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Predicting Discharge and Long-Term Outcome Patterns for Frail Elders

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Objectives: Using the framework of environmental press theory to examine the predictive value of medical rehabilitation team assessments for both functional abilities and long-term living arrangements of early return home and late return home elders. ***Participants:*** One hundred thirty-five older adults (72% women, 84% African American; mean age = 73 years) who lived alone prior to hospitalization for medical rehabilitation. ***Methods:*** Competency measures were collected during the hospitalization. Living arrangements were determined by phone follow-up at 3, 6, and 18 months after discharge. Multivariate analysis of variance identified early return and late return patient groups. Logistic regression analyses then determined the clinical utility of the prediction model. Chi-square analyses addressed group differences in stability of living arrangements. ***Results:*** Medical burden, functional abilities, and cognition were significant predictors of group membership. Among late return patients, 27% continued to live alone at the 18-month follow-up; 59% of the early return patients did so. ***Conclusions:*** Interdisciplinary assessments (including psychological measures) completed in the hospital provide valuable data for discharge planning for older medical rehabilitation patients and are clearly related to successful long-term adjustment.

A 78-year-old widowed African American woman, who was living alone prior to hospitalization, comes to medical rehabilitation because of problems walking after knee replacement surgery. Her hospital roommate, a 74-year-old never-married African American woman, was also living alone prior to falling and breaking her hip. Both patients are adamant that their primary goal is to return to living alone, despite the fact that the widowed woman's three children live in the same city and want her to move in with them. The 78-year-old woman scores well on cognitive testing, has no depression, and has few chronic illnesses. Functionally, she is at an independent or modified independence level by discharge. The treatment team, including the patient, all agrees that discharge home is an optimal outcome. By contrast, the 74-year-old woman is discovered to have multiple small strokes, cognitive test results suggesting moderate dementia, and significant comorbid conditions, including hypertension, diabetes, and atrial fibrillation. Even after 3 weeks of rehabilitation, this patient still needs minimal assistance with many activities of daily living (ADLs). Because the woman is adamant about wanting to go home, she is sent to a subacute rehabilitation setting in a nursing home for further therapy. After subacute rehabilitation, the 74-year-old woman is sent home, despite only very minor gains in functional abilities and no change in cognition. What are the likely long-term outcomes for these patients? How useful are test results gathered in the rehabilitation setting in predicting long-term outcomes? Should elders who live alone return home, even when their abilities are limited? These are some of the clinical questions that led us to conduct an 18-month study on live-alone frail elders.

Living alone is a growing phenomenon among older adults, particularly among the older old of society. Between 1960 and 1980, the proportion of adults over age 65 who lived alone grew from 20% to 28%, and by 1990, the figure stood at 37% or 8.9 million older Americans (Krivo & Mutchler, 1989; Mui & Burnette, 1994). The growth of the live-alone population is further highlighted by the fact that over 1 million or 47% of those over age 85 live alone, and this group is the most rapidly growing population of older adults (Mui & Burnette, 1994). To date, living alone has either been characterized in the literature as an indicator of robust health or conversely as an indicator of extreme frailty. Although this may appear at first to be counterintuitive, it likely reflects the different patterns that exist between population-based normal aging studies and clinically based research samples. Population studies find that elders living alone are more robust in their functional skills, whereas living alone is a risk factor for poor health outcomes in clinical samples. One additional reason that the literature on live-alone elders is confusing is that studies on this topic have lacked a general theoretical framework.

Many of these individuals eventually become consumers of medical rehabilitation. Indeed, close to 40% of nearly 1,000 consecutive admissions over age 60 to an urban rehabilitation hospital involved elders living alone prior to admission (Lichtenberg, 1998). Rehabilitation psychologists are often asked to make recommendations about the amount of supervision necessary for older patients after discharge. This study examines how baseline char-

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acteristics are related to long-term transitions in living situation among elders who were able to return to home immediately after rehabilitation as opposed to those who returned home after shorter or longer intervals elsewhere and those who never returned home alone. These data can provide important empirical support for the use of interdisciplinary assessments (including psychological and neuropsychological variables) in helping to determine discharge options for older medical rehabilitation patients. Given the brief lengths of stays and the rapid pace of assessment in rehabilitation settings, it is important to determine how well assessments conducted in the hospital predict health outcomes over time. Our investigation is embedded within the context of a theory of adaptation that we believe has much to offer rehabilitation clinicians.

