# Volume of Home- and Community-Based Services and Time to Nursing-Home Placement

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**Objective:** The purpose of this study was to determine whether the volume of Home- and Community-Based Services (HCBS) that target Activities of Daily Living disabilities, such as attendant care, homemaking services, and home-delivered meals, increases recipients' risk of transitioning from long-term care provided through HCBS to long-term care provided in a nursing home.

**Data Sources:** Data are from the Indiana Medicaid enrollment, claims, and Insite databases. Insite is the software system that was developed for collecting and reporting data for In-Home Service Programs.

**Study Design:** Enrollees in Indiana Medicaid's Aged and Disabled Waiver program were followed forward from time of enrollment to assess the association between the volume of attendant care, homemaking services, home-delivered meals, and related covariates, and the risk for nursing-home placement. An extension of the Cox proportional hazard model was computed to determine the cumulative hazard of nursing-home placement in the presence of death as a competing risk.

**Principal Findings:** Of the 1354 Medicaid HCBS recipients followed in this study, 17% did not receive any attendant care, homemaking services, or home-delivered meals. Among recipients who survived through 24 months after enrollment, one in five transitioned from HCBS to a nursing-home. Risk for nursing-home placement was significantly lower for each five-hour increment in personal care (HR=0.95, 95% CI=0.92-0.98) and homemaking services (HR=0.87, 95% CI=0.77–0.99).

**Conclusions:** Future policies and practices that are focused on optimizing long-term care outcomes should consider that a greater volume of HCBS for an individual is associated with reduced risk of nursing-home placement.

**Keywords:** Medicaid, Home and Community Based Care, Aged and Disabled, Waivers, Nursing Home

# Introduction

Among disabled older adults in need of formal long-term care services, home- and community-based services (HCBS) provide an alternative to nursing-home placement. Medicaid Aged and Disabled Waiver programs provide community based long-term care to about 14% of community-living older adults who are disabled in activities of daily living (ADL) (Ng, Harrington, & O'Malley, 2008). Medicaid Aged and Disabled Waiver HCBS programs are intended to provide services to disabled and medically ill older adults who would otherwise require long-term care in an institutional setting. HCBS are typically provided in recipients' homes, meeting many older adults' preferences for receiving needed long-term care services in the community, rather than in an institutional setting. HCBS programs are also responsive to policy makers' concerns about the escalating state long-term care expenditures, because long-term care provided through HCBS is significantly less costly than long-term care provided in institutions (Kitchener, Ng, & Harrington, 2004; Mitchell, Salmon, Polivka, & Soberon-Ferrer, 2006; Sands et al., 2008).

Disability in ADL is the most common reason for enrollment in Medicaid Aged and Disabled Waiver HCBS programs (Fortinsky, Fenster, & Judge, 2004). The HCBS services that most directly address ADL disability are attendant care, homemaker services, and home-delivered meals. The array of services that Indiana provides is representative of the array of services offered by most states (Duckett & Guy, 2000) . The process of assigning services to a client involves several steps. First, the client is assigned a social worker at a local Area Agency on Aging who interviews the client or caregiver using a standardized intake form to determine the client's functional and medical needs. The interview includes discussion of the availability of informal caregiving from family and friends. Second, a plan of care is devised to address clients' unmet long-term care needs. The plan of care describes the type and frequency of waiver services that will be provided, and informal supports that complement the waiver services. The third step involves approval by the Medicaid specialists who review the plan of care to ensure that the assigned services are justified. Once the waiver specialist approves the plan, a notice of action is posted after which the client may be contacted by a service provider. Methods for assigning volume of HCBS to Indiana Medicaid Aged and Disabled Waiver clients are comparable to those used by other states (Corazzini, 2003).

No formal guidelines exist for determining the volume of HCBS that should be provided to HCBS recipients (Corazzini, 2003). Prior studies provide evidence that resource allocation is affected by enrollee characteristics. For example, those with low levels of functioning receive a greater volume of formal care (Corazzini-Gomez, 2002). Availability of informal care typically reduces the volume of HCBS made available to clients, because HCBS are designed, in part, to help fill in gaps when informal care is insufficient. Informal caregivers provide approximately 50 to 80 hours of help per week depending on the care receiver's level of disability (LaPlante,

Harrington, & Kang, 2002). Acceptability of HCBS also plays a role in the volume of formal care received; caregivers' and patients' concerns about others being in the home explain, in part, why some clients use little, if any, formal caregiving services (Casado, van Vulpen, & Davis, 2011). Recent analyses of Indiana Aged and Disabled Waiver recipients suggest that the total number of hours of care received is low, with participants receiving on average approximately 20 hours of personal care, 4 hours of homemaking, and 5 home-delivered meals per month, with nearly one in five recipients not getting any of these three services (Xu et al., 2010). These estimates are similar to those seen in other states and in similar programs (D'Souza, James, Szafara, & Fries, 2009; Leutz, Nonnenkamp, Dickinson, & Brody, 2005).

