After Rehabilitation: An 18-Month Follow-Up of Elderly Inner-City Women

Catherine L. Lysack, Stewart Neufeld, Benjamin T. Mast, Susan E. MacNeill, Peter A. Lichtenberg

OBJECTIVE. Elderly inner-city women (n = 125) greater than the age of 60 and living alone and who were consecutively admitted to a large, urban, university-based rehabilitation hospital were followed to (a) examine the power of standardized clinical measures to predict who was living alone 18 months after discharge, (b) determine whether live-alone women at 18 months' follow-up were more independent in instrumental activities of daily living (IADL) than women who were not living alone, and (c) investigate whether women who return home to live alone and have low or declining physical function are at risk for subsequent relocation or death.

METHOD. Data from four standardized assessments (physical function, cognition, comorbidity, and depression) and demographic information were gathered during in-patient rehabilitation. Self-report IADL data were collected via telephone interviews at 3, 6, and 18 months' follow-up.

RESULTS. Statistical analysis of results showed that physical function, cognition, and comorbidity were significant and independent predictors of living alone at 18 months' follow-up. Women living alone at 18 months reported significantly greater IADL independence than women who were not living alone. Path analysis confirmed that the relationship between the clinical measures and living situation at 18 months was mediated by self-reported IADL functioning.

CONCLUSION. Standard clinical data obtained at discharge are useful to identify who can return home to live alone after rehabilitation, but in-home assessment of IADL remains key to understanding the complex skills required to live alone.

Living alone is an increasingly common phenomenon in the United States, especially for elderly women. Nationally drawn samples confirm that more than one third of Americans greater than age 65 (9.5 million persons) live alone and over 7.7 million of this group are women (Bureau of the Census, 1992).

Despite the size of the live-alone population and the anticipated impact of this cohort of aging Americans on the health care system, research is only beginning to identify the necessary skills and conditions to live at home alone. Thus, it is not surprising that research findings in this area are mixed. On the one hand, there is evidence that many older women who live alone experience diminished physical and cognitive functioning, reduced economic resources, and a variety of social losses (Rubin, 1997; Wilmoth, 1998). Older adults who live alone are also reported to be at increased risk for depression and experience more frequent problems with home safety and maintenance than those who live with others (Chappell, 1991; Mui & Burnette, 1994). On the other hand, several large-scale studies of community-dwelling elderly have demonstrated that elderly women who live alone are at no particular disadvantage with respect to increased risk of illness (Magaziner, Cadigan, Hebel, & Parry, 1988) or mortality (Davis, Moritz, Neuhaus, Barclay, & Gee, 1997). Live-alone status may even confer a significant
There is, however, an identifiable subgroup of live-alone older adults who are more clearly at increased risk for functional decline (Campion, 1996). They are elderly women living in the inner city, many of whom are minorities, who also have significant medical problems (Edwards & Baum, 1996; Hays, Fillenbaum, Gold, Shanley, & Blazer, 1995). Schoenbaum and Waidman (1997) report that African Americans have more functional limitations, on average, than their White counterparts. Elderly African-American women are more than one-half as likely to go outside their homes in a typical week as are Whites—a difference that persisted even after controlling for physical independence, socioeconomic resources, and health conditions.

Social and physical environment is known to be an important factor with respect to independent living. Thompson and Krause (1998) studied the relationship between neighborhood conditions and social support and found that deteriorated neighborhoods and fear of crime are critical factors for older adults, and are especially pronounced for older inner-city adults who live alone. There is also evidence from the American Housing Survey to suggest that the physical condition of housing units occupied by older minority women are amongst the most deficient (Choi, 1999). Still, there is evidence that older adults who were living alone prior to hospitalization strongly prefer to return home to live alone (Rubinstein, 1989).

Very few studies have examined the ability of elderly persons to return home to live-alone status after discharge from hospital, let alone in an urban minority population. It is known, from preliminary and cross-validation research with this clinical population that the two strongest predictors of return to independent living at discharge are physical functioning and cognitive status (MacNeill & Lichtenberg, 1997; MacNeill, Lichtenberg, & LaBuda, 2000). Related analyses have confirmed significant differences in activities of daily living (ADL) and instrumental activities of daily living (IADL) between African-American women who live alone and those who do not at 6 months after discharge from medical rehabilitation (Lysack, MacNeill, & Lichtenberg, 2001).