Environmental press theory (EPT), developed by Lawton and Nahemow (1973), contends that adaptation is based on three factors: (a) an individual's competencies, (b) an individual's environment (social and physical), and (c) the interaction between (a) and (b). As applied to rehabilitation, individuals' ability to return home to live alone depends on their personal capacities, the demands of their home environment, and the interaction between those variables. In the current study, we examined only part of the EPT—specifically, how well personal competencies predict living situation outcomes.

Competencies include physical and functional health, cognitive and affective functioning, and quality of life, including sense of efficacy or mastery. Environmental variables encompass the person's home, social context, and neighborhood. The fit between individuals' competencies and the requirements of their environment determines, in large part, how well they function. As Lawton (1985) recognized, declining functional competencies elevate environmental press, a notion partially supported by Morgan et al. (1984).

Competency Variables Related to Adaptation

Although cognition can also be used as an outcome measure, in our research, we used cognition as a predictor variable. MacNeill and Lichtenberg (1997) and MacNeill, Lichtenberg, and LaBuda (2000) demonstrated that cognition and functional abilities were the strongest predictors of immediate return to independent living in older medical rehabilitation patients who lived alone prior to hospitalization. Multivariate epidemiological studies repeatedly identify declining cognition as one of the significant predictors of disability onset (Gill, Williams, Richardson, & Tinetti, 1996; Miller, Longino, Anderson, James, & Worley, 1999; Sarwari, Fredman, Langenberg, & Magaziner, 1998). Cognitive functioning has also been linked to ADL recovery in hospitalized older adults (Hansen, Mahoney, & Palta, 1999) and living arrangements in live-alone elders. Other investigations have consistently reported a significant relationship between declining functional and cognitive abilities and change in living arrangement. Worobey and Angel (1990) investigated the impact of physical decline on living alone in older adults. Using data from the Longitudinal Study on Aging (a national sample of 2,500 older adults, 66% of whom were living alone, who were surveyed in 1984 and recontacted 2 years later), they found that diminished functional capacity was related to a greater tendency to live with others. Similar conclusions were reported by Miller et al. (1999), who used 6 years of data from the Longitudinal Study on Aging for their analyses of community-based moves. Deterioration of advanced ADLs and poorer lower body strength were significant predictors of a community-based residential move. These authors specifically advocated for the inclusion of change in residence as a health outcome index.

Depression is also a predictor of physical recovery (Mossey, Mutran, Knott, & Craig, 1989). Recent evidence suggests that depression precedes disability onset in many older adults (Livingston-Bruce, Seeman, Merrill, & Blazer, 1994). Increased levels of depression have also been described in other samples of live-alone elders (Mui & Burnette, 1994).

Medical burden refers to the collective impact of one or more chronic medical diseases. The variable is of interest in the present study because it is hypothesized that the severity of comorbid medical disease may be related to the ability of live-alone older adults to maintain independent living. Moore and Lichtenberg's (1996) double cross-validation study showed a significant relationship between medical burden and functional abilities. Similarly, Pearlman and Crown (1992) found that medical burden, although not directly related to institutionalization, was related to individuals' functional performance.

Minority older adults who live alone may have specific types of issues associated with their living arrangement. Rubinstein, Kilbride, and Nagy (1992) and Choi (1991) found that live-alone older adults from minority populations (African American and Hispanic) were more likely to live in poverty than were older adults living with others. Despite the financial hardships, the individuals preferred to live alone because they wanted to be independent and enjoyed living alone.

Lawton (1983) defined ADLs and instrumental ADLs as the most basic competencies in gerontology. In the research reviewed above (Gill et al., 1996; Miller et al., 1999), functional abilities are demonstrated to be central to adaptation and to stability of residence in older age. Sarwari et al. (1998) also demonstrated that older live-alone women who report poor functional health at baseline are more likely to experience significant declines in functional health than women who live with others.

Aims of the Study

This study investigated the long-term outcome of urban, mostly African American, elders who lived alone prior to hospitalization. Our aim was to examine how well competency variables distinguished between those who returned home immediately after rehabilitation, those who returned home at later time points and those who never returned home. The competency variables we used included cognition, depression, medical burden, and functional abilities. The following hypotheses were posed.

