Effects on Percent Receiving Care and Hours of Care among Those Receiving It

| | Formal Care | | Visiting Informal Care | | Resident Informal Care | |
|--|------------------------|-------------------|------------------------|-------------------|------------------------|-------------------|
| | Percent Receiving Care | Hours among Users | Percent Receiving Care | Hours among Users | Percent Receiving Care | Hours among Users |
| ADL Disabilities [†] | | | | | | |
| Five | 12.2* | 13.8* | -9.8* | 14.6* | 37.2* | 38.1* |
| Four | 11.3* | 11.0* | -10.2* | 11.0* | 30.1* | 30.6* |
| Three | 11.0* | 9.8* | -9.3* | 7.4* | 23.6* | 19.6* |
| Two | 10.2* | 6.2* | -2.5 | 5.1* | 12.4* | 5.1 |
| One | 8.7* | 6.0* | -0.4 | 4.9* | 6.5* | 11.1 |
| Incontinence [†] | | | | | | |
| Accident, last week | -1.1 | 0.0 | -0.7 | 2.3* | 1.2 | 1.9 |
| Catheter or colostomy | 3.9 | -0.4 | -2.4 | -1.1 | 5.0* | 0.6 |
| Cognitive/Behavior problem [†] | | | | | | |
| Cognitive impairment | -1.1 | 1.0 | 0.2 | 3.3* | 8.1* | 6.0* |
| Inappropriate behavior | -6.3* | 0.9 | -2.3 | 3.9* | 10.8* | 11.7* |
| Home medical treatment | 37.9* | -3.3* | 2.4 | 3.1* | 6.6* | 1.2 |
| State home care program | 9.5* | 2.3* | 1.1 | -2.1 | -3.8* | -7.1* |
| Medicaid eligible | 2.4 | -3.1* | -2.4 | -0.5 | -0.8 | 4.0 |
| City size [†] | | | | | | |
| Large city/suburb | -0.1 | 0.8 | -2.8 | -1.9 | -1.1 | -3.8 |
| Medium city/suburb | 0.7 | -0.1 | 2.0 | -0.7 | 2.5 | -2.5 |
| Income (logarithm) | 5.3* | 3.3* | 2.6 | -0.3 | -3.6* | -5.2 |
| Availability of family [†] | | | | | | |
| Married, has child | -10.1* | -2.1* | 0.6 | 1.6 | 47.2* | 10.9* |
| Married, no child | -8.2* | -2.3 | -17.0* | -11.9* | 46.7* | -1.1 |
| Not married, has child | -7.6* | 0.9 | 0.9 | 5.1* | 11.9* | 5.5 |
| Age | 0.2* | 0.1* | 0.0 | 0.0 | 0.2* | -0.1 |
| Female | 4.0* | 2.2* | 3.2* | 0.8 | -2.7* | 2.1 |
| Race [†] | | | | | | |
| African American | -7.6* | -0.8 | 5.5* | 6.1* | 9.4* | 1.1 |
| Hispanic | -17.9* | -2.3 | 1.7 | 5.8* | 10.4* | 16.2* |
| Completed high school | 5.7* | 1.0 | -4.5* | -1.1 | -0.6 | -2.3 |
| Recently hospitalized | 3.0* | 2.5* | 1.3 | 4.7* | -5.7* | -3.0 |
| Health worsened | -0.7 | -0.7 | 3.7* | -1.7 | -3.6* | 7.3* |
| Loss of caregiver | 3.8 | 1.3 | 6.3* | -1.9 | -5.0* | 8.8 |
| Intercept | -63.8* | -18.5* | -2.9 | 18.8 | -19.7 | 162.2* |
| Sample size | 5150 | 3117 | 5150 | 3339 | 5150 | 1039 |
| Chi-square/ <i>F</i> -statistic [‡] | 1426 | 9.1 | 149 | 8.7 | 2568 | 5.9 |
| <i>R</i> ² § | .33 | .09 | .04 | .08 | .53 | .15 |

*Statistically significant at the 5 percent level using a two-tail test.