Little published evidence exists about whether the number of hours of attendant care, homemaking, or the number of home-delivered meals is associated with long-term nursing-home placement. One study revealed that after closure of an HCBS program, many clients received fewer formal services (e.g., homemaking) in the community (Fischer, Leutz, Miller, von Sternberg, & Ripley, 1998). Closure of the HCBS program was associated with increased risk of institutionalization (Fischer et al., 2003). That study, however, did not specifically examine the association between volume of HCBS and nursing-home placement. Studies of consumer-directed care provide indirect evidence. A randomized controlled study of traditional Medicaid-provided services versus consumer-directed care revealed that those in the consumer-directed care group received significantly more hours of paid caregiving (Carlson, Foster, Dale, & Brown, 2007). Participants in consumer-directed care also had significantly lower rates of nursing-home placement for long-term care than Medicaid members receiving agency-directed HCBS (Dale & Brown, 2006). However, these studies of consumer-directed care did not directly assess the association between the amount of formal care and the risk of nursing-home placement.

Use of existing Medicaid data to study the association between volume of HCBS and nursing-home placement presents both benefits and challenges. External validity is enhanced by using data from Medicaid recipients who qualify for long-term care and for whom services were assigned according to standard protocols. In contrast, internal validity could be compromised if estimation of the association does not consider common factors that underlie need for HCBS and need for nursing-home placement. For example, dependency in ADL predicts both nursing-home placement (Gaugler, Duval, Anderson, & Kane, 2007) and use of HCBS (Alkema, Reyes, & Wilber, 2006). Selection of variables that represent common factors of volume of HCBS and nursing-home use may be guided by Anderson's Behavioral Model of Health Services Use. That model describes individual characteristics that could predispose, enable, and create a need for health services (Andersen & Newman, 2005).

Predisposing characteristics that increase propensity for long-term care services include older age and female gender, White race, and living alone. Individual characteristics that reflect a need for long-term care include chronic diseases, cognitive impairment, and level of functional impairment (Banaszak-Holl et al., 2004; Gaugler et al., 2007). Enabling characteristics describe whether the individual has resources for obtaining needed long-term care. One such

characteristic may be whether the individual has adequate resources to pay for needed care. Cost of care is cited as a major reason for frail older adults having unmet need for HCBS (Casado et al., 2011). In addition, "enabling" refers to whether the individual has a regular source of care to meet his or her long-term care needs. Examples of regular sources of care include availability of informal care provided by family or friends (Charles & Sevak, 2005), or formal care provided through HCBS. HCBS attendant care addresses disability in ADL, a strong determinant of long-term care use. Homemaking services and home-delivered meals provide needed help with instrumental ADL, another factor that creates need for long-term care use. Among older adults who are eligible for long-term care, nearly 90% need help with at least one ADL, and nearly all require help with at least one instrumental ADL, such as doing housework and preparing meals (Fortinsky et al., 2004; Wang, Kane, Eberly, Virnig, & Chang, 2009).

The premise underlying this study is that HCBS could directly reduce the risk for nursing home placement, because they replace the need for similar services provided in a nursing home. The three hypotheses of this study are that greater volume of: 1) attendant care, 2) homemaking services, and 3) home-delivered meals reduce risk for nursing home placement.

# Methods

Data are from the Indiana Medicaid enrollment, claims, and Insite databases. Insite is mainly used by case managers to conduct assessments, prepare plans of care, maintain client case notes, and record client data from plans of care.

## Subjects

Subjects were eligible for Medicaid benefits administered through the Indiana Family and Social Services Administration from January 2001 through June 2004. The study included 3,087 enrollees who had been placed on the Aged and Disabled Waiver. The Aged and Disabled Waiver assists frail older adults as well as physically disabled younger adults. Of those who received HCBS through the Aged and Disabled Waiver, 1,459 (47%) were 65 or more years of age. A total of 89 subjects had no enrollment record despite receiving a care plan, which suggests that they applied for the program, but never enrolled in the program and never received any services. Among the remaining 1,370 subjects, 16 had missing values for at least one of the covariates considered and hence were excluded from the analyses. The analytic sample included 1,354 subjects who were followed from the date they entered the HCBS program until December 2004. Data were provided to investigators by the Indiana Family and Social Services Administration. Human subjects' approval was obtained from Purdue University.

