Competing Risk of Household Expansion or Institutionalization in Late Life

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Objectives. The purpose of this study was to evaluate predictors of change in household size and institutionalization in late life.

Methods. The Duke Established Populations for Epidemiologic Studies of the Elderly cohort (n = 3730) was assessed annually (1986–1996). Independent variables included home ownership, income, cognitive and functional ability, chronic illness, mood, household size, social support, and stressful life events. Competing risk of household expansion or institutionalization was modeled using (a) hazard of either event and (b) odds of household expansion or institutionalization among elders who experienced an event.

Results. Hazard of either event was associated with younger age, Black race, lower income, cognitive problems and stability, functional abilities and deterioration, low chronic illness burden, being unmarried, having more living children, and recent life events. Among those who reported either event, odds of institutionalization (vs. household expansion) were associated with older age, White race, cognitive and functional problems, high chronic illness burden, being married, having fewer living children, smaller household size, social isolation, and exits of nonspouse coresidents.

Discussion. Modeling separate effects of whether there was a household expansion or institutionalization, and if so, which type of event occurred, and taking into account acute and evolving states, enabled more precise understanding of the complex mechanisms involved in determining continued community residence or institutionalization.

Institutionalization is a rare event in late life, and a costly and unpopular option for elders unable to live independently (National Center for Health Statistics, 2001). A primary alternative to institutional care is expansion of informal and/or formal support in the home setting (Wiseman & Roseman, 1979). Life course theorists have proposed that when elders decide whether and how to make a residential change to accommodate deteriorating health, their decisions are based on a complex web of stable and evolving factors (Wiseman, 1980). Previous studies of the risk factors for institutionalization and for need-related household expansion have not addressed the two-stage nature of the decision-making process involved (i.e., whether, then how to change), nor have they accounted for the dynamic nature of many of the most powerful predictors (Hays, 2002; Miller, Longino, Anderson, James, & Worley, 1999; Miller & Weissert, 2000). The aim of this study was to address these two limitations in a large regional survey of elders assessed annually over a 10-year period.

Residential Demography in Late Life

Of 34.5 million U.S. elders aged older than 65 years in 1999, just 4.3% lived in nursing homes (National Center for Health Statistics, 2001). Prevalence of nursing home residence among elders declined 27% since 1973 (National Center for Health Statistics, 2001). The proportion of all patients who were discharged from nursing homes and returned to community settings nearly doubled, from 18% to 30%, between 1985 and 1997. The length of stay in the nursing home for these patients was halved, from 89 to 45 days (Sahyoun, Pratt, Lentzner, Dey, & Robinson, 2001).

Patient mix in nursing homes has shifted and costs have skyrocketed over the past quarter-century. Patients admitted during the 1990s were increasingly dependent, even though admission diagnoses have remained the same. (Cardiovascular, cognitive and mental disorders, and endocrine disorders predominate; Sahyoun et al., 2001). The increased dependence of the patient population in nursing homes is related to two trends in community-based care. Moderately dependent patients are staying at home longer before being institutionalized, thanks to new medical technology or home health care. And acute care patients are being discharged back to the home setting after spending intensive rehabilitation time in nursing homes. Nursing home care is an increasingly expensive option. Costs averaged close to $4,000 per month in 1999, and nearly $3 of every $4 paid to nursing homes came from public coffers (National Center for Health Statistics, 2001).

The other 33 million U.S. elders reside in 21 million community-based households. Over 80% of elders live in single-family dwellings or mobile homes, and the remainder live in structures of 2–50 or more units. Eight percent of U.S. elders live in housing specifically constructed for them, (e.g., assisted living and continuing care retirement communities; Pynoos & Golant, 1996; Somers, 1993; U.S. Census Bureau, 1999).

Dependent and severely impaired elders can and do marshal the resources to continue living at home (Morris, Sherwood, & Mor, 1984). In 22 million U.S. households,
someone provides unpaid assistance to a relative older than age 50 (National Alliance for Caregiving & AARP, 1997). Minority elders are especially likely to adapt to increased health needs by coresiding in households where assistance is available (Blank & Torrecilha, 1998; Choi, 1991; Peek, Henretta, Coward, Duncan, & Dougherty, 1997; Wallace, Levy-Storms, Kington, & Andersen, 1998). Formal in-home health and support services have also proliferated in the wake of increased public funding (Gallagher, 2000).