[†]Omitted categories are: "none" under disability in ADLs, "continent" under incontinence, "none" under cognitive or behavior problem, "not married, no children" under family availability, "small town or rural" under city size, and "white or other" under race.

[‡]Chi-square statistic for the probit models and *F*-statistic for the log hours models.

§Pseudo *R*² for the probit models and adjusted *R*² for the log hours models. The pseudo *R*² reported here is $[1 - (L_{\omega}/L_{\Omega})^{2/n}]/[1 - (L_{\omega})^{2/n}]$, where L_{ω} is the value of the likelihood function when all parameters are constrained to be zero and L_{Ω} is the value of the likelihood function at its maximum.

Table 5: Total Effects on Hours of Care per Week

| | <i>Formal Care</i> | <i>Visiting Informal Care</i> | <i>Resident Informal Care</i> | <i>Total</i> |
|------------------------------------|------------------------|---------------------------------------|---------------------------------------|--------------|
| ADL Disabilities* | | | | |
| Five | 9.8 | 7.7 | 37.2 | 54.7 |
| Four | 8.0 | 5.3 | 30.0 | 43.3 |
| Three | 7.2 | 3.1 | 20.8 | 31.1 |
| Two | 5.0 | 2.9 | 7.8 | 15.6 |
| One | 4.6 | 3.1 | 9.2 | 16.9 |
| Incontinence* | | | | |
| Accident, last week | -0.1 | 1.3 | 1.6 | 2.8 |
| Catheter or colostomy | 0.2 | -1.1 | 2.2 | 1.3 |
| Cognitive/Behavior problem* | | | | |
| Cognitive impairment | 0.5 | 2.2 | 6.7 | 9.4 |
| Inappropriate behavior | -0.2 | 2.1 | 11.2 | 13.1 |
| Home medical treatment | 2.4 | 2.4 | 3.2 | 8.1 |
| State home care program | 2.5 | -1.1 | -5.7 | -4.4 |
| Medicaid eligible | -1.6 | -0.8 | 2.1 | -0.3 |
| City size* | | | | |
| Large city/suburb | 0.5 | -1.8 | -2.7 | -4.0 |
| Medium city/suburb | 0.0 | -0.1 | -0.5 | -0.6 |
| Income (logarithm) | 2.6 | 0.3 | -4.5 | -1.6 |
| Availability of family* | | | | |
| Married, has child | -2.5 | 1.2 | 24.6 | 23.3 |
| Married, no child | -2.3 | -10.9 | 17.1 | 3.9 |
| Not married, has child | -0.3 | 3.5 | 7.9 | 11.1 |
| Age | 0.1 | 0.0 | 0.0 | 0.1 |
| Female | 1.8 | 1.1 | 0.2 | 3.1 |
| Race* | | | | |
| African American | -1.4 | 5.0 | 4.2 | 7.8 |
| Hispanic | -3.5 | 4.1 | 13.7 | 14.3 |
| Completed high school | 1.3 | -1.5 | -1.7 | -1.9 |
| Recently hospitalized | 1.9 | 3.3 | -4.0 | 1.2 |
| Health worsened | -0.5 | -0.4 | 3.0 | 2.1 |
| Loss of caregiver | 1.2 | -0.0 | 3.4 | 4.6 |
| Intercept | -18.7 | 11.7 | 90.6 | 83.7 |

*Omitted categories are: "none" under ADL disability, "continent" under incontinence, "none" under cognitive or behavior problem, "not married, no children" under family availability, "small town or rural" under city size, and "white or other" under race.

Results for number of ADL disabilities are discussed in somewhat greater detail than are the results for other variables to illustrate the interpretation of the different estimates in the two tables.