## Nursing-Home Placement

The primary outcome was time to nursing-home placement since HCBS enrollment, which was obtained from monthly enrollment data. We defined nursing-home placement as nursing-home

admissions that resulted in stays of three months or longer, to distinguish admissions for long-term care from admissions for short-term stays that typically occur for rehabilitation. Recipients were right-censored at the time of discontinuation from the Medicaid program or at the end of the follow-up period.

## Death

Time to death was obtained from the Medicaid enrollment data. Death is considered as a competing event instead of a censoring event for nursing home placement, because subjects were not able to be admitted to nursing homes after death. In the analyses of death, nursing-home admission did not result in censoring.

*Predictors of Nursing Home Placement*

Variables that represent predisposing factors were: age (categorized as less than 75 or at least 75 years), gender, race (categorized as White or other), living arrangement (categorized as alone or not alone), marital status (categorized as married or other), and whether the subject had an informal caregiver. Additional predisposing variables determined from claims records included hospital, emergency department, or nursing home use in the six months prior to HCBS enrollment.

Enabling variables included availability of an informal caregiver, which was determined from two items in the Insite database. The first inquired whether the person had any friend or relative who was able and willing to provide needed assistance, support, and personal or chore services. The second question inquired whether the subject had a friend or relative who had been providing needed assistance, but who was no longer able to continue those services. Other enabling variables included geographic region of Indiana (north, central, south) and whether the subject had to pay some health care expenses out of pocket (spend-down), because the subject's income was above Medicaid's income threshold.

The enabling variables that were used to test the study hypotheses were volume of attendant care, homemaking services, and home-delivered meals. Using claims data, we assessed subjects' average hours of attendant care and homemaking services and the average number of home-delivered meals during the study period. These average values were expressed as volume of services per month. Attendant care helps individuals accomplish ADLs. Homemaking services help with routine household help, such as cleaning or laundry. Home-delivered meals are nutritionally balanced meals delivered to the subjects' homes.

Variables that reflect need for nursing home placement included co-morbidities and disability. Functional status was characterized by number of dependencies in basic ADLs (dressing, bathing, eating, toileting, and transferring) and instrumental ADLs (IADL; preparing meals, doing light housework, shopping for groceries, traveling in a car, managing medication, answering the telephone, calling the telephone operator, managing personal hygiene, and managing finances). The International Classification of Diseases, 9th Revision Clinical

Modification (ICD-9-CM) codes, from claims six months prior to HCBS enrollment, were reviewed to determine presence of co-morbid conditions and to compute a Charlson co-morbidity score (Charlson, Pompei, Ales, & MacKenzie, 1987). Subjects were defined as having dementia if they had a claim with an ICD-9-CM code for dementia (Bharmal, 2007) or a prescription for a cholinesterase inhibitor within one year of the HCBS enrollment. Cholinesterase inhibitors—donepezil, tacrine, rivastigmine, galantamine, and memantine—are used almost exclusively to treat dementia.

## Statistical Analyses

The analyses determined the association between nursing home placement for long-term care and volume of HCBS and covariates in the presence of death as a competing event. The cumulative incidence function, also known as the sub-distribution function, of nursing home placement $F_1(t)$ is the probability of nursing home admission by time $t$. To compare the cumulative incidence curves across covariate groups, we used the test proposed by Gray (1988). Treating nursing home placement as a competing event, we also calculated the cumulative incidence of pre-nursing home death and compared the cumulative incidence curves for death before nursing home placement across covariate groups.

A standard Cox model for time-to-event analysis is inappropriate in the presence of competing risks. First, it considers competing risks of the event of interest as censored observations, which ignores the dependence between the event of interest and competing events. Second, the cause-specific hazard function does not have a direct interpretation in terms of survival probability, which depends on both the hazard rate for the event of interest and the hazard rate for the competing events. An alternative approach is the Fine and Gray method, which directly models the effect of covariates on the cumulative incidence function of interest and death (Fine & Gray, 1999). Specifically, their approach models the subdistribution hazard of the cumulative distribution function. As in the standard Cox model, the subdistribution hazard is assumed to have a proportional hazards effect, as in the following equation.

$$h_1(t;Z) = h_{01}(t)e^{Z'\hat{a}}$$

The cumulative incidence function can then be computed directly using the subdistribution hazards. Unlike the approach when the competing events are ignored, the Fine and Gray approach does not censor the competing events. Instead these competing events are carried forward with appropriate weighting. We used this approach to determine the bivariate relationship between each predisposing, enabling, and need characteristic and nursing-home placement in the presence of death as a competing risk (Exhibit 1). In addition, we use this approach to determine the independent association between the volume of HCBS and nursing-home placement in the presence of death as a competing risk, after adjustment for predisposing, enabling, and need characteristics that are associated with long-term care.