> *Hypothesis 1*: Personal competency variables will predict early return and late return group membership. It was hypothesized that there would be a linear relationship between timing of return to living alone and personal competencies. That is, those returning home immediately after discharge would be more competent than those returning home alone within 3 months, who in turn would be more competent than those returning to living alone between 3 and 6 months. Finally, those returning to living alone in this latter group would be more competent than those who did not return to living alone.

Hypothesis 2: Personal competency variables will predict the long-term stability of patients' living arrangement. It was hypothesized that those in the early return home group would more likely remain living alone long term than those in the late return group.

We used a combination of face-to-face interviews and testing and follow-up data collection through telephone interviews. At baseline, measures of cognition, function, and depression were elicited through standardized evaluations and screening instruments. Medical burden was determined through the physician's diagnoses. Telephone interviews on follow-up captured the participant's self-report data. In some cases in which the participant was unable to conduct a phone interview, we collected information on living arrangements from a caregiver.

Method

Participants

Participants were consecutive admissions to a free-standing Midwestern university-based urban medical rehabilitation hospital who were over the age of 60, were living alone prior to hospitalization, and agreed to participate in an interview and testing session within 1 week of admission. In-person interview data were collected at baseline and at hospital discharge, and 3-, 6-, and 18-month follow-up data were collected by telephone interviews. One hundred ninety-four of 219 eligible individuals agreed to participate in the study, creating an 87% participation rate. An additional 21 potential participants were excluded because of severe aphasia or the inability to complete the baseline interview because of severe cognitive deficits. By 6 months, there were 135 participants in the study. Principal diagnoses included arthritis ($n = 47$; 35%), stroke ($n = 20$; 15%), lower extremity fracture ($n = 27$; 20%), gait disturbance ($n = 13$; 10%), circulatory problems ($n = 13$; 10%), and a range of other conditions, such as spinal cord injuries, neoplasms, and so forth ($n = 15$; 11%). Major reasons for attrition included death ($n = 15$), inability to contact ($n = 24$), refusals ($n = 14$), and severe confusion ($n = 6$). Eighty-four percent of the sample were African American elders, and 72% were women. The mean age of the sample was 73 years, and the mean level of education was 11 years.

In Table 1, the characteristics of those who had complete data are compared with those who did not. There were significant baseline differences between patients who remained in the study and those who were lost to attrition on the Charlson Comorbidity Index (CMI; Charlson, Pompei, Ales, & MacKenzie, 1987) and Functional Independence Measure (FIM; Hamilton, Laughlin, Granger, & Kayton, 1991) motor score. Those lost to attrition had higher medical burden and lower functional abilities. There was also a trend toward group differences on the Dementia Rating Scale (DRS; Mattis, 1988). Those remaining in the study had better cognitive scores, but no significant group differences were found in terms of age, education level, gender, race, or depression.

Table 1
Characteristics of Patients Who Were Retained in the Study and Patients Who Were Lost to Attrition

Characteristic	Retained group[a]	Attrition group[b]	F	χ^2	p
Age (years)	73.32 (8.56)	76.33 (9.85)	2.52		*ns*
Education (years)	10.84 (3.55)	10.70 (3.72)	0.11		*ns*
Gender (% female)	72.2	70.0		0.06	*ns*
Race (% African American)	84.1	83.3		0.47	*ns*
MDRS	119.37 (18.54)	112.64 (17.40)	3.21		*ns*
FIM motor score	68.99 (12.57)	57.17 (19.61)	13.99		$< .001$
GDS	7.79 (6.18)	7.23 (5.02)	0.11		*ns*
CMI	1.56 (1.15)	2.07 (1.62)	4.30		$< .05$

Note. $N = 135$, $df = 1$, for each F and χ^2. Gender and race are presented as percentages; all other values are presented as means (and standard deviations). Attrition was due to death, refusal, and/or loss to follow-up. MDRS = Mattis Dementia Rating Scale; FIM = Functional Independence Measure; GDS = Geriatric Depression Scale; CMI = Charlson Comorbidity Index.
[a] $n = 135$. [b] $n = 59$.

Measures

Living arrangement. Return to living alone was classified as living alone or not alone. Living alone was defined by the U.S. Census as those who reside in a dwelling by themselves and have no other regular person(s) spending the night.