ADL Disability

The number of disabilities in activities of daily living is strongly associated with the probability of receiving both formal and informal care, particularly resident informal care. The probability of receiving resident informal care is 37.2 percent greater for persons who need help with all five types of ADL help than for the omitted group, those who do not need any ADL help. (Persons in the sample who do not need ADL help typically do need IADL help, such as meal preparation, shopping, etc.). The probability of receiving formal care also increases with disability. For the most seriously disabled (those with five ADL limitations), the probability of receiving formal care is 12.2 percent greater than for the least disabled (those with no ADL limitations). In contrast with formal and resident informal care, the probability of receiving visiting informal care decreases with disability. (This result need not follow from the resident care results because, as stated earlier, persons often receive more than one type of care.)

Conditional on receiving each type of care, the hours of care received increases with the number of ADL disabilities. For example, the most seriously disabled users of each type of care receive 13.8, 14.6, and 38.1 more hours per week of formal, visiting informal, and resident informal care, respectively, than the least disabled.

The separate effects of disability on the probability of receiving care and on the hours of care received by those receiving it are combined to obtain the effect on hours not conditional on receiving care in Table 5. Among users and nonusers combined, hours of all three types of home care increase with the number of ADL disabilities. The increase is greatest for resident informal care. Those requiring help with five ADL limitations received 37.2 more hours of resident informal care than those with no ADL disability. The corresponding estimates for formal and informal visiting care are smaller but nonetheless substantial: 9.8 and 7.7 hours, respectively.

The right-hand column of Table 5 shows estimates of the effect of disability on total hours of care from all three sources. Total hours are about the same for those with one and two ADL disabilities, but they then increase sharply with each additional disability. The difference in total hours between those with five ADL limitations and those with none is large, 54.7 hours.

Other Measures of Need for Care

Bowel or bladder incontinence (or needs for help with a catheter or colostomy) has a small effect on total hours of care after controlling for disability. Moreover, only 2 of the 12 underlying receipt and conditional hours coefficients are statistically significant.

Total hours of care are greater, even after controlling for disability, among persons displaying cognitive impairment or inappropriate behavior that affects ability to perform activities or requires supervision for safety. Those with cognitive impairment but not behavior problems received a total of 9.4 more hours of care than those with neither cognitive impairment nor behavior problems. Those with behavior problems (most of whom were also cognitively impaired) received a total of 13.1 more hours than those with neither problem. The pattern of the underlying receipt and conditional hours coefficients is similar to that for ADL disability. The one significant exception to this pattern is that inappropriate behavior reduces the probability of receiving formal home care. The supervision needed by those with behavior problems may be too costly to provide with visiting staff, or providers themselves may withdraw from cases where behavior problems are difficult to manage.

Receipt of medical treatment (for example, wound care, taking vital signs, physical therapy) at home from either a formal or informal caregiver is strongly related to the receipt of formal care. The probability of receiving formal care is 37.9 percent higher for those receiving medical treatment at home. This is by far the most important predictor of receiving formal care. Although not surprising given the type of care needed, it should be noted that this result is not tautological since some of the medical treatments were provided informally. Of those receiving help with medical treatment at home, 20.1 percent received such help only from informal caregivers, and 17.3 percent from both formal and informal caregivers (not shown). Receipt of medical treatment at home is nonetheless an imperfect measure of need for treatment because it is not certain that everyone who needs it gets it.

Whatever the measurement problems that may exist, the empirical result is consistent with receipt of medical treatment being a measure of greater need for home care. However, this result also has an alternative interpretation. Receipt of medical treatment is a proxy not only for need for skilled nursing care but also for coverage under Medicare. (Medicare reimburses for home health care if there is a need for skilled care.⁴) Thus, greater probability of receiving formal home care may reflect a response to the large subsidy formal care gets when

it is authorized under Medicare. The extent to which the results reflect the effect of the subsidy versus need for skilled care cannot be determined from these data.