**Exhibit 1. Cumulative Incidence Rate of Nursing-Home Placement at 24 Months With Death as a Competing Event**

|  | N | Cumulative Incidence | P-Value |
|---|---|---|---|
| Total | 1354 | 0.204 | |
| *Predisposing* | | | |
| Age | | | 0.0003 |
| Less than 75 years | 537 | 0.145 | |
| 75 years or older | 817 | 0.242 | |
| Gender | | | 0.3692 |
| Female | 1143 | 0.211 | |
| Male | 211 | 0.165 | |
| Race | | | 0.0991 |
| White | 1118 | 0.212 | |
| Other | 236 | 0.164 | |
| Living arrangement | | | 0.8502 |
| Not alone | 631 | 0.202 | |
| Alone | 723 | 0.205 | |
| Marital Status | | | 0.3629 |
| Married | 205 | 0.208 | |
| Other | 1149 | 0.182 | |
| Hospitalization in prior 6 months | | | 0.4028 |
| No | 872 | 0.214 | |
| Yes | 482 | 0.185 | |
| Emergency department visit in prior 6 months | | | 0.1450 |
| No | 681 | 0.224 | |
| Yes | 673 | 0.183 | |
| Nursing-home placement in prior 6 months | | | 0.0254 |
| No | 1191 | 0.195 | |
| Yes | 163 | 0.279 | |

| Exhibit 1 (cont.) | N | Cumulative Incidence | P-Value |
|---|---|---|---|
| *Enabling* | | | |
| Informal help | | | 0.6628 |
| No | 125 | 0.190 | |
| Yes | 1229 | 0.205 | |
| Spend-down | | | 0.3239 |
| No | 567 | 0.187 | |
| Yes | 787 | 0.215 | |
| Region | | | 0.3145 |
| North | 279 | 0.174 | |
| Central | 560 | 0.212 | |
| South | 515 | 0.212 | |
| *Need* | | | |
| Number of basic ADL dependencies | | | 0.3715 |
| 0–1 | 234 | 0.187 | |
| 2–3 | 811 | 0.217 | |
| 4–5 | 309 | 0.178 | |
| Number of instrumental ADL dependencies | | | 0.0026 |
| 0–4 | 367 | 0.156 | |
| 5–6 | 496 | 0.214 | |
| 7–9 | 333 | 0.261 | |
| Charlson score | | | 0.0065 |
| 0 | 386 | 0.255 | |
| 1 | 292 | 0.213 | |
| 2+ | 676 | 0.169 | |
| Congestive heart failure | | | 0.0803 |
| No | 939 | 0.217 | |
| Yes | 415 | 0.174 | |
| Chronic obstructive pulmonary diseases | | | 0.0030 |
| No | 941 | 0.226 | |
| Yes | 413 | 0.153 | |

| Exhibit 1 (cont.) | N | Cumulative Incidence | P-Value |
|---|---|---|---|
| Cerebrovascular disease | | | 0.5850 |
| No | 1116 | 0.201 | |
| Yes | 238 | 0.218 | |
| Dementia | | | <0.0001 |
| No | 1051 | 0.162 | |
| Yes | 303 | 0.351 | |
| Diabetes mellitus | | | 0.0215 |
| No | 915 | 0.224 | |
| Yes | 439 | 0.158 | |
| Hypertension | | | 0.2086 |
| No | 813 | 0.221 | |
| Yes | 541 | 0.177 | |

*The p-values were obtained from the Gray's test for comparing the cumulative incidence curves over the follow-up period across covariate groups.

SOURCE: Data are from the Indiana Medicaid enrollment, claims, and Insite databases.

The means and interquartile ranges of each predisposing, enabling, and need characteristic, and volume of attendant, homemaking, and home-delivered meals are reported in Exhibit 2. The associations between these characteristics and volume of HCBS were determined using the non-parametric Wilcoxon-Mann-Whitney test for variables with two categories, and the Kruskal-Wallis test for variables with more than two categories. All statistical analyses were performed using SAS 9.

