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Variation in Living Environments Among Community-Dwelling Elders

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Abstract

Introduction: Many studies examine the movement of elderly individuals across living arrangement and institutional care settings, but the rapidly evolving structure of elderly living environments makes traditional measurement paradigms less representative. We investigate the diverse health-related environmental characteristics of noninstitutional elderly living environments in 1993 and their association with health.

Methods: We use the 1993 wave of the Asset and Health Dynamics of the Oldest Old (AHEAD) survey, which includes both physical and social characteristics of the living environment for over 7,000 older Americans. Grade of membership (GoM) models are used to summarize variation in social and physical environment characteristics, and examine differences between males and females. We also estimate the cross-sectional association between living environment and several measures of physical and mental health status.

Results: Results illustrate extensive within and between-sex heterogeneity in elderly living environments using five "idealized" environment types, as well as significant associations with physical and mental health status measures.

Conclusion: As older individuals stay in the community for longer periods of time, traditional empirical representations of "home" need to be replaced by definitions of noninstitutional environments that meaningfully represent the social and physical challenges faced by this rapidly growing segment of our population.

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Short running page headline: Variation in Elderly Living Environments

Introduction

The number of elderly persons in the United States is increasing rapidly, both in number and as a proportion of the population. Estimates indicate that approximately one-fifth of the U.S. population will be aged 65 or older by 2030 (Administration on Aging, 2001). There is evidence that elders are becoming less limited in their physical functioning (Freedman, Martin, & Schoeni, 2002), suggesting that in the future elderly individuals may be able to live independently in the community later in life. Recent evidence suggests that elders are moving away from traditional modes of care such as nursing homes (Bishop, 1999) and into a diverse and evolving collection of settings in which they may receive formal or informal support (e.g., R. A. Kane, 1995).

The rapidly evolving structure of noninstitutional elderly living environments makes traditional measurement paradigms decreasingly representative, since, as discussed by Anderson, Chen, & Hula (1984: 48), "…the diversity of the alternatives creates a set of environments with varying social, economic, and physical characteristics." This shortcoming is important in light of evidence suggesting that the living environment characteristics of older individuals are associated with both their physical and mental health (R. L. Kane et al., 1998; Waite & Hughes, 1999) as well as settings into which they move in the future (Freedman, 1996). Given this shift of elders away from nursing homes into alternative arrangements, Bishop (1999: 154) states, "…we need population-based surveys with sound identification of care environments." McFadden (1996) stresses the need to consider both the physical characteristics and social resources of a given type of arrangement, since each can have distinct effects on health and may exist as separate choices.

The interaction between older individuals and their environments has extensive public health significance (Satariano, 1997). One area of theory regarding elderly living environment structure focuses on a broad set of living environment characteristics that may affect and be affected by individuals (see detailed discussions by Lawton (1989) and Carp (1987)). More recent work by Verbrugge and Jette (1994) defines physical and social environment characteristics as extra-individual factors that impact a four-stage process to disablement as either positive or negative interventions along this pathway. Subsequent empirical work by Lawrence and Jette (1996) has supported this model of disability development.

The basis for our analysis is the seminal work by Lawton and Nahemow (1973) on the Ecological Model of aging, which considers affective and behavioral outcomes as a result of interaction between personal abilities, or *competencies*, and the demands placed on the individual by his or her physical and social environment, or *environmental press*. Attributing the concept of “press” to Murray (1938), Lawton and Nahemow define environmental press as (Lawton, 1989: 63), "the extent to which an environment demands a response from the person."

Inherently dynamic in nature, a central feature of Lawton and Nahemow’s framework is that (Lawton, 1989: 63), "favorable behavioral and affective outcomes are likely to result from a match between personal competence and environmental demand." This match between competence and press that results in positive outcomes is referred to as the *adaptation level*. Also part of their framework was the possibility that a significant mismatch between press and competence in either direction could result in poor outcomes, i.e., if it the difference between press and competence exceeds a given threshold.