**Competing Risk of Household Expansion or Institutionalization in Late Life**

Life course theorists have proposed that when current community-based residences provide an unsatisfactory fit with health needs, elders (or their kin or physicians) are faced with two distinct decisions: whether or not to make a change, and what kind of change to make (DeJong & Gardner, 1981; Wiseman & Roseman, 1979). The prior decision, whether to make a change, is influenced by life cycle and other triggering events (e.g., recent hospitalization), personal history (e.g., residential and parenting history), cumulative personal factors, (e.g., functional or cognitive deficits), and environmental factors (e.g., the availability of formal health services; Wiseman, 1980).

The subsequent decision, what change to make to meet the health needs, has been described variously in migration typologies. For example, Wiseman (1980) hypothesized that elders may make two “local assistance move (to) health care institutions (or) to residence with or near to primary kin [italics added]” (p. 151). Burholt (1999) proposed a “high level of assistance (move) in with kin, into sheltered accommodation . . . , or into an institution [italics added]” (p. 2082). Litwak and Longino (1987) proposed both a help-seeking move closer to kin and, where kin resources are inadequate for the need for assistance, a move into an institutional setting.

Theory and demography make it clear that institutionalization and household expansion are only two of many options available to older persons with increased needs for help. Interstate and intrastate moves for greater proximity to primary kin, but not into the same residence with them, are alternatives that do not necessarily involve an expanded household. Moves into assisted living apartments or life care units may result in residential accommodations of the same absolute size, while still increasing the availability of support. Correspondingly, not all increases in late-life household size are the result of the needs of the older person (Hayes & Al-Hamad, 1997). Nevertheless, evidence suggests that many household expansions involving older persons are designed—at least in part—to provide assistance to them (Al-Hamad, Flowerdew, & Hayes, 1997; Blank & Torrecilha, 1998). Furthermore, most household expansion will be the result of local, rather than long-distance moves, and the households where elders live with others will be predominantly single-family units (Pynoos & Golant, 1996).

**Antecedents of Two Residential Outcomes**

Miller and Weissert (2000) recently summarized the extensive longitudinal evidence for risk factors of institutionalization in three categories: (a) needs, (b) predisposing conditions, and (c) enabling conditions. The most chronologically proximate causes of nursing home entry were needs related to functional, cognitive, sensory, and mood impairments and number and severity of comorbid medical conditions. More distal predisposing factors were advanced age, White race, living alone, presence of a caregiver (but less familial and caregiver support), and less social interaction. Factors that enabled institutionalization included not being a homeowner, as well as environmental factors, such as bed availability, state reimbursement rates, and market case mix. Finally, the authors concluded that utilization gets utilization, in that prior hospitalizations and use of nursing homes, home care services, and medications were all predictive of future institutionalization. Notable was lack of convincing evidence linking gender, income, or urban dwelling to institutionalization. Evidence was inconclusive for poor self-rated health, being unmarried, and cardiovascular, cerebrovascular, and depressive disorders.

Far less attention has been directed toward the antecedents of household expansion. Household expansion is defined here as a net increase in household coresidents between two points in time. For example, an elder who lived alone at baseline and lived with a daughter, son-in-law, and grandchild a year later experienced a net household expansion of 3 persons over 1 year. Hays (2002), following Wiseman (1980) and George (1996), summarized the risk factors for household expansion as either triggering events or contextual factors. Triggers were events such as death of a spouse or recent hospitalization that triggered household expansion (Hays, Fillenbaum, Gold, Shanley, & Blazer, 1995; Lichtenberg, MacNeill, & Mast, 2000; Mickus, Stommel, & Given, 1997; Roan & Riley, 1996; Silverstein, 1995). Contextual factors were either stable or evolving. Stable factors (demographics and early and midlife events or achievements) act as main and interactive effects on household expansion. These include (a) female gender (Al-Hamad et al., 1997; Davis, Moritz, Neuhaus, & Barclay, 1996; Hayes & Al-Hamad, 1997); (b) minority race (Blank & Torrecilha, 1998; Choi, 1991, 1995; Davis et al., 1996; Hays et al., 1995; Peek et al., 1997); (c) age (Blank & Torrecilha, 1998; Hays et al., 1995; Schmertman, Boyd, Serow, & White, 2000; Wilmoth, 1998); (d) lower education level; and (e) more children (Choi, 1991).

Factors known to evolve over time have demonstrated important direct effects on household size. Routinely, however, such factors have been operationalized using data gathered at a single point in time (i.e., the predictor variable is a snapshot of a moving target). Examples of important risk factors for household expansion whose assessment has been largely cross-sectional are (a) low income (Burholt, 1999; Davis et al., 1996; Mutchler & Burr, 1991), (b) functional and cognitive impairments (Hays et al., 1995; Mickus et al., 1997; Pendry, Barrett, & Victor, 1999), (c) medical morbidity (Al-Hamad et al., 1997; Silverstein, 1995), and (d) high levels of familial support (Mickus et al., 1997). A few studies have modeled the predictive effect of a change, in every case a change in function between two points in time (Pendry et al., 1999; Speare, Avery, & Lawton, 1991; Worobey & Angel, 1990). Evidence of the importance of two other factors that are subject to change has been inconclusive: (a) marital
status (Choi, 1991, 1995, 1996; Schmertman et al., 2000) and (b) mental health problems (Pendry et al., 1999).