We introduce the concept of “fitness to live alone” by which we mean the interplay of functional ability, assistance from others, and environmental factors that enable someone to live alone. To initiate an examination of fitness to live alone we need longer-term studies that identify factors that distinguish live-alone women from those not living alone. Longer-term follow-up can also help identify those who return home at some point after rehabilitation but later move to a different living arrangement or die. Here we can begin to examine important but complex questions related to discharge readiness and environmental supports. Better information about fitness to live alone will enhance clinicians’ abilities to work with patients and their families to achieve independent living at home, if feasible, or to make other suitable recommendations.

**Study Purpose**

The purposes of this study were threefold: (1) To determine whether physical function, cognition, comorbidity, depression, length of stay, and demographic factors measured during rehabilitation can predict living alone for women 18 months after discharge; (2) to determine whether women living alone 18 months after discharge are more independent in IADL than those not living alone (we hypothesized that those who are living alone are more independent); and (3) to begin to empirically define how personal competency variables relate to our broader concept “fitness to live alone.” Secondary questions pertaining to the third purpose included: (a) Are lower functioning women who are nevertheless living at home at increased risk for a change in living arrangement or death? and (b) are women living alone who decline in IADL function at an increased risk of moving into a different living arrangement?

**Methods**

**Design Overview**

The study reported here is part of a larger longitudinal clinical study (n = 194) in which a series of standardized clinical assessments (described below) were conducted at or near discharge from in-patient rehabilitation. Follow-up data were collected by telephone interviews at 3, 6, and 18-months post-discharge. Related results at 6 months’ follow-up are reported elsewhere (Lysack, MacNeill, Neufeld, & Lichtenberg, 2002).

**Defining the Sample**

Research participants were consecutive admissions to a free-standing Midwestern university-based urban medical rehabilitation hospital who were greater than the age of 60 years and living alone prior to admission. In this study, living alone was defined as sole resident of the home. Of the 243 patients eligible, 194 (80%) consented to participate in the study and completed the initial study assessment. The remainder either refused to participate (13%) or were
excluded because of aphasia or because they did not speak English (7%). Only age and gender data were collected for nonparticipants, and these variables did not differ from the research volunteers. The analysis reported here focuses on the women in the study (n = 139), in particular, those women (n = 125) with complete data regarding living situation and about whom it was known whether they were living alone or not living alone at 18-months’ post-discharge or who had died. We excluded from this study those women whose living situation was unknown (n = 14). The majority of the women (110 of 125 or 88%) were African American, and ranged in age from 60 to 98 years, with a mean age of 75.5 years (SD = 9.2). The mean education level of the sample was 10.9 years, although 25% of the women had completed more than a 12-year high school education. As would be expected, nearly two thirds (62%) of the sample were widowed, while 31% were separated or divorced and 7% had never been married. The living situations (including “unknown”) of all 139 women in the initial study at rehabilitation discharge, and at 3, 6, and 18-months’ post-discharge are presented in Table 1. The study was approved by the University’s Human Subjects Committee and we obtained informed consent from all study participants.

Measures and Procedures

Four standardized assessments administered just prior to patient discharge from rehabilitation and a structured patient interview (designed specifically for this study) administered by telephone at 3, 6 and 18-months’ follow-up provided study data.

The Functional Independence Measure (FIM) (Hamilton, Granger, Sherwin, Zielzny, & Tashman, 1987) evaluates functional performance on 18 activities of daily living (ADL): Feeding, grooming, bathing, dressing (upper and lower), toileting, bladder and bowel control, locomotion, stair climbing, transfers (bed, toilet, and bathtub), comprehension, expression, sociability, problem-solving, and memory. Each item is scored from 1 (completely dependent) to 7 (completely independent) using a standardized, performance-based protocol. The FIM has high inter-rater reliability, with an intra-class correlation coefficient of 0.97 for the total score (Hamilton, Laughlin, Granger, & Kayton, 1991). Recent reviews have confirmed the excellence of its psychometric properties (Cohen & Marino, 2000; Ottenbacher, Hsu, Granger, & Fiedler, 1996). Ottenbacher and colleagues (1996) report a median inter-rater reliability for the total FIM of .95 and median test-retest and equivalence reliability values of .95 and .92, respectively. Validity has been demonstrated with brain-injured patients and stroke patients (Cook, Smith, & Truman, 1994) and for persons ages 80 years and above (Pollak, Rheault, & Stoeckler, 1996). Occupational therapists and physical therapists on the rehabilitation unit collected the FIM data as part of their routine clinical duties.