**Exhibit 2. Recipients' Characteristics and Average Monthly Volume of Home- and Community-Based Services**

| | Attendant Care | | Home-Making | | Home-Delivered Meal | |
|---|---|---|---|---|---|---|
| | Median (Interquartile Range) | | | | | |
| Total | 8 | (0–26.2) | 0 | (0–5.1) | 0 | (0–10.1) |
| *Predisposing* | | | | | | |
| Age | | | | | | |
| Less than 75 years | 7.4 | (0–24.9) | 0 | (0–5.9) | 0 | (0–11.3)* |
| 75 years or older | 8.3 | (0–27.4) | 0 | (0–4.6) | 0 | (0–9.3) |
| Gender | | | | | | |
| Female | 8.5 | (0–26.7)* | 0 | (0–5.0) | 0 | (0–9.5)* |
| Male | 5.0 | (0–24.6) | 0 | (0–5.5) | 0 | (0–12.6) |

| Exhibit 2 (cont.) | Attendant Care | | Home-Making | | Home-Delivered Meal | |
|---|---|---|---|---|---|---|
| Race | | | | | | |
| White | 7.6 | (0–25.3) | 0 | (0–5.6)*** | 0 | (0–10.2) |
| Other | 9.6 | (0–30.5) | 0 | (0–0.6) | 0 | (0–9.6) |
| Living arrangement | | | | | | |
| With others | 5.8 | (0–25.5)*** | 0 | (0–0.4)*** | 0 | (0–7.9)*** |
| Alone | 9.8 | (0–27.4) | 0 | (0–7.2) | 0 | (0–12.2) |
| Marital Status | | | | | | |
| Married | 5.5 | (0–24.6)* | 0 | (0–3.1) | 0 | (0–11.1) |
| Other | 8.5 | (0–26.4) | 0 | (0–5.5) | 0 | (0–9.9) |
| Hospitalization in prior 6 months | | | | | | |
| No | 8.9 | (0–28.0)** | 0 | (0–5.2) | 0 | (0–11.0) |
| Yes | 6.4 | (0–24.3) | 0 | (0–4.8) | 0 | (0–9.6) |
| Emergency department visit in prior 6 months | | | | | | |
| No | 8.9 | (0–27.7)* | 0 | (0–4.7) | 0 | (0–10.3) |
| Yes | 7.2 | (0–25.0) | 0 | (0–5.6) | 0 | (0–9.7) |
| Nursing–home placement in prior 6 months | | | | | | |
| No | 8.2 | (0–25.5) | 0 | (0–5.3)** | 0 | (0–10.0) |
| Yes | 6.9 | (0–33.5) | 0 | (0–1.3) | 0 | (0–11.7) |
| *Enabling* | | | | | | |
| Informal help | | | | | | |
| No | 6.6 | (0–20.9) | 0 | (0–7.1)** | 3.4 | (0–14.2)*** |
| Yes | 8.3 | (0–26.5) | 0 | (0–4.8) | 0 | (0–9.6) |
| Spend-down | | | | | | |
| No | 0 | (0–27.9) | 0 | (0–6.3)* | 0 | (0–14.8)*** |
| Yes | 8.0 | (0–24.9) | 0 | (0–4.4) | 0 | (0–6.1) |
| Region | | | | | | |
| North | 4.8 ( | 0–19.4)*** | 0 | (0–6.7)*** | 0 | (0–3.8)*** |
| Central | 9.1 | (0–29.3) | 0 | (0–6.0) | 0 | (0–8.6) |
| South | 8.3 | (0–28.5) | 0 | (0–2.4) | 0 | (0–12.8) |

| Exhibit 2 (cont.) | Attendant Care | | Home-Making | | Home-Delivered Meal | |
|---|---|---|---|---|---|---|
| *Need* | | | | | | |
| Number of basic ADL dependencies | | | | | | |
| 0–1 | 5.0 | (0–16.6)*** | 0.1 | (0–6.0)*** | 0 | (0–8.4)*** |
| 2–3 | 8.9 | (0–26.6) | 0 | (0–5.8) | 0 | (0–12.5) |
| 4–5 | 8.5 | (0–37.0) | 0 | (0–0) | 0 | (0–2.8) |
| Number of instrumental ADL dependencies | | | | | | |
| 0–4 | 7.4 | (0–21.7)* | 0 | (0–6.6)*** | 0 | (0–9.3)** |
| 5–6 | 10.2 | (0–27.6) | 0 | (0–5.6) | 0 | (0–12.6) |
| 7–9 | 5.8 | (0–31.3) | 0 | (0–0.5) | 0 | (0–7.9) |
| Charlson score | | | | | | |
| 0 | 8.3 | (0–24.0) | 0 | (0–4.0) | 0 | (0–11.9) |
| 1 | 10.6 | (0–28.0) | 0 | (0–5.2) | 0 | (0–8.9) |
| 2+ | 6.7 | (0–26.6) | 0 | (0–5.7) | 0 | (0–10.1) |
| Congestive heart failure | | | | | | |
| No | 8.4 | (0–25.9) | 0 | (0–4.8) | 0 | (0–10.4) |
| Yes | 7.3 | (0–27.0) | 0 | (0–6.1) | 0 | (0–9.1) |
| Chronic obstructive pulmonary diseases | | | | | | |
| No | 8.9 | (0–27.7)*** | 0 | (0–4.3)* | 0 | (0–10.3) |
| Yes | 5.0 | (0–23.0) | 0 | (0–6.4) | 0 | (0–9.7) |
| Cerebrovascular disease | | | | | | |
| No | 8.0 | (0–25.5) | 0 | (0–5.3)* | 0 | (0–11.3)** |
| Yes | 8.4 | (0–28.2) | 0 | (0–3.2) | 0 | (0–6.0) |
| Dementia | | | | | | |
| No | 8.5 | (0–24.9) | 0 | (0–5.7)*** | 0 | (0–11.3)** |
| Yes | 5.7 | (0–32.0) | 0 | (0–1.4) | 0 | (0–6.8) |