Among those receiving formal care, the hours of formal care used by those receiving home medical treatment is significantly lower than for those not receiving them. This is consistent with the nature of home medical treatments, which are typically provided formally in relatively short home health aide or nursing visits. Those who use formal care but do not need medical treatments may hire homemakers, personal care aides, or companions who provide nonmedical personal care and supportive services. Their visits are typically longer than those of nurses, which may explain the negative effect of receipt of medical treatment on hours of formal care among those receiving it.

For informal care, the probability of receiving both visiting and resident informal care and the hours conditional on receipt of each of these types of care is greater for persons receiving medical treatments at home. (Only two of these four coefficients are statistically significant, however.) Thus, for informal care the need aspect of the measure appears to dominate the price aspect—otherwise the probability of receiving informal care would be lower for persons receiving medical treatments. In addition, the significant positive effect of receipt of medical treatment on visiting hours of care among those receiving visiting informal care suggests that in contrast to formal caregivers, visiting informal caregivers do not make short nursing visits; instead, receipt of medical treatment appears to indicate a greater overall need for care.

Finally, the overall effect of receipt of medical treatments on total hours of care is 8.1 hours, divided about equally among the three types of care.

Availability of Formal Care

As stated, data on the price of home care that each person faced were not available. The analysis used three proxy indicators of availability of formal care instead.

One proxy for availability of formal care is whether the site has a state program that pays for home care. Such programs typically lower the price to zero for a limited amount of home care for those eligible. The results are consistent with formal care being substituted for informal care where there is a state home care program. Both the probability of receiving formal care and the hours of formal care conditional upon receipt are greater where a state home care program exists. In

contrast, where a state home care program exists, the probability of receiving resident informal care and the hours of resident informal care conditional upon receipt are smaller. (Coefficients for visiting informal care are not statistically significant.) These results must be interpreted cautiously: the four sites that had state home care programs may have differed from the six that did not in other respects that account for the difference in the use of formal and informal care.

A second proxy, Medicaid eligibility, does not significantly affect the receipt of formal home care. This may be because Medicaid covers relatively little home care of any kind. Medicaid accounted for less than 10 percent of the total expenditures for formal community services used by the control group during the first six months after enrollment in Channeling. (See Corson et al. 1986, Table V.2.) Among users, persons eligible for Medicaid used significantly less formal care than those who were not eligible. As with Medicare, Medicaid-covered home health visits may be shorter than those paid for privately or by state programs, which are less likely to be short nursing visits. Informal care is not significantly related to Medicaid eligibility.

A third proxy for availability of formal care is whether the person lived in an urban or rural area. Visiting home care providers must spend more time traveling between homes when the population density is low. As a result, formal home care might be expected to be less easily available in rural than in urban areas. The evidence does not support this hypothesis—type of community had no effect for any type of care. This is inconsistent with the research of McAuley and Arling (1984) and Soldo (1985), who found that receipt of formal care was greater in urban areas.

Income

As expected, higher income is associated both with a greater probability of using formal care and a greater use among users, on the one hand, and with a lower probability of using resident informal care and lower use among users, on the other. (This last coefficient is not statistically significant.) These estimates translate into income elasticities of demand for formal home care of 0.36 and for resident informal care of -0.17. Informal visiting care did not vary significantly with income. Total hours of care decreased slightly with income.

Availability of Family

The availability of informal care has a large effect on the care received. Overall, those with both a spouse and a child receive the greatest total

hours of care; those with neither spouse nor child, the least; and those with one or the other, an amount somewhere between.

The largest effects are on resident informal care. The probability of receiving resident informal care is, not surprisingly, almost 50 percent higher for those who are married (and hence are already living with a potential caregiver). Among persons who are not married, those with children are more likely to receive resident care than those without. Hours of resident care conditional on receipt are greater among those who are married and have children than among those with neither a spouse nor a child.