Cognition. The DRS (Mattis, 1988) was created for use with individuals with dementia and evaluates attention, initiation, memory, abstract reasoning, and visuospatial construction. The DRS takes 20–45 min to administer, depending on the patient's level of cognitive functioning. The DRS has been found to have excellent test–retest reliability ($r = .97$) and split-half reliability ($r = .90$; Coblentz et al., 1973; Gardner, Oliver-Munoz, Fisher, and Empting, 1981). Concurrent validity is also satisfactory, with a significant correlation between the total DRS score and Wechsler Adult Intelligence Scale IQ score ($r = .75$; Mattis, 1988). Vangel and Lichtenberg (1995) demonstrated that the DRS in cognitively intact urban older adults is useful for clinical and research purposes. Results from samples of highly literate and educated older adults found the DRS to have a ceiling effect (Mattis, 1988). In contrast, Vangel and Lichtenberg found that the scores on the DRS do not display a ceiling effect in urban older adults, probably because of their relatively lower levels of education. Indeed, Lichtenberg (1998) reported that many commonly used neuropsychological tests are more likely to have floor effects when used with less educated urban older adults. Bank, Yochim, MacNeill, and Lichtenberg (2000) provided new age- and education-corrected norms for the DRS in older cognitively intact urban elders.

Depression. Depression was assessed using the Geriatric Depression Scale (GDS; Yesavage et al., 1983), a series of 30 yes–no self-referent statements. The GDS was specifically developed for use with older adults and has well-documented reliability and validity (Brink et al., 1982; Parmelee, Katz, & Lawton, 1989; Rapp, Parisi, & Walsh, 1988). Past studies support the use of the GDS with medically ill and mild to moderate cognitively impaired older adults (Lichtenberg, Marcopulos, Steiner, & Tabscott, 1992; Norris, Gallagher, Wilson, & Winograd, 1987; Parmelee et al., 1989; Rapp et al., 1988). The traditional cutoff score for the GDS is 10. Those scoring above 10 on the GDS have a high likelihood of a depressive disorder.

Medical burden. The CMI (Charlson et al., 1987), a weighted combination of chronic diseases, was originally created to predict mortality. Moore and Lichtenberg (1996) and the Health Care Financing Agency (Deyo, Cherkin, & Ciol, 1992), however, have found it to be a valid and excellent predictor of morbidity and disability outcomes. One advantage of the CMI is that it can be abstracted from medical record databases, thereby reducing the demand on physicians. The CMI is both sensitive to severity of different diseases and efficient to collect. The CMI was originally developed by ascertaining the combination of diagnoses that best predicted 1-year mortality in a group of hospitalized patients (Charlson et al., 1987). Diseases significantly associated with mortality were identified, and weights were assigned equivalent to adjusted relative risks. The CMI was validated on a cohort of 685 medical patients by predicting 1-year survival that accounted for a greater proportion of the deaths due to comorbid

conditions than a simple measure of number of coexisting conditions alone. The relationship of the CMI to disability was demonstrated in a double cross-validation study in which the CMI was shown to be the best predictor of ADL recovery in medical rehabilitation patients (Moore & Lichtenberg, 1996). Recently, Arfken, Lichtenberg, and Kuiken (1998) validated the CMI as a predictor of mortality using older medical rehabilitation patients. Scores on the CMI typically range from 1 to 3, with 3 or higher indicating the presence of several severe diseases. Thus, a score of 2 should be seen as significantly complicated comorbid medical illness. Total scores can range from 0 to 13; to get scores higher than 3, one must have a metastatic tumor or AIDS diagnosis.

Performance-based ADLs measure. The FIM (Hamilton et al., 1991) is a 7-point rating scale created as part of the Uniform Data System for Medical Rehabilitation. The FIM is a performance-based measure and was designed to assess the ability to carry out ADLs (e.g., dressing, toileting, ambulation, and grooming). Each of 18 self-care tasks is rated on a 7-point scale ranging from 7 (*completely independent*) to 1 (*completely dependent*). The ratings are conducted by physical and occupational therapists subsequent to direct observation of the participant's performance of these tasks. The FIM has been shown to have high interrater reliability, with an intraclass correlation coefficient of .97 for the total score (Hamilton et al., 1991). Validity has also been demonstrated with brain injured patients and stroke patients (Cook, Smith, & Truman, 1994; Granger, Cotter, Hamilton, & Fiedler, 1993). Rasch analysis has provided support for two clinically different aspects of disability (Granger, Hamilton, Linacre, Heinemann, & Wright, 1993). Thirteen self-care and locomotion items measure motor disability; five communication and cognition items measure cognitive disability. In this study, the 13-item FIM motor score was used as a measure of ADLs.