Neuropsychologists at the rehabilitation hospital measured patients’ depression and levels of cognition. Depression was assessed using the Geriatric Depression Scale (GDS) (Yesavage et al., 1983), and scores were reported according to the following convention: 0–10 no depression present; 11–16 mild depression; and 17 and more moderate depression. The original GDS was developed for patients with geriatric populations, and is composed of 30 yes–no self-referent statements. The instrument developers report strong validity and reliability scores: A split-half reliability coefficient of 0.94, a test-retest reliability correlation of 0.85, and a highly significant (p < .001) analysis of variance result when GDS score was used to correctly classify subjects as normal, mildly depressed, and severely depressed (Yesavage et al., 1983). The short form (GDS-SF), used in this study, is significantly correlated to the long form when used with geriatric psychiatric patients (r = 0.84, p < .01), as well as with the nonclinical elderly (r = 0.66, p < .01) (Sheikh & Yesavage, 1986).

Cognition was evaluated using the Mattis Dementia Rating Scale (MDRS) (Mattis, 1988). The performance-based MDRS includes scales for attention, initiation, grapho-motor construction, abstraction, and memory. A score of 124 or higher indicates intact cognition; scores between 103–124 are indicative of mild or moderate cognitive impairment; and scores lower than 103 indicate more severe impairment. The MDRS has excellent test-retest reliability (r = .97) and split-half reliability (r = .90) (Gardner, Oliver-Munoz, Fisher & Empting, 1981).

To quantify the influence of co-morbid chronic conditions for this sample, the Charlson Index of Co-Morbidity (CMI) was used (Charlson, Pompei, Ales, & MacKenzie, 1987). Total score on the CMI is calculated by coding each coexistent disease according to weights related to the relative risks of mortality associated with each disease. High scores reflect a high number of diseases or increased disease

Table 1. Living Arrangement of Women at Rehabilitation Discharge and at 3, 6, and 18 Months’ Post-Discharge.

<table>
<thead>
<tr>
<th></th>
<th>At Discharge</th>
<th>3 Months’ Post-Discharge</th>
<th>6 Months’ Post-Discharge</th>
<th>18 Months’ Post-Discharge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alone</td>
<td>64</td>
<td>83</td>
<td>93</td>
<td>65</td>
</tr>
<tr>
<td>Family or Friends</td>
<td>42</td>
<td>21</td>
<td>18</td>
<td>21</td>
</tr>
<tr>
<td>Nursing Home or Hospital</td>
<td>31</td>
<td>22</td>
<td>10</td>
<td>13</td>
</tr>
<tr>
<td>Assisted Living</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Home/Complex</td>
<td>0</td>
<td>7</td>
<td>15</td>
<td>25</td>
</tr>
<tr>
<td>Attendant</td>
<td>0</td>
<td>4</td>
<td>2</td>
<td>14</td>
</tr>
<tr>
<td>Deceased</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Missing</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
severity, or both. The CMI was validated on a cohort of 685 medical patients and found to be a significant predictor of 1-year survival \((p < .0001)\) (Moore & Lichtenberg, 1996). Test-retest reliability, assessed with the intraclass correlation coefficient, is 0.92 (Katz, Chang, Sangha, Fossel, & Bates, 1996). It is the only published method of controlling for comorbidity factors that was developed empirically. The Health Care Financing Agency (Deyo, Cherkin, & Ciol, 1992) has indicated that the CMI is a valid and excellent predictor of morbidity and disability outcomes. Medical diagnoses were abstracted from the patients’ charts and were rechecked for accuracy by medical records’ staff prior to calculation of the CMI.