The literature currently lacks comprehensive, empirically-tested definitions of the multitude of noninstitutional states in which elderly individuals reside. We address this important gap by assembling a framework based on existing gerontological theory to examine the physical and social characteristics of noninstitutional elderly living environments and their cross-sectional association with health. The term *elderly living environment* is used here to describe a diverse collection of physical and social characteristics of noninstitutional housing that may impact the processes of aging, comparable to the term *shelter and care setting* used by (Golant, 1998). Our approach to the measurement of noninstitutional living environments is distinctive because of the comprehensive list of factors considered and our use of a large and nationally-representative sample.

Much of the current empirical evidence regarding living environments focuses primarily on living arrangements (i.e. coresidence patterns), and the association of arrangements with future health, function, or care use (e.g., see the review by Palloni (2001)). For example, living arrangement definitions used in the existing literature include living alone versus with a spouse, children or other relatives, and heading or not heading multiperson households, in addition to residence in a nursing home or retirement community. Complementary work has focused on the association of different coresidence profiles with the provision of care (Barrett & Lynch, 1999; Spillman & Pezzin, 2000) and the additional beneficial impacts that social networks and supports might have on the risk of poor physical and mental health outcomes (e.g., see the review in Glass, Mendes de Leon, Seeman, and Berkman (1997)).

However, studies that focus exclusively on coresidence arrangements may miss additional contributions from incremental physical modifications. Individuals may make small modifications in a current residence rather than move to a new one (Pynoos, Cohen, Davis, & Bernhardt, 1987; Struyk, 1987). Such interventions are receiving attention as a means of keeping elderly individuals in place and delaying or preventing adverse health events and transition into formal care settings such as nursing homes (Mitka, 2001). To understand fully the effects of these interventions, it is essential to define and characterize the environments of community-dwelling elders more fully, and investigate the associations between environment characteristics and health and function.

Data and Measures

Data are from the 1993 wave of the Asset and Health Dynamics of the Oldest Old (AHEAD) survey (University of Michigan, 1993), part of the longitudinal Health and Retirement Study. The HRS (Health and Retirement Study) is sponsored by the National Institute of Aging and conducted by the University of Michigan. The AHEAD is nationally representative multistage area probability sample conducted in 1993 of the noninstitutionalized population born in or before 1923 containing interviews from 7,503 eligible respondents in 5,723 households. The study uses a combination of phone and in-person interviews in a complex sampling design, which includes an oversampling of Blacks, Hispanics, and residents of Florida (Heeringa, 1995; Soldo, Hurd, Rodgers, & Wallace, 1997). This analysis uses variables from the 1993 AHEAD and Tracker 3.1 public use data files issued by the HRS and the public use Version C of the HRS data issued by Rand (St.Clair et al., 2003). Specifically, variables for age, race, education, and total wealth come from the public use Rand Version C data file (St.Clair et al., 2003).

From the sample of eligible respondents, 77 individuals are excluded from the analysis due to updated age and birth year information collected in subsequent later waves of the survey suggesting that they were under age 70 in 1993. An additional 332 are missing information on at least one of the thirty-four living environment variables needed for the analysis, and therefore excluded. These modifications result in a sample of 7,094 individuals (2,778 males, 4,316 females) for the analysis of living environment characteristics. Comparison of basic demographic and health information between the analysis sample and those excluded indicate that the analysis sample is older, more male and more white ($p<0.05$, survey-corrected Pearson chi-squared). With respect to the living environment variables, comparisons suggest that individuals in the analysis sample are less likely to be coupled, have step-child household members or unmarried female non-resident children, but more likely to have married female household members and bathroom modifications (however, it is important to note that several of the latter comparisons on social relations have very few positive responses). A subset of observations are available for analysis of the cross-sectional relationship between physical and mental functional status measures and living environments, primarily because proxy interviews do not provide cognition and depressive symptoms outcome measures. Functional status measures include self-rated health (N=7,089), physical impairment (N=6,441), CES-D depressive symptom scores (N=6,350), and cognitive performance scores (N=6,070).