Statistical procedure. Participants who remained in the study through the 6-month follow-up and those who were lost to attrition were compared on demographic characteristics (age, education, gender, and race) and key baseline measures (DRS, CMI, FIM motor score, and GDS) using *t* tests and chi-square tests, as appropriate. Multivariate analysis of variance (MANOVA) was used to determine whether the groups differed in competency measures on the basis of their timing of return (or nonreturn) to independent living, and logistic regression analyses were used to determine how well baseline predictors differentiated the competent from at-risk groups. A chi-square statistic was used to determine whether the rates of changed living arrangements differed between the early versus late groups on 18-month follow-up.

Results

Overall, the participant group represented elders who had higher rates of disability and higher rates of service usage than many samples of community-dwelling elders. At baseline, 77% of the sample reported being fully independent with ADLs prior to hospitalization. This decreased to 59% at 3 months and to 51% at 6 months. Those reporting three or more ADL limitations grew from 10% at baseline to 14% at 3 months and to 17% at 6 months. Fifty-four percent of the sample used community services (housekeeper, transportation, church volunteers, and meals on wheels) at baseline, and 58% used these services at both 3 months and 6 months. Return to living alone is a dynamic characteristic. Seventy-four percent of our sample returned to living alone within 3 months of discharge from medical rehabilitation, 10% returned home alone between 3–6 months, and 16% never returned home alone. Transitions back to living alone occurred equally between those initially discharged to nursing homes and those discharged to families. Living with family decreased from 28% at hospital discharge to 14% at 3 months to 11% at 6 months. Living at a nursing home decreased from 20% at discharge to 11% at 3 months to 8% at 6 months.

Table 2 presents the means and standard deviations of the groups on the basis of when they returned home to living alone. A MANOVA was significant, $F(3, 132) = 11.02$, $p < .0001$. Our hypothesis that there would be a significant linear trend for competencies according to when patients returned to living alone, however, was not supported. Indeed, follow-up univariate one-way analyses of variance (ANOVAs) found that the significant differences between groups divided them into two, not four, groups. Cognition, medical burden, depression, and functional abilities were not significantly different between those who were discharged home alone immediately after discharge as compared with those who returned home within 3 months (F values ranged from 0.59 to 1.34, $p > .05$). At the other end of the spectrum, further ANOVAs revealed that those who returned home from 3 to 6 months were identical on baseline functioning to those who never returned to living alone (F values ranged from 0.23 to 0.98, $p > .05$). One-way ANOVAs found significant differences among those who were discharged immediately, those who returned home alone between 3–6 months after discharge, and those who never returned home alone on all variables except depression: FIM, $F(3, 132) = 7.28$, $p < .0001$; DRS, $F(3, 132) = 5.87$, $p < .001$; CMI, $F(3, 132) = 3.78$, $p < .01$. Surprisingly, those who returned to living alone by 3 months postdischarge from rehabilitation also had significantly higher cognition, medical burden, and functional abilities than did those returning home alone between 3–6 months and those who never returned home alone: FIM, $F(3, 132) = 5.35$, $p < .001$; DRS, $F(3, 132) = 4.84$, $p < .001$; CMI, $F(3, 132) = 3.13$, $p < .01$. Inspection of the scores led us to divide the early return group into those who returned home alone within 3 months of rehabilitation discharge and the late return group into those who returned home alone between 3–6 months and those who never returned home alone.