In addition to the four standardized measures, a brief study interview was developed to gather follow-up data by telephone at 3, 6, and 18 months after patient discharge. The interview included a series of close-ended questions focusing on patient residence and IADL performance. IADL was assessed using Lawton and Brody’s Instrumental Activities of Daily Living Scale (IADL Scale) (1969). The 10 items on this scale are telephone use, financial management, medication use, food preparation, housekeeping, laundry, use of transportation, shopping, driving, and chores—repairs. IADL items are scored on a 4-point scale, and possible total scores range from zero (complete dependence) to 4.0 (complete independence). Lawton and Brody (1969) reported test-retest reliability of .73 and acceptable correlation with observer ratings \((r = .61)\) for the IADL Scale. In our sample, the internal consistency using Cronbach’s alpha was 0.935.

Data Analysis

Data were analyzed using the SPSS PC+ statistical software package (version 10.0). Frequency counts and percentages were used to summarize demographic characteristics and clinical data, including patients’ FIM, GDS, MDRS, and CMI scores, and functional status (IADL). MANOVA was used to compare clinical scores and demographic characteristics between women who were living alone at 18 months’ post-discharge and those who were not living alone. The t test was used to test for significant differences in mean total IADL scores between live-alone and non–live-alone women. Logistic regression was used to model the capacity of standardized clinical measures measured during in-patient rehabilitation to predict live-alone status at 18 months’ post-discharge. To examine the inter-relationships between baseline measures and subsequent outcomes at 18 months, a path model was estimated using AMOS software (version 3.6, 1997). In this model, the relationships between baseline personal competency variables (FIM, GDS, MDRS, and CMI) and primary (IADL function at 18 months) and secondary (living situation) outcomes at 18 months were examined. This model was estimated with maximum likelihood estimation.

Results

Predicting Live-Alone Status Using Clinical Measures and Demographic Characteristics

In this section we compare women who were living alone 18 months after discharge with women who were not living alone at 18 months, including those who had died, on their scores on four standardized measures (FIM, GDS, MDRS, and CMI), collected prior to discharge from rehabilitation. Details of this comparison are found in Table 2. We also measured length of in-patient rehabilitation stay and the demographic variables age, race, and years of education. Comparison of these variables for the live-alone and non–live-alone women are also found in Table 2.

It should be noted that the total FIM score was divided into two sub-scores for analysis purposes—“FIM motor” (consisting of the first 13 “physical” ability items on the original measure) and “FIM social-cognition” (consisting of comprehension, expression, social interaction, problem solving, and memory). This reflects the research literature that shows the FIM measures two different constructs (Cohen & Marino, 2000). Because the FIM social-cognition score was highly correlated with the MDRS (Pearson \(r = .735\)), we dropped further consideration of the FIM social-cognition score in later analyses in favor of the more comprehensive MDRS.

We performed a multivariate analysis of variance (MANOVA) to test for mean differences in our clinical assessments (FIM, GDS, MDRS, CMI), as well as age, years of education, length of rehabilitation stay, and race between women living alone and women not living alone.

Data were analyzed using the SPSS PC+ statistical software package (version 10.0). Frequency counts and percentages were used to summarize demographic characteristics and clinical data, including patients’ FIM, GDS, MDRS, and CMI scores, and functional status (IADL). MANOVA was used to compare clinical scores and demographic characteristics between women who were living alone at 18-months’ post-discharge and those who were not living alone. The t test was used to test for significant differences in mean total IADL scores between live-alone and non–live-alone women. Logistic regression was used to model the capacity of standardized clinical measures measured during in-patient rehabilitation to predict live-alone status at 18 months’ post-discharge. To examine the inter-relationships between baseline measures and subsequent outcomes at 18 months, a path model was estimated using AMOS software (version 3.6, 1997). In this model, the relationships between baseline personal competency variables (FIM, GDS, MDRS, and CMI) and primary (IADL function at 18 months) and secondary (living situation) outcomes at 18 months were examined. This model was estimated with maximum likelihood estimation.