**New Tests of Migration Theory**

In spite of the extensive literature on institutionalization and household expansion, studies to date have not adequately accommodated the theorized two-stage decision-making process. Most analyses assume that two separate decision-making processes (“Is the current residential arrangement so unsatisfactory that a change must be made?” and “Given unsatisfactory residential arrangements, what change is made?”) are proceeding in a parallel fashion, rather than sequentially. Mutchler and Burr (1991), for example, modeled the risk of incident coresidence and institutionalization (each compared to living alone) over 2.5 years of follow-up among unmarried elders. Wallace and colleagues (1998) modeled the probability of using unpaid or paid home care or a nursing home (each compared to no care). Miller and colleagues (1999) modeled the risk of a move and an institutionalization (each compared to no move). The disadvantage to such analyses is that they obscure the distinctions between the predictors of separable decisions.

As noted above, a second widespread limitation of previous studies is that residential changes are predicted by single cross-sectional baseline measures of selected factors. In most cases, such factors are inherently unstable and known to evolve over time. One solution has been to model concurrent change in residence and function, but such a strategy renders unfeasible inference about causal order. An alternative where at least three repeated measures are available is to use time-varying covariates, thereby updating measures of each predictor variable to its most proximal prior assessment. Another strategy would be to employ random effects procedures to estimate a slope of change over time; the resulting slope functions as a reference to the effects of improvement or deterioration over time (Littell, Milliken, Stroup, & Wolfinger, 1996).

The current study partially addressed the limitations described above in two ways. First, we distinguished the predictors of whether either change is made versus the type of change that is made. Second, we distinguished the effects of (a) trigger events (death of a spouse, departure of a nonspouse coresident, hospitalization), (b) stable contextual factors (age at baseline, gender, race, urban–rural residence, number of living children), (c) those that vary intermittently (home ownership, annual income, chronic medical burden, mood, marital status), and (d) those that change progressively (cognitive and functional status). We addressed these predictors of household expansion or institutionalization in a large community-dwelling cohort of elders in the Piedmont region of North Carolina assessed annually over a 10-year follow-up period.

**Methods**

**Design and Sample**

The Established Populations for Epidemiologic Studies of the Elderly at Duke University (Duke EPESE) is a population-based, prospective survey of elderly (65+ years) community-dwelling respondents (n = 4,162). The sample was selected by stratified, random household sampling from five contiguous counties in northcentral North Carolina (Cornoni-Huntley et al., 1990), using a four-stage, stratified, probability sampling design (Hays et al., 1995).

Ten years of longitudinal health and social environment data are available. Subjects were interviewed annually between 1986 and 1992, and again in 1996. Annual (core) interviews assessed household composition, marital status, health resource utilization including dates of nursing home entries and exits, chronic disease incidence, and functional status of the subject. At baseline and every 3rd year, the core questionnaire items were enriched with extensive assessments of mood and cognitive status, chronic illness burden, health behaviors, socioeconomic status, and social support. All measures used in this study were self-reported.

The sample for this study excluded respondents who were neither Black nor White (n = 30), who were missing baseline assessments of cognitive status (n = 71), or whose death or institutionalization occurred in the first 6 months of the follow-up period (n = 331). The resulting sample size was n = 3,730.

**Measures**

We used two events in a competing risk model of time to first event. The events were (a) household expansion or (b) institutionalization. We calculated three other events as censoring events: (a) death, (b) dropout (lost to follow-up), and (c) end of study.

We measured time until the first event as days between the baseline interview date and the date of the reported change. At every interview, respondents reported on the age, gender, and relationship of all individuals living in their households. For the first interview in which the reported household size increased, we set the date of the change at the midpoint between that interview and the preceding one (generally ½ year); we calculated time until institutionalization as the difference between the date of the first reported nursing home entry and the date of baseline interview. We confirmed death dates by a search of the National Death Index.

Independent variables included both trigger events and contextual factors. Trigger events included departure of a nonspouse coresident, death of a spouse, or a hospitalization. Trigger events were counted as positive when reported at the interview prior to the report of household expansion or institutionalization. The time reference for trigger events was “in the past year” when assessed at baseline and “since we talked to you last” at all other interviews.