Table 3 presents the demographic and baseline measure comparisons between the early return and late return groups. None of the demographic measures collected (gender, age, and race) was significantly different between the two groups. Three of the baseline measures, however, were significantly different between the groups in these univariate analyses. Using a Bonferroni correction of $p < .0125$, cognition, medical burden, and functional abilities differed between the groups. The early return group had significantly better

Table 2
Personal Competency Measures of Patients Based on the Timing of Their Return to Living Alone

Measure	Returned alone			Never returned alone ($n = 21$)
	At discharge ($n = 60$)	By 3 months ($n = 41$)	By 6 months ($n = 13$)	
MDRS	127 (11)	119 (18)	105 (26)	111 (20)
GDS	6.6 (5.0)	7.9 (6.0)	7.6 (5.0)	10.1 (7.0)
CMI	1.4 (1.0)	1.2 (1.1)	2.5 (1.2)	1.8 (1.2)
FIM	75.5 (6.0)	70.6 (8.0)	58.7 (14.0)	58.3 (16.0)

Note. $N = 135$. All values are presented as means (and standard deviations). MDRS = Mattis Dementia Rating Scale; GDS = Geriatric Depression Scale; CMI = Charlson Comorbidity Index; FIM = Functional Independence Measure.

Table 3
Univariate Comparison Between Early and Late Return to Live Alone

Measure	Early	Late	*p*
Demographics			
Gender (% female)	81	69	*ns*
Age (years)	72.9 (8.7)	75.0 (8.6)	*ns*
Race (% African American)	90	91	*ns*
Baseline measures			
CMI	1.4 (1.0)	2.0 (1.3)	< .01
FIM motor score	74.0 (7.2)	58.0 (15.4)	< .001
MDRS	124.5 (14.5)	108.1 (22.3)	< .001
GDS	6.6 (5.4)	8.7 (6.5)	*ns*

Note. Gender and race are presented as percentages; all other values are presented as means (and standard deviations). CMI = Charlson Comorbidity Index; FIM = Functional Independence Measure; MDRS = Mattis Dementia Rating Scale; GDS = Geriatric Depression Scale.

cognitive abilities, $t(133) = 5.94$, $p < .001$, and functional abilities, $t(133) = 7.34$, $p < .001$, and significantly less medical burden, $t(133) = 3.30$, $p < .01$, than did the late return group.

Logistic regression analyses were then conducted to determine the clinical utility of the baseline predictors. The logistic regression analyses (see Table 4) revealed that baseline competency characteristics were significant predictors of group membership (i.e., early return or late return group), $\chi^2(133, N = 135) = 68.5$, $p < .0001$. Both medical burden ($\beta = .62$, $p < .01$) and FIM motor score ($\beta = -.14$, $p < .0001$) were significant predictors of independent living outcomes, and there was a trend for cognitive functioning to predict group membership ($\beta = -.03$, $p < .10$). Depression was not a significant predictor of group outcomes. The final model (with predictors CMI, FIM motor score, and cognition) yielded the following: Sensitivity was 91%, specificity was 70%, positive predictive power was 86%, and negative predictive power was 79%. Given that the base rate for being in the competent group was 60%, the predictor variables are clinically useful in increasing the accuracy of group membership and thereby identifying who would return early to living alone and who would return late.

As an illustration of the use of the model, we used the mean scores to demonstrate the odds ratio and the clinical utility of the equation. Using the mean score of the late returners, for example, one can determine that the odds of someone with a CMI score of 2.0, an FIM motor score of 58, and a DRS score of 109 returning home late would be 2.98. This odds ratio is calculated by the following equation: P(late) = P(late)P(early) × 1 – P(late). Another way of saying this is that the probability of this individual returning home late is 75%. This is a conversion of the odds ratio to a percentage by the equation P(late) + (1 – P – late) = 2.98.

As a second illustration, the model uses the means from the early return group, which indicates that the odds of someone with a CMI score of 1.35, an FIM motor score of 74, and a DRS score of 124.5 (the mean scores for the early return to living alone group) returning to living alone early is 7.1. This means the probability of this individual returning home early is 88%.

The analyses completed at 18 months help answer the question of what the clinical significance of being able to predict membership in early return and late return groups is. At 18 months, of those participants still living, the early return group members were significantly more likely to continue to be living alone than were the late return group members (even those who did eventually return home alone), $\chi^2(133, N = 135) = 5.3$, $p < .05$. Of those participants returning early to living alone, 59% remained living alone at 18-month follow-up, compared with only 27% of those who were late in returning to live alone. Given that change in living arrangement has been demonstrated to be an important outcome measure, these results support the notion that those who return to living alone late were correctly classified at 6 months as similar to those in the never return alone group.