Availability of family also affects visiting informal care. Those who are married and have no children receive the least visiting informal care. They are 17 percent less likely to receive visiting informal care. Those who do, receive 11.9 fewer hours of visiting care a week than those who have neither spouse nor child. A spouse without children apparently gets much less help from visiting caregivers than a spouse with children. The only other significant result was for hours of visiting informal care conditional on receipt: unmarried (typically widowed) persons with children receive more hours of visiting care than those who are unmarried and childless.

Consistent with expectation, the availability of a spouse or child reduced the probability of receiving formal care, by about 7 to 10 percentage points, compared with the probability when neither a spouse nor child was available. Among those receiving formal care, however, the amount of care received differed only for those who had a spouse and child. For them, the amount of formal care conditional on receipt was 2.2 hours less than for those with neither spouse nor children. Availability of informal care apparently affects the decision to rely on formal care but does not have a large effect on hours conditional on receipt. Moreover, the unconditional effect of the availability of family on hours of formal care is not large—2.5 hours or less.

Sociodemographic Characteristics

With one exception, the sociodemographic variables, although sometimes statistically significant, do not have a large effect on the amount or type of home care used. The exception is race. African Americans and Hispanics are less likely to rely on formal care and more likely to rely on informal care, both resident and visiting, than are whites. (The effect on visiting informal care for Hispanics is not significant.) In addition, African Americans and Hispanics receiving informal visiting care use more of it than whites, and Hispanics receiving resident care

use more of it than whites. When these effects are combined to obtain the unconditional effect on hours of care, African Americans and Hispanics receive somewhat less formal care and more resident and visiting informal care than whites.

Recent Change

Because the model has been estimated using cross-section data, observed care arrangements may be out of equilibrium. For example, persons who have been sick for some time are more likely to have adjusted their living arrangement to their care needs than are those whose care needs have recently increased. Hence, those whose health condition has recently gotten worse are less likely to rely on resident informal care. The same would be true of those who have recently lost a caregiver, assuming the caregiver had lived with a disabled elder. The model includes three measures of recent change: recent hospitalization, worsening of health, and loss of a caregiver. The results are consistent with expectation. For all three measures, those with a recent change for the worse have a significantly lower probability of receiving resident care than those without recent changes. In addition, persons whose health has worsened or who have lost a caregiver have a higher probability of receiving visiting informal care, and those recently hospitalized have a higher probability of receiving formal visiting care than those without the recent changes.

CONCLUSIONS

This article has analyzed the determinants of the amount of home care used by eligible applicants to the Channeling program, including hours of formal visiting care, informal visiting care, and resident informal care. Several of the findings have implications for understanding home care use and for long-term care policy.

The remarkably strong relationship between the total hours of care received and the number of disabilities in activities of daily living has implications for the design of home care programs. It confirms an assumption implicit in the eligibility criteria chosen for proposed home care programs: restricting eligibility to those with disabilities in activities of daily living, particularly more than three, will direct benefits to those who, at least on average, have greater care needs. In addition, the strong relationship between hours of care and number of ADL disabilities suggests that ADL disability could also be used to deter-

mine the amount of the home care benefit. For example, the maximum cost of the home care to which a person is entitled could be made to depend on the number of ADL disabilities the person has. Similarly, a personal care allowance program could base the size of the allowance on the number of ADL disabilities.

Whether for determining either eligibility or benefit levels, however, disability should not be used by itself. Cognitive impairment, behavior problems, and need for medical treatments are important predictors of the amount of care received, even after controlling for ADL disability. This strongly suggests that home care needs depend on more than just ADL disability.

The significant relationship between income and the amount and type of home care used suggests that home care arrangements may change in the future. The work of Easterlin, Macdonald, and Macunovich (1990) and of Rivlin and Wiener (1988) suggests that real incomes will be higher for future cohorts of elderly. If so, a positive income elasticity of demand for formal care—even the modest one estimated here (0.38)—implies that future demand for formal care will be greater than simple demographic projections of the size of the disabled population would suggest.⁵

The positive income elasticity of demand for formal home care also has implications for identifying the beneficiaries of expanded public financing for home care. If persons who are already purchasing home care privately become eligible for a new public program, public expenditures are likely to replace some of the existing private expenditures. Such replacement is likely to occur disproportionately among persons with higher incomes who use more formal home care (some of which is purchased privately).