Results

Predicting Live-Alone Status Using Clinical Measures and Demographic Characteristics

In this section we compare women who were living alone 18 months after discharge with women who were not living alone at 18 months, including those who had died, on their scores on four standardized measures (FIM, GDS, MDRS, and CMI), collected prior to discharge from rehabilitation. Details of this comparison are found in Table 2. We also measured length of in-patient rehabilitation stay and the demographic variables age, race, and years of education. Comparison of these variables for the live-alone and non–live-alone women are also found in Table 2.

It should be noted that the total FIM score was divided into two sub-scores for analysis purposes—“FIM motor” (consisting of the first 13 “physical” ability items on the original measure) and “FIM social-cognition” (consisting of comprehension, expression, social interaction, problem solving, and memory). This reflects the research literature that shows the FIM measures two different constructs (Cohen & Marino, 2000). Because the FIM social-cognition score was highly correlated with the MDRS (Pearson \(r = .735\)), we dropped further consideration of the FIM social-cognition score in later analyses in favor of the more comprehensive MDRS.

We performed a multivariate analysis of variance (MANOVA) to test for mean differences in our clinical assessments (FIM, GDS, MDRS, CMI), as well as age, years of education, length of rehabilitation stay, and race between women living alone and women not living alone.

Data Analysis

Table 2. Mean Scores (Demographics, Physical Function, Cognition, Depression, and Comorbidity) by Live-Alone Status at 18 Months’ Post-Discharge.

<table>
<thead>
<tr>
<th>Mean Score (Standard Deviation)</th>
<th>Living Alone 18 months’ post-discharge ((N = 65))</th>
<th>Not Living Alone 18 months’ post-discharge or deceased ((N = 66))</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIM Motor</td>
<td>72.7 (9.3)</td>
<td>63.3 (12.2) ***</td>
</tr>
<tr>
<td>MDRS (cognition)</td>
<td>126.6 (14.5)</td>
<td>110.7 (17.6) ***</td>
</tr>
<tr>
<td>GDS (depression)</td>
<td>6.4 (5.1)</td>
<td>9.1 (6.3) ***</td>
</tr>
<tr>
<td>CMI (comorbidity)</td>
<td>1.2 (0.9)</td>
<td>1.8 (1.2) **</td>
</tr>
<tr>
<td>Age</td>
<td>73.2 (8.5)</td>
<td>78.0 (9.3) ***</td>
</tr>
<tr>
<td>Education (years)</td>
<td>11.7 (3.7)</td>
<td>10.0 (3.1) **</td>
</tr>
<tr>
<td>Race</td>
<td>83% African American</td>
<td>95% African American</td>
</tr>
<tr>
<td>Length of Stay (days)</td>
<td>13.2 (5.6)</td>
<td>16.2 (5.7) **</td>
</tr>
</tbody>
</table>

* = \(p < .05\), ** = \(p < .01\), *** = \(p < .001\); ( ) = standard deviation

MANOVA model including the above variables: \(F(8,110) = 7.1; p < .0001\)

FIM = Functional Independence Measure; MDRS = Mattis Dementia Rating Scale; GDS = Geriatric Depression Scale; CMI = Charlson Co-morbidity Index
(including those who were deceased) 18-months' post-discharge. The overall model was significant ($F(8,110) = 7.1; p < 0.0001$). Each of the dependent variables except race was significantly different for the group of women living alone at 18 months versus the group that was not. Women living alone at 18 months after rehabilitation discharge had higher FIM motor ($F(1,117) = 20.8; p < 0.001$) and cognition (MDRS) scores ($F(1,117) = 28.7; p < 0.001$), and lower comorbidity (CMI) ($F(1,117) = 9.0; p = .003$) and depression (GDS) scores ($F(1,117) = 6.5; p = .012$). Those living alone were also different in two demographic characteristics: they were younger ($F(1,117) = 9.5; p = .003$) and had more years of formal education ($F(1,117) = 7.7; p = .006$). As one might expect, those living alone had a shorter rehabilitation stay as well ($F(1,117) = 8.9; p = .003$).