| Exhibit 2 (cont.) | Attendant Care | | Home-Making | | Home-Delivered Meal | |
|---|---|---|---|---|---|---|
| Diabetes mellitus | | | | | | |
| No | 8.5 | (0–26.9) | 0 | (0–4.2)** | 0 | (0–9.9) |
| Yes | 7.2 | (0–25.5) | 0 | (0–6.2) | 0 | (0–10.5) |
| Hypertension | | | | | | |
| No | 7.6 | (0–25.3) | 0 | (0–5.1) | 0 | (0–10.0) |
| Yes | 8.7 | (0–27.4) | 0 | (0–5.0) | 0 | (0–10.2) |

*p-value<0.2; **p-value<0.05; ***p-value<0.01
SOURCE: Data are from the Indiana Medicaid enrollment, claims, and Insite databases.

# Results

Of the 1,354 Medicaid recipients who received long-term care through HCBS waivers, 467 (35%) received no attendant care, 834 (62%) received no homemaking, and 804 (59%) did not receive home-delivered meals. A total of 229 (17%) did not receive any of the three HCBS that addressed ADL disability. The median monthly hours of attendant care was 26.2 hours, the median monthly hours for homemaking was 0 hours, and the median number of home-delivered meals per month was zero.

The average follow-up period was 16.2 months with a standard deviation of 9.7 months. A total of 250 subjects (19%) entered a nursing-home, 352 (26%) died before nursing-home placement, and 77 (5.7%) lost Medicaid eligibility by the end of the study period. Exhibit 1 shows that most subjects were female (84%), White (83%), and had informal help from friends or relatives (91%). The two most prevalent co-morbid conditions were hypertension (40%) and diabetes mellitus (32%). Also presented in Exhibit 1 are the cumulative incidence rates of nursing-home placement at 24 months, while treating death as a competing event. Although the follow-up period ranged from one month to 36 months, most subjects were no longer enrolled by 36 months, so bivariate significance tests for the association between subject characteristics and cumulative incidence of nursing home placement are reported for 24 months in Exhibit 1. Subjects who were 75 years or older had a significantly higher rate of nursing-home placement than their younger counterparts (p<0.001). The rate of nursing-home placement for subjects with dementia was more than twice as high as that for subjects without dementia. Those who lived alone had a comparable rate of nursing-home placement compared to those who lived with others.

Exhibit 2 describes the association between patients' predisposing, enabling, and need characteristics, and average monthly volume of attendant care, homemaking, and home-delivered meals. The medians and interquartile ranges reveal that regardless of patient characteristics, one in four did not receive attendant care, and one in two did not receive home-making or home-delivered meals. Patients' characteristics associated with greater volume of attendant care included being female, living alone, being unmarried, no admissions to a hospital

or emergency department in the six months prior to enrollment, living in central or the southern portions of the state, moderate levels of ADL or IADL disability, and lack of pulmonary disease. Characteristics associated with having greater volume of home-making services include being White, living alone, lacking informal help, not having a nursing-home visit in the prior six months, living in central or southern portions of the state, having fewer ADL and a moderate number of IADL dependencies, having pulmonary disease, dementia, or diabetes mellitus, and lack of cerebrovascular disease. Characteristics associated with receiving more home-delivered meals include being older, being male, living alone, lacking informal help, not having met spend-down, living in the central or southern portions of the state, and having a moderate number of ADL or IADL dependencies.

Exhibit 3 presents the adjusted hazard ratios of HCBS in the context of other characteristics that could predispose, enable, or create need for nursing home admission. The only predisposing characteristic associated with time to nursing home admission was race; non-White race was associated with reduced risk for nursing home admission (HR=0.66; 95% CI=0.44-0.98). Need characteristics associated with nursing home admission were IADL limitations and dementia. Compared to 1–4 limitations, those with 7–9 had a significantly higher risk of nursing home placement (HR=1.50; 95% CI=1.04–2.15). Dementia was associated with a significantly higher risk for nursing home placement (HR=2.64; 95% CI=1.95 – 3.57).