Information defining the social and physical dimensions of living environment press is measured primarily at the household level; exceptions are couple status and perceptions of help in the future. Household level responses are thus assigned to each eligible respondent living in the household. A list of the social components of environmental press considered in this analysis, along with the marginal frequency of each response, is given in Table 2a. Social components of environmental press include couple status (married/partnered or alone), a spectrum of coresidence configurations, the existence of different “care-types” of nonresident children (single or married, sex), proximity of nonresident children (living greater or less than ten miles away), and the perceived ability to get long-term help from relatives or friends. Although this last variable also asks if the individual already receives care and thus may partially reflect a mix of help perceptions and health status, it is included because it is believed to be a strong indicator of an important social resource. In addition, organized community living environments for elders are assessed with regard to the availability of meal, daily housekeeping, and nursing care services. A list of the physical components of environmental press and their marginal frequency is given in Table 2b. Physical components of environmental press include the type of home and its press-related characteristics (number of floors, living space, rooms, bathroom locations, kitchen facilities), ownership, duration of residency, modifications (ramps, wheelchair or bathroom modifications, railings, and call devices), the condition of the residence and neighborhood safety, and an indicator of whether the individual lives in an urban or rural MSA (reflecting extra-household mobility challenges).

Health measures include self-rated health (1-5, 1=excellent), a depressive symptoms score (0-8), a cognitive performance score (1-35), and a functional impairment score. Depressive symptoms are measured using a count of positive responses to an eight-item version of the Center for Epidemiologic Studies Depression Scale (CES-D) (Radloff, 1977). Cognitive performance is assessed by a sum of elements from the telephone interview for cognitive status (TICS), immediate and delayed recall tests, and a serial subtraction exercise. Higher CESD-8 scores indicate more depressive symptoms, while higher cognitive performance scores indicate stronger cognitive performance.

The functional impairment score is based on a modified version of the weighting system for functional limitations developed by Finch, Kane, and Philip (1995). Their methodology defines dependency in terms of how much assistance is required to perform a particular task. Weights are assigned to each degree of difficulty for a collection of tasks and used to rescale a given individual’s set of responses to a score between 0 (no dependency) and 100 (maximum dependency). Because the HRS ADL and IADL questions do not exactly match the wording of that considered by Finch, Kane, and Philip (1995), we applied their ordinal scale for “needing a little/lot/complete assistance” to parallel HRS ADL questions asking if the respondent gets help occasionally/some/ all of the time for the same task, thus preserving the same order in responses.

Similarly for IADLs, needs “a lot” and “complete” assistance are mapped to “unable to do without help” and “can't do”, respectively.

Methods

Grade of Membership (GoM) models (Manton, Woodbury, & Tolley, 1994; Woodbury & Clive, 1974) are used to summarize the collection of discrete living environment conditions into a small number of idealized “pure-type” combinations, and then describe the actual environment of each individual according to their similarity to one or more of the pure-types. GoM models have proven useful for various applications in gerontology; examples include health status summaries of elderly samples (Berkman, Singer, & Manton, 1989; Manton, Cornelius, & Woodbury, 1995) and late-life sibling relationships (Gold, Woodbury, & George, 1990). An important feature of GoM representations is that individuals can share conditions with two or more pure-types. This greatly facilitates the characterization of heterogeneous populations where many individuals are identified by a multiplicity of conditions, no combination of which necessarily occurs in the full population with high frequency.

The GoM model estimates two sets of parameters. First, for each of *K* pure-types, a collection of response probabilities is estimated corresponding to each possible choice of every living environment characteristic. Second, for every individual in the sample, *K* scores are estimated that quantify the similarity of the given individual to each of the *K* pure-types (each score is between zero and one and sums to one for each individual). The first score quantifies similarity to the first pure-type, the second score similarity to the second pure-type, and so on. For example, individuals whose profile of responses to the living environment variables exactly reproduces the combination of responses given by the k^{th} pure-type will receive a score = 1 for their k^{th} score, and zeros for the others. The two sets of parameters are estimated iteratively by maximizing a conditional likelihood function, beginning from a set of initial values for the two sets of parameters (see Manton et al. (1994) for further details). Our models are estimated separately for males and females both to avoid correlation of observations within households and to allow comparisons of pure-types between sexes.