Thus, taken individually, we see that the scores on the FIM motor, MDRS, CMI, and GDS assessments at rehabilitation discharge, as well as length of stay, and the demographic characteristics of age and education, were significantly different for those women living alone at 18-months' post-discharge versus those who were not living alone. However, some of these variables are significantly correlated (for example, Pearson $r = -0.26$ for length of rehabilitation stay and FIM motor score). This leads us to inquire further about a minimal set of variables measured at discharge that would best predict live-alone status at 18 months' follow-up.

We proceeded by using a stepwise backward logistic regression to develop a model relating these standard clinical measures and demographic variables to live-alone status at 18-months' post-discharge (see Table 3). Three variables were significant and our final model is: Log[$p/$not living alone] = -9.104 + 0.05FIM motor + 0.057MDRS -0.733CMI.

Note that depression, length of rehabilitation stay, age, race, and education were not significant factors in predicting live-alone status after considering FIM motor, MDRS, and CMI. The sensitivity of the model is 71.9%, the specificity is 76.5%, and the negative predictive power is 78.8%. To illustrate the use of the model suppose that a woman has a discharge FIM motor score of 72.7, an MDRS score of 126.6, and a CMI score of 1.2 (the mean scores of a woman living alone). Then the model predicts her odds of living alone as 2.4 (probability of 71%). As a second illustration, suppose a woman has a discharge FIM motor score of 63.3, an MDRS score of 111.7, and a CMI score of 1.8 (the mean scores of a woman not living alone). Then the model predicts her odds of not living alone as 2.6 (probability of 72%). Thus, the regression analysis shows that 3 of the 4 clinical measures are significant and independent predictors of older women's live-alone status at 18-months' follow-up.

**Instrumental Activities of Daily Living (IADL)**

Much can happen between discharge from rehabilitation and 18 months' follow-up, including functional improvement. Therefore, the elderly inner-city women in the study were telephoned at 3, 6, and 18-months' post-discharge and asked questions about their current levels of independence in a variety of activities of instrumental ADL. In this section we compare reported IADL independence for women who were living alone 18 months after discharge with those who were not living alone. We have IADL data for 56 of 65 women who were living alone at 18 months, and data for 30 of 35 women who were not living alone. As with any self-report, the levels of IADL independence reported here may be systematically overestimated and therefore not reflect “true” levels of IADL independence, so we urge cautious interpretation.

The differences in the total IADL scores between the group living alone and the group not living alone were highly significant ($\chi^2(84) = 7.7; p < 0.0001$). Also, the order of difficulty of the IADL tasks was quite similar for women who lived alone and those who did not, and ranged from easier tasks such as using the telephone to the most difficult tasks such as housekeeping, driving, and chores (see Figure 1). Finally, self-reported IADL performance was very low for those not living alone. With the exception of phone use, medication use, and financial management, at least 83% of women not living alone were dependent on personal assistants to perform IADL activities. Thus, the data on IADL support the hypothesis that those living alone at 18-months' follow-up are functionally more able than those who are not.

**Women at Risk of Residential Relocation and Death**

We also examined whether women living alone but with low reported functional abilities were at risk for subsequent change in living arrangement or death. To do this we focused on the 84 women who were living alone at 6
months after discharge from in-patient rehabilitation and for whom we have living arrangement data at 18 months (93 women were living alone at 6 months but 9 were missing at 18 months). Of these 84 women, 63 were living alone at 18 months, 13 were not living alone, and 8 had died.

Our first observation was that 8 of 10 deaths occurring in our sample between 6 and 18 months were women who were living alone at 6 months after discharge from rehabilitation. Of the women living alone at 6 months, we have 6-month IADL data on 71 of 76 women who were living at 18 months and 5 of 8 women who had died. The total mean IADL score of the women who had died (mean IADL = 22.4) was significantly lower than the mean score of those who were still living at 18 months (mean IADL = 29.2; t(74) = 2.2; p = 0.03). Second, women who were living alone at 6 months but not living alone at 18 months did not have significantly lower IADL scores at 6 months than women living alone at 18 months. Thus, knowledge of IADL scores at 6 months does not allow us to say that certain women are at risk for a subsequent change in living arrangement, although lower IADL scores are associated with a higher probability of death.