**Exhibit 3. Risk of Nursing-Home Placement After Enrollment in the Aged and Disabled Waiver Program**

| Variable | Nursing-Home Placement | | |
| --- | --- | --- | --- |
| | Hazard Ratio | 95% Confidence Interval | P-Value |
| *Predisposing* | | | |
| Age: 75 years or older | 1.143 | 0.837–1.562 | 0.400 |
| Gender: Male | 1.044 | 0.703–1.552 | 0.830 |
| Race: Non-White | 0.657 | 0.440–0.980 | 0.040 |
| Living arrangement: Alone | 1.269 | 0.936–1.722 | 0.120 |
| Marital status: Married | 0.934 | 0.613–1.425 | 0.750 |
| Hospitalization in prior 6 months | 1.257 | 0.885–1.785 | 0.200 |
| Emergency department visit in prior 6 months | 0.934 | 0.675–1.294 | 0.680 |
| Nursing-home placement in prior 6 months | 1.280 | 0.857–1.914 | 0.230 |

**Exhibit 3 (Cont.)**

| Variable | Hazard Ratio | 95% Confidence Interval | P-Value |
|---|---|---|---|
| *Enabling* | | | |
| Informal help | 1.011 | 0.649–1.575 | 0.960 |
| Spend-down | 1.081 | 0.821–1.424 | 0.580 |
| Region: Central | 1.275 | 0.891–1.825 | 0.180 |
| Region: South | 1.220 | 0.836–1.781 | 0.300 |
| *Need* | | | |
| Basic ADL: 2–3 limitations | 1.367 | 0.957–1.952 | 0.086 |
| Basic ADL: 4–5 limitations | 0.909 | 0.581–1.423 | 0.680 |
| Instrumental ADL: 5–6 limitations | 1.342 | 0.986–1.828 | 0.061 |
| Instrumental ADL: 7–9 limitations | 1.495 | 1.040–2.148 | 0.030 |
| Charlson score: 1 | 0.793 | 0.542–1.160 | 0.230 |
| Charlson score: 2+ | 0.648 | 0.389–1.078 | 0.095 |
| Congestive heart failure | 1.022 | 0.718–1.456 | 0.900 |
| Chronic obstructive pulmonary diseases | 0.740 | 0.514–1.064 | 0.100 |
| Cerebrovascular disease | 1.255 | 0.862–1.827 | 0.240 |
| Dementia | 2.638 | 1.947–3.574 | <.001 |
| Diabetes mellitus | 0.918 | 0.635–1.327 | 0.650 |
| Hypertension | - | - | - |
| *HCBS Enabling* | | | |
| Attendant care (per 5 hours) | 0.951 | 0.924–0.978 | <.001 |
| Homemaking (per 5 hours) | 0.869 | 0.765–0.988 | 0.032 |
| Home-delivered meals (per 5 meals) | 0.921 | 0.845–1.004 | 0.061 |

SOURCE: Data are from the Indiana Medicaid enrollment, claims, and Insite databases.

Results provide evidence for the study hypotheses that greater volume of HCBS is associated with reduced risk for nursing-home placement. Every 5-hour increase in the volume of attendant care services per month was associated with a 5% (95% CI: 0.022, 0.076) lower risk of nursing-home placement. Each additional 5 hours of homemaking per month was associated with a 13% (95% CI: 0.012, 0.235) lower risk of nursing-home placement. Nursing-home placement was not associated with receipt of home-delivered meals, having an informal caregiver, or other enabling characteristics that reflected availability of resources (e.g., spend-down) to obtain needed care.

# Discussion

Among enrollees in an Aged and Disabled Waiver program, greater volume of attendant care and homemaking is associated with lower risk of nursing-home placement. Among recipients who survived through 24 months after enrollment, 1 in 5 transitioned from HCBS to a nursing-home. Data are not available to describe why nearly a third of recipients did not receive attendant care and more than half did not receive homemaking services. We do not know whether lack of receipt of these services reflected needs that were already met or whether recipients and their families refused these services. Regardless of why recipients had no personal care or homemaking services, this study revealed that as few as 5 hours per month of these services were associated with decreased risk of nursing-home placement, and that greater volume of these services was associated with even lower risk. This finding may be of use to those who assess and counsel older adults and their families about need for formal care services. The study may also inform Medicaid administrators and policy makers about potential downstream costs associated with a low volume of HCBS.