That African Americans and Hispanics use less formal care and more informal care than whites raises some important unanswered questions. This difference may reflect differences in tastes—for example, a greater propensity to share households among the former two groups. But it may also reflect unmeasured differences in economic status or access to care. Further research is needed to distinguish among these potential causes. If the difference reflects differences in preferences that affect reliance on informal care, this is presumably not a policy concern. If, however, it reflects differences in access to formal home care or nursing home care, policies may be needed to eliminate inequities.

This analysis has not directly addressed the choice of living arrangement (whether to live alone or with others). However, because 95 percent of the persons in this sample who are living with others

receive some care from them, sharing households is virtually equivalent to receiving resident informal care. Therefore, effects on the probability of receiving resident informal care can be interpreted, to a close approximation, as effects on the probability of living with someone else.

Interpreted in this way, the results suggest that the probability of sharing households increases with all measures of need for care, availability of immediate family, age, and being African American or Hispanic; and that it decreases with the presence of a state home care program, income, being female, and recent changes for the worse. These relationships are consistent with two competing hypotheses: one, that people change their community living arrangements in response to these variables; and the other, that institutionalization decisions leave a selected population in different living arrangements in the community. For example, the strong relationship between receiving resident informal care and the number of ADL disabilities is consistent with the hypothesis that disabled elderly persons move in with informal caregivers (or vice versa) as care needs increase. However, it is also consistent with the hypothesis that persons who live alone are more likely to enter a nursing home when care needs increase than are those who are living with others. The population left in the community is thus highly selected, with those living alone less disabled than those living with others.

While the analysis presented here cannot discriminate between these two competing hypotheses, the strong relationship with need for care suggests that living arrangement adjustments are an important aspect of long-term care decisions. Although the results can only serve to raise questions about factors that affect the choice of living arrangement, they do highlight the potentially important role of living arrangements in long-term care choices.

Finally, the analysis has shown that informal caregivers are not only the most common providers of care in the community (which is well known), but they also provide far and away the greatest amounts of care. Moreover, the amount of informal care received increases with disability at a much greater rate than does formal care under the same circumstances. This suggests that as care needs increase, family and friends step in to provide the bulk of care.

These findings concerning informal care highlight difficult equity choices that must be made about who should receive public long-term care benefits. How informal care is valued affects—either explicitly or implicitly—the choice of eligibility criteria and benefit levels for home care programs. Those with immediate family are endowed with a

resource that others do not have, and the estimates presented here suggest that the differences in endowments are great. Those with a spouse and one or more children receive on average 23 hours more care per week than those with neither.

The family members providing this care bear a substantial long-term cost. This cost, moreover, is distributed unequally among the potential caregiver population. Some people have spouses, parents, or others close to them who live their lives without serious disability, while others must take responsibility for caring for relatives who are seriously disabled for a very long time. These latter caregivers face the largely uncompensated cost of providing informal care. Those who actually provide the care are much more often women than men. Women therefore bear a disproportionate share of the uncompensated cost of providing informal care.

Taking the availability of family into account in determining eligibility or benefit levels comes into conflict with the values of many people and poses difficult implementation problems. Demonstrations and state programs typically have not used the availability of informal care as an eligibility criterion. Instead, they have made case managers responsible for determining benefit levels for individual clients. Yet this simply shifts the responsibility for making these equity judgments to the case manager where the decisions are less visible. In allocating long-term care, in short, it is impossible to avoid judgments about how to treat differences in the availability of informal care.