We next asked whether decline in functional ability is associated with a change in living arrangement. Of the 76 women who were living alone 6 months after in-patient rehabilitation and also alive at 18 months, we have 6-month and 18-month IADL data for 53 of 63 women living alone at 18 months and 11 of 13 women not living alone. The mean reported total IADL score for the women still living alone at 18 months was almost identical to what it was at 6 months’ post-discharge (6-month mean IADL = 29.7; 18-month mean IADL = 30.4). However, the mean IADL score for women who experienced a change in living arrangement between 6 and 18 months declined dramatically from 27.3 to 18.9 (paired t(10) = 2.7; p = 0.02). Thus, there is some preliminary evidence that women who experience a decline in functional ability are at increased risk for subsequent change in living arrangement.

Path Analysis

To examine the complex inter-relationships among personal competency variables (the clinical measures and IADL) and live-alone status, a path model was estimated (AMOS, 1997). This was an attempt to better understand the relative contribution of these variables to the ultimate outcome in this study, living alone. In this model, all potential paths between the four clinical baseline variables (FIM, GDS, MDRS, and CMI, all measured at or near discharge from in-patient rehabilitation), IADL function at 18 months’ post-discharge, and the 18-month outcome (living alone versus not) were estimated including direct paths linking baseline variables to living situation at 18 months. The analysis showed that, overall, there were no significant direct relationships between the four clinical measures and living situation at 18 months once IADL functioning at 18 months was entered into the model; thus, IADL mediates the relationship between the baseline clinical measures and living situation at 18 months. Figure 2 illustrates the final results of this model with only the statistically significant paths included for simplicity. As indicated in Figure 2, greater cognitive impairment and greater functional impairment at the time of discharge were associated with poorer IADL functioning at 18 months, which in turn is associated with a lesser likelihood of living at home alone.

Discussion

Findings in this study provide evidence for the clinical utility of the Functional Independence Measure (FIM) motor,

![Figure 1. Percent of Women Independent in 10 Instrumental Activities of Daily Living (self-reported) at 18 Months’ Post-Discharge by Live-Alone Status (Self-Report).](http://ajot.aota.org/)

![Figure 2. Path Diagram Depicting Significant Relationships Between Baseline Competency Variables, IADL Functioning, and Live-Alone Status at 18 Months Post Discharge.](http://ajot.aota.org/)
Charlson Co-morbidity Index (CMI), and Mattis Dementia Rating Scale (MDRS) scores, all measured at discharge, to predict living arrangement (alone or not alone) 18 months after discharge from in-patient rehabilitation. Evidence of the predictive power of these clinical assessments is demonstrated by the regression analysis, and is further supported by the significantly higher levels of IADL function reported by live-alone women at 18 months’ follow-up. The unique contribution of the path analysis is to illustrate how each clinical measure affects IADL performance, which in turn affects the ability to live alone.

One question of clinical relevance was whether we were able to predict who among women discharged home alone were at risk for subsequent change in living arrangement or death. Our analysis of women living alone 6 months after discharge showed that women who died had lower total IADL scores and women who experienced declines in their IADL scores were at risk for a change in living arrangement. This finding speaks to the importance of community-based services to identify cases where there is significant functional decline so that actions can be taken to help prevent the occurrence of adverse outcomes.

A related issue is understanding the finding that, although independence level was much higher for women living alone at 18-months, there were still a substantial number of women within this group who were not independent in some important IADL skills. To achieve the goals of these tasks many of these women must have been receiving considerable assistance from family, friends, or community services, even though they were living alone. Again, this reinforces the importance of community services or family and friends, or both, to support these women in their homes; otherwise, as our data suggest, some of these women may be at increased risk for a subsequent change in living arrangement or death.