Stable or time invariant factors included race, gender, urban or rural residence, and number of living children. These were measured at the baseline interview. We operationalized time-varying factors as follows. Economic resources included home ownership and annual income. Health resources and challenges included (a) age, (b) comorbid chronic conditions scaled in tertiles of mild, moderate, and severe burden (Fillenbaum, Leiss, Pieper, & Cohen, 1998);
Variables could vary at the point in time of each of these processes. A strategy commends itself for studying a competing risk view (ADLs, gross mobility, marital status, and household size) or at years 3, 6, and 10 (chronic medical burden, cognitive function, depressive symptoms, and social interaction and availability).

We assumed also three of the time-varying factors changed progressively over time: (a) ADL difficulties, (b) gross mobility deficits, and (c) cognitive problems. We plotted crude trajectories of these variables. For each factor, respectively, we used a random-effects model to estimate each respondent’s intercept and trajectory over time, for example,

\[ \text{SPMSQ}_t = \beta_{0i} + \beta_{1i}(\text{time}_t) + \epsilon_t, \]

where \( \beta_{0i} = \lambda_0 + \mu_{0i} \), \( \lambda_0 \) is the mean of the intercept and \( \mu_{0i} \) is the individual deviation from that mean; \( \beta_{1i} = \lambda_0 + \mu_{0i} \), \( \lambda_0 \) is the mean slope and \( \mu_{0i} \) is the individual deviation from the mean slope. The random-effects estimates of individual change obtained from this model are empirical-Bayes weighted averages of individual-level and group-level trajectories (SAS Institute, 1997). In comparison to conventional ordinary linear regression methods, empirical-Bayes methods for estimating individual trajectories have been shown to minimize estimation error and improve precision across a distribution of individual change (Bryk & Raudenbush, 1992; Strenio, Weisberg, & Bryk, 1983).

**Analysis Strategy**

The present study considered whether one process governed the decision to make one of two changes and another governed the type of change to make. In such a case, Allison (1995) recommended that the optimal design strategy is (a) to identify the risk factors for the timing of the change, without regard to its type, and (b) for all those who experienced a change, to predict which type of change occurred. In this way, the determinants of whether to make a change and which alternative is chosen are best distinguished. Such a strategy commends itself for studying a competing risk (i.e., “when the different event types are alternative means for achieving the same goal”; p. 207), as is the case when the goal is to increase personal support for the older person.

Using event-time analyses, we estimated one model for the timing of a first household expansion or institutionalization (without distinguishing between them). We recalculated the probability of the event of interest for each sample member who reported either change, on the basis of all remaining sample members who had not yet experienced a change or had been censored. By design, independent predictor variables could vary at the point in time of each of these recalculation. We allowed any condition presumed to vary intermittently over time to reflect the value of the assessment closest in the past to the event. For conditions assessed annually (e.g., marital status), we used the value from the assessment immediately prior. For conditions assessed every 3 years (e.g., depressive symptoms), the assigned value reflected the status reported at the interview immediately prior to the event. For persons who reported household expansion or institutionalization between the 6-year interview and the 10-year interview, time-varying covariates were set to the values assessed at the 6-year interview. Sample members who were censored by death or losses to follow-up were more likely than others to be older, male, and married, to have more functional disability, cognitive impairments, comorbid conditions, and fewer children, to receive less assistance, and to report less social interaction.

Interpretation of the empirical-Bayes parameter estimates is as follows: for each unit of difference in the variable at time \( t \), there is a \( b \) increase in the log hazard of the event. These log hazards are exponentiated and reported as hazards. Collinearity among predictor variables was not problematic (i.e., variance inflation factors were <5.1 and condition numbers were <6.8).

Finally, we described the household composition of sample members before and after the increase in household size among those whose households expanded prior to institutionalization or censoring. Household composition prior to institutionalization is described in a companion paper (Hays & George, 2002).

We treated missing baseline data on predictor variables by convention (Hays et al., 1998): (a) imputations to the mean for variables with less than 2% missing data, (b) imputed regression-predicted scores for items with 2–5% missing data, and (c) stochastic regression imputed scores for items with >5% missing data (David, Little, Samuhel, & Triest, 1986). We set missing time-varying data to the most proximal prior nonmissing measure for that subject (e.g., where a subject was institutionalized between Wave 2 and Wave 3 and homeownership data were missing at Wave 2, we imputed homeownership to the Wave 1 score). We censored sample members with missing follow-up data on place of residence (lost to follow-up). We imputed missing dates of nursing home entry to the midpoint between the date of the first interview with a report of nursing home residence and the date of the preceding interview.