The number of profiles (pure-types) *K* is determined iteratively, and in this analysis was guided by the principles of GoM model fit developed by Singer (1989) and Berkman, Singer and Manton (1989) reflecting a tradeoff between model complexity and parsimony. Our objective was to produce a set of pure-types that would serve as useful reference points among which to summarize the living environments of individuals in the sample. Increasing the number of pure-types generally improves the model fit but also produces more complex and frequently less interpretable pure-type characterizations. Searching among models with $K = 2, 3, 4$, etc. pure-types, we concluded that $K = 5$ pure-types provided a reasonable balance between pure-type detail and interpretability, capturing several representative nodes across a spectrum of living environment configurations.

Because the likelihood surfaces for GoM models contain multiple local maxima, it is necessary to fit them beginning from a diversity of starting conditions. Confidence that a global maximum has been reached increases substantially when subject-matter-based guidance about the approximate location of such peaks can be utilized to constrain the set of starting conditions that need to be considered. In choosing "informed" (Manton et al., 1994: 72) initial values for the *K* pure-type response probabilities, we selected sets that let to highly idealized and simplified forms of the five living environments. These restricted sets of initial values were chosen following extensive exploratory analyses and inevitable interpretive judgments by the investigators. Initial GoM scores for each individual were agnostically set to be uniform across all individuals and equal to one divided by the number of pure-types.

After estimation, we identify a subset of characteristics that distinguish each pure-type following Singer (1989) and Berkman, Singer, and Manton (1989). The list of distinguishing characteristics for each pure-type is then gathered into a narrative describing that pure-type. For each pure-type we define particular responses to a variable as "distinguishing" a pure-type if the estimated response probability is at least twice the marginal frequency of that response in the sample. For relatively prevalent characteristics (assumed here to be responses with marginal probabilities greater than 0.4), the response is distinguishing if the estimated pure-type probability is at least 35% greater than the marginal frequency.

We analyze the distribution of individuals across pure-types by summarizing the distribution of the scores measuring similarity to each of the pure-types. An individual is defined as being represented by a single pure-type if their individual score associated with that type is greater than 0.9 (Berkman et al., 1989; Singer, 1989). Membership in exclusively two pure-types is defined by having exactly two scores that sum to 1. Similarly, membership in three or four pure-types is defined by having exactly three and four nonzero scores, respectively. Although our estimated GoM likelihood function does not incorporate strata or sampling unit characteristics of the sampling design, the respondent-level probability weights are used to reweight the individual GoM scores ex post, thus more closely reflecting the distribution of elderly individuals in the population sampled (Manton et al., 1994: 36) .

An ordered logit model is used to estimate the cross-sectional relationship between self-rated health and an individual's profile of living environment GoM scores, while ordinary linear regression is used for similar models of physical impairment, CES-D, and the cognition scores (each regression specification corrects for survey design characteristics). All models control for age (indicator for equal to or greater than 80), sex, race (indicator for nonwhite), years of education, and total household wealth. GoM models were estimated using a modified version of the GOM3 software written by (Charpentier, 1996). All other analyses were performed using Stata/SE version 8.2 (StataCorp, 2003) and the *svy* ordered logit and linear regression commands.

Results

Descriptive weighted sample information is given in Table 1. The sample of females is older, poorer, more physically impaired, and demonstrates more depressive symptoms ($p<0.05$). There are also many differences between males and females in unweighted marginal frequencies of responses to the social and physical environment variables (Tables 2a and 2b). These unweighted differences are important because, as discussed above, each estimated response probability is compared to the associated marginal frequency. The largest differences include those for couple status, expectations of future help, and home ownership.

[Table 1 about here.]

Grade of Membership Pure-type Response Probabilities

The response probabilities estimates for the social and physical environment variables associated with each of the five pure-types are given in Tables 2a and 2b. Pure-type response probabilities that meet the admissibility criterion are in bold, and the associated distinguishing characteristics for each pure-type are described below (the titles for each pure-type, in italics, convey the essential nature of the pure-type but are not intended to be inclusive summaries).