Only a very small handful of studies focused on predicting independent living for older adults have been conducted by occupational therapists. None has focused on the live-alone population. Still, these studies represent important steps forward for the profession to the extent that they show how occupational therapists have influenced the development and testing of performance-based functional instruments used to measure the ability to live independently. For example, Hasselkus (1982) examined the relationship between self-care performance and independent living in a sample of geriatric home-care patients using the Barthel Index and showed how systematic evaluation of self-care can assist clinicians in predicting independent living. Others have advanced IADL measurement with newer performance-based tools such as the Assessment of Living Skills and Resources (ALSAR) (Williams et al., 1991). The ALSAR represents an important interdisciplinary initiative to develop a test to assist in the measurement of independent living in older adults. The innovation of the ALSAR was its inclusion of available resources—not only personal skills and competencies—in the overall measurement of individual functioning. Williams and her research team (1991) reported strong support for the validity and reliability of the ALSAR, and showed that the ALSAR test score at admission was a significant predictor of admission to more structured living arrangements, as well as hospitalization and death 6 months later. Thus, there is some modest research in the occupational therapy literature to support the findings we report here. Although recent research suggests the self-report version of the ALSAR may not be sensitive to changes in IADL in older community-dwelling adults (Hilton, Fricke, & Unsworth, 2001), it remains an important tool for community-based clinicians to use to assess the role of community-based services and supports in maintaining older adults at home.

Our findings extend this literature in two ways. First, findings show how in-home IADL plays an important role in identifying potentially at-risk older adults. Second, and aided by the path analysis, our data show that comorbidity and cognition are just as powerful influences on subsequent ability to live alone as physical functioning, perhaps more so. While psychologists are the rehabilitation team members who most often conduct standardized tests of cognition, it is certainly the case that comprehensive occupational therapy evaluations include many opportunities to evaluate patient cognition and comorbidity related to performance of daily functional tasks from routine self-care to more complex kitchen and bathroom IADLs. In fact, their evaluations may best simulate real in-home conditions. Study findings reported here reinforce the importance of continued attention to the impact of comorbidity and cognition on the determination of discharge readiness in older adults.

Limitations and Conclusions

Several limitations of this study must be acknowledged. First, while the results of this study extend our knowledge about personal competency variables such as functional independence and IADL, environmental variables were not measured in this study. Hence our goal of understanding what it means for older women to live alone safely is only modestly extended. Further research must be undertaken to examine the influence of local resources and personal assistance, for example, which are critical elements in any evaluation of individual “fitness to live alone.”

The second limitation pertains to the definition of living alone as “sole resident of the home.” Study findings
indicate that family, friends, and neighbors likely played an important role in supporting these elderly inner-city women in their homes, and that the women in this study may have used a variety of community services such as transportation and home delivered meals. In turn, these supports and services would have exerted an influence on some live-alone women's ability to remain at home alone. The authors acknowledge that data on the kinds and levels of assistance would have yielded more information about how apparently dependent women manage to live alone, but this was not the primary focus of the study. The value of the study rests in its ability to demonstrate the power of in-rehabilitation measures to predict living alone at 18 months after discharge.

A third limitation is that our logistic regression model is based on the data in this study. A regression model developed on a sample of patients with different characteristics may have yielded different estimated regression coefficients. Also, there may have been other (unmeasured) variables that, if included in the model, would have better predicted live-alone status at 18 months after rehabilitation discharge. Further investigation of the clinical utility of standard assessments should be conducted in other samples of rehabilitation patients.

Finally, women in this study were not asked if they wanted to live alone, or what living alone meant to them. It should be remembered that living alone is not always a preferred choice, but may be a forced necessity; many elderly inner-city women simply have no economic option in regard to living arrangements. Although previous research has demonstrated that elderly patients are reluctant to consider alternatives to returning home, even when they have substantial self-care deficits (Unsworth, 1996; Worobey & Angel, 1990), much of this research has only included suburban White women, with some notable exceptions (Edwards & Baum, 1996; Thompson & Krause, 1998). Additional research that attends to the meaning of place in diverse populations of older adults and the relationship between strong feelings about living alone and functional independence is needed.

**Conclusion**

Clinical measures at patient discharge provide some useful information about who is most likely to be living alone 18 months after discharge from rehabilitation but more work needs to be done. Reported IADL scores are higher for women living alone at 18 months compared to those who are not, and women whose IADL performance declines may be at risk for subsequent change in living arrangement. The next step in our line of live-alone research is to test our developing theories about “fitness to live alone” in a larger study that includes relevant environment variables, including home hazards and social supports and service utilization, and careful consideration of the issue of living arrangement preference and choice.

**References**