**Results**

Descriptive statistics for the sample are presented in Table 1. Between 1986 and 1996, 22% of the sample reported household expansion as the first event; 15% reported institutionalization as the first event. Over that decade, one quarter continued to live in the same size or in a smaller household; just over 30% died, and 6% were lost to follow-up but had made no household expansion or institutionalization up to that time. The median time until first household expansion or institutionalization or censoring was 2,197 days (6 years 2.5 months) after the baseline interview.

The mean age of the sample at baseline was 73 years. The sample was predominantly female, White, and urban dwelling. A majority were homeowners. Average annual income was $13,700.00.
At their first event, sample members reported an average of two cognitive difficulties, one gross mobility deficit, fewer than one ADL deficit, and three depressive symptoms. Over time, some of the sample members declined, and some improved in cognitive ability, gross mobility, and ADL function. Negative values (decreasing disability) signify improvement in function, positive values (increasing disability) signify declines in function. On average, the sample showed a small annual increase in number of cognitive problems, mobility difficulties, and ADL deficits. Most sample members reported a high chronic disease burden at their first household expansion or institutionalization.

Not being married was the norm at the time of their first event. Sample members averaged 2.5 living children and a household size of just under 2 persons. A minority reported impairment in each dimension of social support. Death of the spouse and departures of other (nonspouse) household coresidents in the year before the first event were rare. Nearly one quarter had been hospitalized in the year before the change.

Risk factors for first household expansion or institutionalization are presented in Table 2. Older sample members were less likely to make these changes, and Black sample members were significantly more likely to do so. Income was protective against change: each additional $10,000 of annual income decreased the risk by 9%.

Among health factors, the absolute number of cognitive difficulties increased the risk of a household expansion or institutionalization; each additional error reported on the SPMSQ in the year prior to the change increased the risk by 25%. An increasing slope of cognitive difficulties over time was protective against household expansion or institutionalization; each additional error reported on the SPMSQ in the year prior to the change increased the risk by 25%. An increasing slope of cognitive difficulties over time was protective against household expansion or institutionalization; each additional error reported on the SPMSQ in the year prior to the change increased the risk by 25%. An increasing slope of cognitive difficulties over time was protective against household expansion or institutionalization; each additional error reported on the SPMSQ in the year prior to the change increased the risk by 25%. An increasing slope of cognitive difficulties over time was protective against household expansion or institutionalization; each additional error reported on the SPMSQ in the year prior to the change increased the risk by 25%. An increasing slope of cognitive difficulties over time was protective against household expansion or institutionalization; each additional error reported on the SPMSQ in the year prior to the change increased the risk by 25%.
institutionalization was increased by 82% for gross mobility and 56% for ADLs. Thus, although the absolute number of functional difficulties appeared to have counterintuitive stabilizing effects, trajectories of worsening function had destabilizing effects as expected. Moderate or severe chronic illness burden had stabilizing effects with respect to household expansion or institutionalization.

Among social environment factors, being married decreased the risk of household expansion or institutionalization by 46%. Each living child increased the risk of change by 5%. Events that were more likely to trigger change (to either a household larger than the original or to an institution) were recent death of a spouse and departure of a non-spouse household coresident.

The odds of institutionalization (vs. household expansion) for persons who had one of the two events are also presented in Table 2. Age increased the odds of institutionalization; Black race was protective against institutionalization. Odds of institutionalization were elevated by cognitive problems, mobility difficulties, and ADL deficits. With respect to trajectories, worsening ADL disability over time decreased the odds of institutionalization. Odds of institutionalization were increased by 39% for sample members with high chronic illness burden compared with those with a low burden of chronic illnesses.

Social resources were selectively protective against institutionalization. Although being married increased the odds of institutionalization by 67% among those who made a change, children decreased the odds of institutionalization by 16% for each living child. Elders in larger households were less likely to be institutionalized and more likely to experience a household expansion, as were those reporting more social interaction. Of the three recent life events assessed, death of a spouse and recent departure

Table 2. Risk Factors for First Event of Household Expansion or Institutionalization and, Among Those Reporting Either Event, Type of Change