ACKNOWLEDGMENTS

The author is grateful to Randy Brown for econometric advice; Jon Christianson, Dean Farley, Tom Grannemann, Peter Gottschalk, Chris Murtaugh, Jaana Muurinen, Pam Short, Bill Spector, Brenda Spillman, Robyn Stone, and the anonymous reviewers for helpful comments on an earlier draft of this article; Herman Liau, Beth MacDougall, and Sandy Smoot of Social and Scientific Systems, Inc. of Bethesda, MD for programming support; and Mary Seidenberg for secretarial support.

NOTES

1. Higher income was associated with more receipt of formal services (Branch, Jette, Evashwick, et al. 1981) and less receipt of informal care

- (Branch and Jette 1983). Evashwick et al. (1984) found that those who are Medicaid eligible are more likely to use formal care. Availability of informal care was associated with greater probability of receiving any care (McAuley and Arling 1984) and informal care (Branch and Jette 1983), but the evidence of its effect on receipt of formal care was mixed.
2. Soldo, Wolf, and Agree (1990) found a positive effect of income, and McAuley and Arling (1984) found a positive effect of education. Soldo, Wolf, and Agree (1990) found a greater probability of receiving formal care among those eligible for Medicaid, and McAuley and Arling (1984) and Soldo (1985) found a greater probability to exist in urban areas.
 3. Age and severe or moderate cognitive impairment were both associated with greater expenditures on personal care and housekeeping and smaller expenditures on home health care. Variables associated only with greater expenditures on personal care and housekeeping were being female, monthly income of \$500-\$1,000, having no assets, being in the Channeling treatment group, and greater nursing home bed supply; paralysis was associated with smaller expenditures. Variables associated only with greater expenditures on home health care were Medicaid eligibility, cancer, stroke; senility was associated with smaller expenditures.
 4. Much of the formal home care that the Channeling sample received was covered by Medicare. Medicare paid for approximately two-thirds of the control group's formal care during the first six months of follow-up. See Corson et al. (1986, Table V.2).
 5. The effect of higher income of future cohorts could, of course, be offset by other factors. For example, despite greater incomes at retirement, greater longevity of future cohorts could result in lower incomes late in life when disability is most likely. Or, rising relative prices of formal home care could at least partly offset the effect of rising incomes.

REFERENCES

- Applebaum, R. A. "Recruitment and Characteristics of Channeling Clients." *Health Services Research* 3, no. 1 (April 1988): 51-66.
- Branch, L., A. Jette, C. Evashwick, M. Polansky, G. Rowe, and P. Diehr. "Toward Understanding Elders' Health Service Utilization." *Journal of Community Health* 7, no. 2 (Winter 1981): 80-92.
- Branch, L. G., and A. M. Jette. "Elders' Use of Informal Long-Term Care Assistance." *The Gerontologist* 23, no. 1 (February 1983): 51-56.
- Branch, L. G., T. T. Wetle, P. A. Scherr, N. R. Cook, D. A. Evans, L. E. Hebert, E. N. Masland, M. E. Keough, and J. O. Taylor. "A Prospective Study of Incident Comprehensive Medical Home Care Use among the Elderly." *American Journal of Public Health* 78, no. 3 (March 1988): 255-59.
- Christianson, J. B. "The Effect of Channeling on Informal Caregiving." *Health Services Research* 3, no. 1 (April 1988): 99-117.
- Carcagno, G. J., R. Applebaum, J. Christianson, B. Phillips, C. Thornton, and J. Will. *The Evaluation of the National Long Term Care Demonstration*:

- The Planning and Operational Experience of the Channeling Projects*. Princeton, NJ: Mathematica Policy Research, July 1986.
- Corson, W., T. Grannemann, and N. Holden. "Formal Community Services under Channeling." *Health Services Research* 23, no. 1 (April 1988): 83-98.
- Corson, W., T. Grannemann, N. Holden, and C. Thornton. *Channeling Effects on Formal Community Based Services and Housing*. Princeton, NJ: Mathematica Policy Research, May 1986.
- Coulton, C., and A. K. Frost. "Use of Social and Health Services by the Elderly." *Journal of Health and Social Behavior* 23, no. 4 (December 1982): 330-39.
- Duan, N., W. G. Manning, Jr., C. N. Morris, and J. P. Newhouse. "A Comparison of Alternative Models for the Demand for Medical Care." *Journal of Business and Economic Statistics* 1, no. 2 (April 1983): 115-26.
- Dwyer, J. W., and M. K. Miller. "Differences in Characteristics of the Caregiving Network by Area of Residence: Implications of Primary Caregiver Stress and Burden." *Family Relations* 39, no. 1 (January 1990): 27-37.
- Easterlin, R. A., C. Macdonald, and D. J. Macunovich. "Retirement Prospects of the Baby Boom Generation: A Different Perspective." *The Gerontologist* 30, no. 6 (December 1990): 776-83.
- Edelman, P., and S. Hughes. "The Impact of Community Care on Provision of Informal Care to Homebound Elderly Persons." *Journal of Gerontology: Social Sciences* 45, no. 2 (March 1990): S74-S84.
- Evashwick, C., G. Rowe, P. Diehr, and L. Branch. "Factors Explaining the Use of Health Care Services by the Elderly." *Health Services Research* 19, no. 3 (August 1984): 357-82.
- Greene, V. L. "Substitution between Formally and Informally Provided Care for the Impaired Elderly in the Community." *Medical Care* 21, no. 6 (June 1983): 609-19.
- Kemper, P. *Living Arrangement and the Demand for Home Care: An Illustrative Theoretical Model*. Division of Long Term Care Studies Program Note. Rockville, MD: Agency for Health Care Policy and Research, April 1990.
- Kemper, P., R. S. Brown, G. J. Carcagno, et al. Special Issue: "The Evaluation of the National Long Term Care Demonstration." *Health Services Research* 23, no. 1 (April 1988): 1-174.
- Liu, K., T. D. McBride, and T. A. Coughlin. "Costs of Community Care for Disabled Elderly Persons: The Policy Implications." *Inquiry* 27 (Spring 1990): 61-72.
- Manton, K. G., and T. Hausner. "A Multidimensional Approach to Case Mix for Home Health Services." *Health Care Financing Review* 8, no. 4 (Summer 1987): 37-54.
- McAuley, W. J., and G. Arling. "Use of In-home Care by Very Old People." *Journal of Health and Social Behavior* 25, no. 4 (March 1984): 54-64.
- Moscovice, I., G. Davidson, and D. McCaffrey. "Substitution of Formal and Informal Care for the Community-Based Elderly." *Medical Care* 26, no. 10 (October 1988): 971-81.
- Phillips, B. R., S. A. Stephens, and J. J. Cerf. *The Evaluation of the National*

- Long Term Care Demonstration Survey Data Collection Procedures*. Princeton, NJ: Mathematica Policy Research, March 1986.
- Rivlin, A. M., and J. M. Wiener. *Caring for the Disabled Elderly: Who Will Pay?* Washington, DC: The Brookings Institution, 1988.
- Soldo, B. J. "In-home Services for the Dependent Elderly: Determinants of Current Use and Implications for Future Demand." *Research on Aging* 7, no. 2 (June 1985): 281-304.
- Soldo, B. J., D. A. Wolf, and E. M. Agree. "Family, Households, and Care Arrangements of Frail Older Women: A Structural Analysis." *Journal of Gerontology: Social Sciences* 45, no. 6 (November 1990): S238-S249.
- Stoller, E. P. "Parental Caregiving by Adult Children." *Journal of Marriage and the Family* 45, no. 4 (November 1983): 851-58.
- Wan, T. T. H. "Functionally Disabled Elderly: Health Status, Social Support, and Use of Health Services." *Research on Aging* 9, no. 1 (March 1987): 61-78.
- Williams, B. C., E. K. Phillips, J. C. Torner, and A. A. Irvine. "Predicting Utilization of Home Health Resources." *Medical Care* 28, no. 5 (May 1990): 379-91.