The associations between subjects' characteristics and volume of care have face validity in the context of guidelines for assigning Medicaid waiver HCBS. For example, guidelines stipulate that Medicaid waiver HCBS are meant to supplement, but not replace, informal care. Bivariate results provide evidence that these guidelines were considered when assigning care. Those living with others received fewer HCBS than those who lived alone, and those who had an informal caregiver received fewer HCBS than those who did not have an informal caregiver. Similarly, those who had to pay some health care expenses out of pocket (spend-down), because their income was above Medicaid's income threshold, received fewer HCBS. The finding that hospitalization in the prior 6 months was associated with less attendant care is also in the expected direction. Many hospitalized older adults are discharged with home health services. A prior study showed that case managers do not supplement existing home health services when assigning HCBS for long-term care (Corazzini, 2003). To our knowledge, prior studies have not reported bivariate associations between subjects' characteristics and volume of HCBS. The results reported in Exhibit 2 inform which patients' characteristics are associated with greater volume of care. Such information is relevant to Medicaid policy makers as they plan resources needed for their Medicaid waiver HCBS recipients.

Subjects' characteristics associated with nursing-home placement found in this study are consistent with those reported in prior studies. A meta-analysis revealed that the two strongest predictors of nursing-home placement are cognitive impairment and prior nursing-home placement (Gaugler et al., 2007). The bivariate results presented in Exhibit 1 show the same trend. Another similarity in findings between the meta-analysis and our study is that the association of level of ADL disability and nursing-home placement is non-linear. A moderate level of functional disability is associated with greater risk of nursing-home placement than low or high levels of functional disability. Together, these results provide evidence for similarity

between our study and prior studies in the underlying processes driving the need for long-term care services.

## Limitations

Findings from this study must be considered in the context of limitations associated with using existing administrative data. Data limitations prevent exploration of the mechanisms by which a lower volume of services is associated with a greater risk for nursing-home placement. For example, data were not available to describe availability of community resources (e.g., meals provided by churches) or factors influencing case-management decision making processes. Although the process used to assign volume of services should have considered these factors, we were unable to verify these assumptions statistically. A related limitation is that there may have been need for nursing-home placement that was not captured by the variables included in this study. One example is that we only knew whether an informal caregiver was available and not how many hours the caregiver was available. Since volume of HCBS is a function of availability of informal care, low volume of HCBS might be related to the subjects' needs being met. Low volume might also be a function of subjects' and families' concerns about others being in the home, while subjects' needs were not completely met. We do not know whether including hours of informal care would have changed the results; a meta-analysis of U.S. data revealed that hours of informal care do not significantly predict nursing-home placement (Gaugler et al., 2007).

The quasi-experimental design of this study prevents conclusions about causality. Thus, results of this study cannot be used to make prescriptive recommendations for assigning volume of HCBS to clients. Additional research is needed to determine whether changes in volume of HCBS are predictive of subsequent nursing-home admission. Such changes could occur in the context of need for home health after hospital discharge. This study did not include data about whether the subject had home health services associated with a prior hospitalization, but we did find that prior hospitalization was associated with lower volume of attendant care. This is consistent with others' findings that case managers do not supplement existing home health services with HCBS (Corazzini, 2003). Despite these limitations, the study findings do provide evidence of the importance of monitoring clients who receive a low volume of HCBS. Further, the results provide evidence for the need for additional research to determine how to optimize delivery of HCBS and clinical outcomes among clients with Aged and Disabled Waivers.

## Conclusions

The success of Medicaid Aged and Disabled Waiver HCBS programs in delaying nursing-home placement depends, in part, on whether the program is meeting enrollees' ADL needs. As states continue to expand their HCBS programs, it is important to consider whether state policies to control per-diem costs will affect quality of care and will reduce the potential for HCBS to

substitute for long-term care. The results of this study suggest that restricting volume of HCBS to very low levels increases risk for nursing-home placement and therefore may be at odds with a goal of using HCBS to prevent or delay nursing-home placement. Specifically, compared to receiving no attendant care, each additional five hours of attendant care per month is associated with a 5% reduction in risk for nursing home-placement. Attendant care addresses disability in ADL, which is a major driver of need for long-term care. Similarly, each 5-hour increase in home-making is associated with a 13% decrease in risk of nursing-home placement. Additional research is needed to examine costs associated with increasing volume of HCBS that address older adults' functional disabilities. The cost analysis should not only consider the direct costs associated with providing services, but also potential savings associated with delaying or preventing nursing-home placement. Findings would inform the development of policies that optimize states' use of long-term care resources.

## Disclaimer

Dr. Weiner is Chief of Health Services Research and Development at the Richard L. Roudebush Veterans Affairs Medical Center in Indianapolis, Indiana. The views expressed in this article are those of the authors and do not necessarily represent the views of the Department of Veterans Affairs.

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