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Risk of First Household Expansion or Institutionalization</th>
<th>Odds of Institutionalization (vs. Household Expansion)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Adjusted Hazard Ratio</td>
<td>95% Confidence Limits</td>
</tr>
<tr>
<td>Demographic Status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>0.68</td>
<td>0.56, 0.82</td>
</tr>
<tr>
<td>Age²</td>
<td>1.003</td>
<td>1.001, 1.004</td>
</tr>
<tr>
<td>Female gender</td>
<td>0.92</td>
<td>0.79, 1.08</td>
</tr>
<tr>
<td>Black race</td>
<td>1.33</td>
<td>1.18, 1.51</td>
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<tr>
<td>Urban residence</td>
<td>1.03</td>
<td>0.90, 1.17</td>
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<tr>
<td>Homeowner</td>
<td>0.96</td>
<td>0.83, 1.12</td>
</tr>
<tr>
<td>Annual income ($10,000s)</td>
<td>0.89</td>
<td>0.80, 0.98</td>
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<tr>
<td>Physical and Mental Health</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cognitive problems</td>
<td>1.25</td>
<td>1.19, 1.32</td>
</tr>
<tr>
<td>Cognitive change (per year)a</td>
<td>0.70</td>
<td>0.67, 0.74</td>
</tr>
<tr>
<td>Gross mobility difficulties</td>
<td>0.80</td>
<td>0.72, 0.89</td>
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<tr>
<td>Gross mobility change (per year)a</td>
<td>1.82</td>
<td>1.61, 2.06</td>
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<tr>
<td>ADL deficits</td>
<td>0.73</td>
<td>0.65, 0.82</td>
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<tr>
<td>ADL change (per year)a</td>
<td>1.56</td>
<td>1.39, 1.76</td>
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<td>Chronic illness burden</td>
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<tr>
<td>Moderate (vs. mild)</td>
<td>0.81</td>
<td>0.70, 0.95</td>
</tr>
<tr>
<td>Severe (vs. mild)</td>
<td>0.61</td>
<td>0.51, 0.72</td>
</tr>
<tr>
<td>Depressive symptoms</td>
<td>1.001</td>
<td>0.98, 1.02</td>
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<tr>
<td>Social environment</td>
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<tr>
<td>Married</td>
<td>0.54</td>
<td>0.44, 0.66</td>
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<tr>
<td>Living children</td>
<td>1.05</td>
<td>1.03, 1.07</td>
</tr>
<tr>
<td>Household size</td>
<td>1.02</td>
<td>0.93, 1.12</td>
</tr>
<tr>
<td>Household size²</td>
<td>1.02</td>
<td>0.99, 1.04</td>
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<tr>
<td>Impaired social interaction</td>
<td>1.18</td>
<td>0.99, 1.42</td>
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<tr>
<td>Important instrumental support</td>
<td>0.91</td>
<td>0.75, 1.11</td>
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<tr>
<td>Important subject social support</td>
<td>1.04</td>
<td>0.84, 1.28</td>
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<td>Recent Stressful Life Events</td>
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<tr>
<td>Death of a spouse</td>
<td>1.59</td>
<td>1.13, 2.23</td>
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<tr>
<td>Nonspouse coresident departure</td>
<td>1.86</td>
<td>1.37, 2.51</td>
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<tr>
<td>Hospitalization</td>
<td>0.92</td>
<td>0.78, 1.08</td>
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<tr>
<td>Model Fit Statistics</td>
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<tr>
<td>−2 Log Likelihood (df) p-value</td>
<td>1496.20 (26)</td>
<td>0.0005</td>
</tr>
</tbody>
</table>

Note: ADL = activity of daily living.

*Ratios < 1.00 indicate protective effects that are associated with worsening problems. Ratios > 1.00 indicate risk that is associated with worsening problems.*
of a nonspouse coresident both reduced the odds of nursing home entry. Among those in residential transition, hospitalization and death of a spouse were as likely to trigger a household expansion as an institutionalization.

In Table 3 we present the proportion of sample members in the household expansion group who resided in households of selected intergenerational configurations before and after the expansion. About one third (25.3% + 1.3% + 5.8%) of preexpansion households included a coresident of the same generation as the sample member (G1), primarily spouses. Postexpansion, the great majority of these (86%–96%) still included a same-generation household coresident, but also included an increase in coresidents of younger (G2 and/or G3) generations.

The remaining two thirds of preexpansion households included no other coresidents of the same (G1) generation as the sample member. Of these, most included no younger coresidents either, representing 47.8% of the total sample. Postexpansion, most of this group (46.9%) coresided with members of G2 and/or G3 generations: children, children-in-law, nieces or nephews, with or without grandchildren. Slightly less frequently (23.5%), this group lived in expanded households with new members of the same generation (with or without others). Least frequently (14.3%), they lived with grandchildren (G3 generation) only. Among sample members who, prior to expansion, lived only with members of a younger generation, most lived with still more children, nieces or nephews, and/or grandchildren after the expansion.

**DISCUSSION**

This prospective population-based study is the first to disaggregate the predictors of two related decision-making processes first described in migration theory over 20 years ago. We illustrate that distinctly different factors help to determine when a change will be made versus the type of change that will be made. This study is also the first to employ random coefficient procedures to estimate the effects of evolving state variables (cognitive and functional status changes) on two separate decisions. These two innovations yield the following benefits.