Pure-type I: No Physical Modifications/Strong Social Resources—For both males and females, this pure-type is characterized by availability of help in the future from friends/relatives, married nonresident children, single/partnered female nonresident children, and nonresident children who live less than ten miles away. Individuals of this type live in a single family, multistory home in very good condition and in a safe neighborhood, with living space on more than one floor (all with bathrooms). The environment for males is additionally distinguished by being with a spouse/partner, while females additionally have single/partnered male nonresident children, nonresident children living more than ten miles away, own a larger home, and have lived there for more than 10 years.

Pure-type II: Physical Modifications/Weak Social Resources—Males and females described by this pure-type are coupled, cannot get help in the future, have married nonresident children, but no nonresident children less than 10 miles away. They live in a mobile, single story residence in excellent condition and in a safe neighborhood, in which they have lived less then 10 years. In addition, males locate in rural areas, while females lack nonresident female children, but generally have nonresident children living greater than 10 miles away, and have small but distinguishing probabilities of living in a medium sized, multi-level living space that they own.

Pure-type III: No Physical Modifications/Very Strong Social Resources (Coresidence)—Males and females are not coupled, already get help from friends/relatives, have a multitude of coresidence arrangements, and no married nonresident children. The residence is a two family, multi-level home or duplex that is rented from a relative, in fair to poor condition and in a relatively unsafe area. Males also do not have their own kitchen facility, while females have no nonresident children, and may be in a large single family home.

[Tables 2a and 2b about here.]

Pure-type IV: Extensive Physical Modifications (60+ community)/Weak Social Resources—Males and females are not coupled, already get help, and have services as part of their environment. Lived in for less than ten years by the resident, the structure is a small, rented (not from relative) multistory townhome/other with living spaces on one floor, several modifications, and in a relatively unsafe neighborhood. Males also have no married female nonresident children, may be in a 2 family home or duplex and do not have their own kitchen facilities, while females have a multi-level environment in a neighborhood with poor safety.

Pure-type V: No Physical Modifications/Very Weak Social Resources— This pure-type, for both males and females, has no nonresident children, and lives in a medium-sized, single family home. Males cannot get help in the future from friends/relatives, can have a single story residence in fair condition and with fair safety. Females own the residence and have lived there for longer than ten years.

Distribution of Individual GoM Scores Among Pure-types

Table 3 displays the weighted frequencies of individuals across the sex-specific pure-type definitions given above. A little over 6% of males and females, respectively, associate with only one of the pure-type environments. The most prevalent among these for both males and females is pure-type I (No Physical Modifications/Strong Social Resources). The second most prevalent single environment membership is for pure-type V (No Physical Modifications/Very Weak Social Resources). The least prevalent single environment membership is for pure-type III (No Physical Modifications/Very Strong Social Resources (Coresidence)). Almost 29% of males and females are described by mixes among two pure-types. The most common two-type mix for both sexes is between pure-types I and V, followed by mixes between I and II (Physical Modifications/Weak Social Resources).

[Table 3 about here.]

Mixes among the three types are the largest group for both males and females, representing approximately 45% of each sex. Males and females share their most common three-type mix (I, II, and V), but differ in the next most prevalent mixes. Males are next most likely to mix environments I and II with IV (Extensive Physical Modifications (60+ community)/Weak Social Resources) or III, respectively, while females to mix IV and V with environments I or II, respectively. Four and five type mixes represent the most heterogeneous individuals. The distribution among four-type mixes reinforces that pure-type III has the lowest prevalence of membership among all the pure-types, for both males and females. Mixes among five types represent a residual group.