Discussion

The purpose of this study was to test whether key personal competency variables at baseline (as specified by EPT) were related to patterns of functioning and living arrangements among older medical rehabilitation inpatients. Higher functional abilities (both physical and mental) and lower medical burden significantly increased the likelihood of an earlier return to living independently after hospitalization. Early or late return to living alone, in turn, predicted stability or change in living arrangements at an 18-month follow-up period. These findings provide support for two major points: (a) EPT can provide very useful interdisciplinary applications in geriatric rehabilitation, and (b) there is an identifiable at-risk group of live-alone elders who return to living alone after several months of not doing so.

These data provide empirical evidence for the use of the EPT and for the primacy of assessing frailty in geriatric rehabilitation patients. Typically, geriatric rehabilitation patients have been classified according to their principal diagnosis (e.g., stroke, hip fracture, gait disturbance), but it is becoming clear that frailty issues, such as comorbid diagnoses, functional abilities, and cognition, may be more predictive of adaptation than is primary diagnosis. Frailty is defined as having impairment in more than one major area of functioning. Rehabilitation psychologists can advocate for greater collaboration among interdisciplinary team members in discharge planning and the integration of medical, functional, and cognitive assessments in determining how frail a particular patient is.

This research demonstrated that a significant number of live-alone elders change their living arrangements on long-term follow-

Table 4
Logistic Regression Model

Variable	Beta	E^beta	*p*
Constant	10.67	42,859	< .001
CMI	0.62	1.86	.007
FIM motor score	−0.14	0.87	< .001
MDRS	−0.03	0.98	.061

	Predicted	
Observed	Early	Late
Early	83	8
Late	13	31

Note. The top part of the table presents the logistic regression model; the bottom part of the table presents the overall model chi-square. CMI = Charlson Comorbidity Index; FIM = Functional Independence Measure; MDRS = Mattis Dementia Rating Scale.

up. Those who were frailer were more likely never to return to living alone later or, if they did, were more likely to have that living arrangement be short lived. This frail high-risk group is important to identify during their inpatient stay for geriatric rehabilitation because the potential consequences for them of return to living alone can be severe and negative. Living alone has been significantly correlated with frailty among older adults receiving emergency medical services. Gurley, Lum, Sande, Lo, and Katz (1996) investigated the effects of living alone on being found helpless or dead by paramedics. A total of 387 individuals who lived alone were found in their homes helpless during a 12-week period. The authors concluded that the older old (those over age 75) who live alone are at greatest risk of losing not only their physical independence but also their lives.

These findings are valuable as there is little data on older urban African American medical rehabilitation patients. Frailty and living alone may be a particular hardship for urban African American elders. Living alone may exacerbate the risk of social isolation in African American elders. Simonsick, Kasper, and Phillips (1998) found that older African American women who lived alone were at particular risk for home confinement. Other researchers have specifically compared the rate of residence change in African American versus Caucasian live-alone elders. Older urban African American adults who live alone are more likely to change their living arrangements and to end up living with others than are urban Caucasian older adults (Choi, 1991; Hays, Fillenbaum, Gold, Shanley, & Blazer, 1995). Rubinstein et al. (1992) documented that 33% of the African American older adults they studied lived alone and that women represented 77% of this group. Eighty-six percent of their sample preferred to live alone, and health problems were the predominant reasons that living arrangements were changed.

There are important limitations to this study that must be recognized. First, the sample is an elderly urban, largely African American, sample, which limits its generalizability to other groups of medical rehabilitation patients. Second, competency measures were assessed at a global level, and specific areas of cognition, medical burden, and functional abilities were not considered separately (e.g., memory, toileting vs. transferring, diabetes vs. stroke). Future research in this area would also benefit from careful consideration of the person–environment transaction, as described in the EPT. Despite these limitations, this study makes an important contribution to the understanding of how baseline assessments relate to transitions to independent living following discharge. It is clear that functional abilities and cognition assessments provide for significant prediction of long-term outcomes. In this study, long-term outcomes included length of time it took to return to independent living and ability to remain living alone after returning home alone with a disability. Assessments completed during hospitalization, then, can be used to help patients and families understand some of the future likely scenarios in terms of living arrangements.

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