First, having estimates of the separate effects of individual risk factors on the two processes enables a better understanding of the mechanisms of each. For example, it is observed that adult children promote overall instability in parental households, perhaps by refusing to countenance their parents continuing to live in unsuitable circumstances. Then, having destabilized the household, the prevalence of adult children protects against institutionalization, probably by increasing opportunities for community-based coresidence. Marriage, on the other hand, stabilizes late-life households (perhaps by providing mutually compensatory assistance for dyads as needs escalate). However, in the event of a change, marriage increases the odds of institutionalization (perhaps because the needs of one spouse had grown unmanageable even for an intimate partner or because options for expanding an alternative household for two were more limited than for one.)

The effect of health problems on the overall risk of a household expansion or institutionalization is complex. Specifically, the effects of functional and cognitive problems differ, and the effects of overall trajectories and the absolute numbers of problems differ. Worsening functional trajectories and the absolute number of cognitive problems predict newly expanded households or new institutionalizations. The corollary is that elders who make these two household changes also report the fewest functional difficulties and comorbid problems and the most cognitive stability. One possible explanation for this finding is that propensity to make the residential changes we studied may be shared by two general types of elders. One type may be the most functionally able elders, who could offer more instrumental aid and assistance to potential coresidents, thereby increasing their own chances of household expansions. Or, their higher mobility levels may place them at greater risk of hip fractures or other conditions requiring institutionalizations. The second type of elder in housing transition may be declining rapidly in functional ability but have possibly already

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**Table 3. Generational Composition of Pre- and Postadjustment Households Among Sample Members Whose First Event Was Household Expansion (Unweighted n = 997)**

<table>
<thead>
<tr>
<th>Generation of Other Household Members in Year Before Expansion</th>
<th>Generation of Other Household Members in Year After Expansion</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>G1+ Only or (G1 and G2)* or (G1 and G3)** or (G1 and G2 and G3) %</td>
</tr>
<tr>
<td>-------------------</td>
<td>---------------------------------------------------------------</td>
</tr>
<tr>
<td>G1 onlya</td>
<td>178 (25.3)</td>
</tr>
<tr>
<td>G1 and G3b</td>
<td>12 (1.3)</td>
</tr>
<tr>
<td>(G1 and G2)* or (G1 and G2 and G3)</td>
<td>54 (5.8)</td>
</tr>
<tr>
<td>Sample member lived alone or with Other/UK generationd</td>
<td>504 (47.8)</td>
</tr>
<tr>
<td>G3 only</td>
<td>48 (3.5)</td>
</tr>
<tr>
<td>(G2 and G3) or (G2 only)</td>
<td>201 (16.4)</td>
</tr>
<tr>
<td>Total</td>
<td>997 (100.0)</td>
</tr>
</tbody>
</table>

aG1 = index generation/same generation as sample member: spouse, sibling, cousin.
cG3 = third generation: grandchild.
dOther/UK (unknown generation) = parent, other relative, friend, renter, boarder, paid employee, other unrelated.
reached significant levels of cognitive decrement before the residential change. For these older adults, environmental misfit may be most acute. We ruled out a third possibility, that more independent elders, having more to lose, are declining functionally at a faster rate than others. Rather, our data show a strong positive association between number of limitations and the rate of worsening function over time (Pearson’s $r = .81$, $r = .75$, and $r = .78$, $p < .0001$ for all).

On the other hand, elders in stable (or shrinking) households report high numbers of functional problems and deteriorating trajectories of cognitive problems. Comorbidity burden is also high. Some of these elders may already be in supportive environments (i.e., living with kin and receiving caregiver support) such that they could maintain their places of residence. Others may be experiencing declines in cognitive domains that go undetected or are amenable to adaptive strategies in a stable community-living environment until a critical mass of difficulties trigger a household expansion or institutionalization.

Among all those who actually make such changes, the absolute number of cognitive and functional problems and chronic illnesses promote institutionalization over household expansion. Accounting for these effects, we find a trajectory of worsening ADL problems over time promotes household expansion. Broadly speaking then, functional and cognitive status, as opposed to deterioration, plays the greater role in type of new living arrangement for elders in residential transition. Inability to perform tasks is a more robust predictor of type of change than is rapidity of decline in ability.

An additional example of the benefits of disaggregating the effects on distinct decisions is that we observe that loss of a spouse and household exits other than the death of the spouse are dramatically disruptive to late-life households and strongly predictive of even larger households, rather than of institutionalization. This effect may be similar to indirect evidence reported by Hayes and Al-Hamad (1997). Some older persons’ households may serve as anchors for fluid, multigenerational family networks, whose members come and go as their own needs dictate rather than because the older person has unmet needs for residential resources. Although elders who begin caring alone for grandchildren are relatively few in this study, married elders with expanded multigenerational households are somewhat more prevalent, although still in the minority overall.

Another benefit of the study is that repeated measures over a decade of follow-up are available, allowing acute states to be accounted for with time-varying covariates. In addition, overall trajectories of deteriorating states, some as long as 10 years in the making, are modeled with considerable precision. Accounting for each effect on the outcomes in question allows us to observe, for example, that the trajectory of ADL decline works additively with acute cognitive and functional deficits to predict institutionalization among elders in need of more supportive environments.

Findings from this study are consistent with many previous studies and refine those of others. For example, 10-year incidence of institutionalization is 15% in the Duke EPESE, which is consistent with the 1%–4% annual incidence rates (depending on region surveyed) reported in other studies conducted during the 1980s (Coward, Netzer, & Mullens, 1996; Foley et al., 1992). Our findings on age and race effects are also consonant with those of others (Wallace et al., 1998; Wilmoth, 1998). Our study also supports causal inferences regarding the direct effects of functional decline on household change, as suggested by earlier work (Speare et al., 1991; Worobey & Angel, 1990). In addition, this study complements that of Miller and colleagues (1999), who suggested that elders with cognitive limitations and little assistance were at risk of community-based moves. We find that, over and above the effects conferred by social support, poor cognitive function increases the risk of household expansion or institutionalization. However, where Miller and colleagues found cognitive deterioration to be concurrent with intracommunity moves, we suggest that cognitive deterioration predates two types of household instability, which are triggered by the high level of cognitive incapacitation.

If, as we suggest, previous research has mixed the effects of two separate decisions, then it is useful to revisit the most robust predictors of institutionalization, as summarized by Miller and Weissert (2000), to ask what effects they had on the separate components of migration decision making. Cognitive problems promote both decisions: to make a change and, among elders who make a change, in favor of institutionalization. On the other hand, controlled analyses indicate that older age, White race, physical function problems and chronic illness burden inhibit change but, where a change occurs, promote institutionalization. Isolated elders and those in small households are neither more nor less likely to change, but, where a change does occur, these elders are more likely to be institutionalized than to reside in larger households.

Several findings from the current study are contrary to previous evidence, as described by Miller and Weissert (2000). Impaired mood, impaired social support, prior hospitalizations, and home ownership are not important predictors of either decisional component in this study. Because the current findings represent improvements in scaling and modeling strategies, confirmatory tests of these factors in other populations will be useful. Findings from this study also suggest that evidence regarding marriage or urban dwelling, which heretofore had proven inconclusive, may be partially clarified by separating their effects on each decision component and/or by allowing them to vary over time.

There are certain limitations to this study. Chief among them is the regional sample, precluding generalization of effects beyond the Piedmont area of North Carolina. However, by focusing on a circumscribed population-based sample, the need for external environmental measures, such as bed availability and state reimbursement rates—variables which were not available in the Duke EPESE—is partially abrogated. The Duke EPESE also lacks assessment of other competing risks, such as long-distance migration or moves closer to but not into coresidence with kin. Neither does it assess whether household expansions are in situ or to a different domicile. These comparisons and refinements must await national repeated-measures studies that follow a cohort across greater distances, such as the AHEAD cohort, and that link household size and/or composition and geographic locators. Third, the event-time models employed here have the inherent limitation of removing sub-
jects from future consideration once a first event has occurred, even if that event is temporary (e.g., a temporary institutionalization). Lack of sensitivity to transition history may result in model misspecification, especially because short-term stays are predictive of longer stays (Miller & Weissert, 2000). Models where subjects are not censored after first events are under development and will represent an advance on the current analysis (Anderson, Borgano, Gill, & Keiding, 1982; Hougaard, 2000). Finally, future studies would profit by including assessment of both the goals of migration and the expectancy of achieving them, to describe more explicitly the personal motives that drive the decision-making process (DeJong & Fawcett, 1981).

In conclusion, this study suggests that factored into late-life migration decisions is a complex web of factors that affect the different decision components in different ways. Making some kind of change is strongly influenced by a wide range of contextual factors—some of which are long-standing and some of which are evolving—as well as by recent stressful life events. Making the specific change to achieve more community- or institution-based support is largely influenced by the elder’s social environment, as well as his or her functional and medical needs. Future research in other samples and with primary data will serve to refine these findings.

Acknowledgments

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