Cross-Sectional Results on Living Environment and Health

Estimates of the cross-sectional association between measures of physical and mental health status and the living environment GoM scores are given in Table 4. Since the pure-type definitions vary by sex, models are estimated independently for males and females. In each case, pure-type I (No Physical Modifications/Strong Social Resources) is the reference pure-type. A consistent result is that, across all health outcomes and both sexes, individuals living in environments that are increasingly similar to pure-type III (No Physical Modifications/Very Strong Social Resources (Coresidence)) have significantly worse expected levels of each health outcome, relative to pure-type I and independent of controls for age, race, education, and wealth. A similar finding is revealed for individuals living in environments that are similar to pure-type IV (Extensive Physical Modifications (60+ community)/Weak Social Resources), though the association is not significant at traditional levels for self-rated health among males. Additional differences by sex are also evident. Males living in environments that are increasingly similar to their pure-type II (Physical Modifications/Weak Social Resources) have significantly better self-rated health and lower levels of physical impairment, relative to males living in environments that are similar to their pure-type I (controlling for other factors). Conversely, males living in environments increasingly similar to pure-type V (No Physical Modifications /Very Weak Social Resources) have significantly worse self-assessed health and higher CES-D scores, relative to males living in environments that are similar to pure-type I (controlling for other factors). However, both males and females living in environments increasingly similar to their respective pure-type V profiles demonstrate significantly better physical impairment scores.

Discussion

These results quantify diversity of the social and physical characteristics of noninstitutional environments in which our elders reside, point out distinctions between males and females, and illustrate the association of several idealized types of environments with physical and mental functioning measures. Noninstitutional living environments are exceedingly heterogeneous; the majority of individuals in the sample live in environments that are described as combinations of two or more pure-types. That the most popular two-type mix is among I and V indicates that social resources (when present) often accompany challenging physical environments, suggesting, for example, that social resources may be implemented more readily than physical alterations.

Models estimating the association between living environment characteristics and measures of mental and physical functioning suggest that, independent of variables controlling for age, race, education, and wealth, individuals with the worst functioning are generally located in environments with relatively more physical and social resources (lower press). An interesting exception is illustrated by the relatively challenging (high press) environment represented by pure-type V. Although this environment score is associated with better physical functioning scores for both males and females, it is associated with worse self-rated health and CES-D scores among males.

Although these analyses are based on cross-sectional data and therefore cannot explicitly model the dynamic interaction between press and competence that is part of the Lawton and Nahemow (1973) framework, these results do provide several clues of their interaction. In general, the consistent associations between poorer physical and mental functioning (low competence) and GoM scores for the most supportive environments (low press) are consistent with potential efforts to achieve the balance between press and competence and thus the adaptation level that is central to the framework. However, the difference between males and females in their associations between what may be considered an environment of relatively high press (pure-type V) and the outcome measures may serve to illustrate more subtle features of the framework.

Assuming for the moment that the level of press is equal across both the male and female descriptions of pure-type V, if this and similar results are found to be robust in future, dynamic empirical evaluations they would have several theoretical implications. These include, for example, that: 1) the threshold for adaptation may differ between affective and behavioral (i.e., as reflected here in physical impairment) outcomes; 2) the thresholds for adaptation may differ across both sex and outcome domain; and perhaps more specifically, 3) in some contexts males may be more likely than females to experience an imbalance between their ability to adapt physically versus affectively. Thus, under these conjectures, one interpretation of the particular empirical result observed here might be that males observed in environments similar to pure-type V, although of relatively high physical competence, may be beyond their particular affective threshold for successful adaptation. Alternatively, assume that the level of press is higher for males living in environments similar to their pure-type V than females living in their pure-type V environment (recall that one difference is the explicit absence of help in the future for males). Under this assumption, the observed differences in outcomes across males and females would not carry such theoretical implications of heterogeneity in threshold definition or adaptability. This result would simply be consistent with the experience of a higher level of press among males.

There are several limitations to this analysis. First, 409 of the original 7,503 (5.5%) eligible respondents were excluded because of missing data or inconsistent age information, potentially compromising the representative nature of the estimates. Second, the Grade of Membership model that is estimated separately for males and females does not account for the complex sampling design of the AHEAD. Therefore, there may be correlation at the strata or PSU level among observations due to clustering. In this analysis we therefore implicitly assume that the major correlation exists within households (the influence of which is eliminated by estimating separate GoM models by sex) and that any remaining correlation at the strata or PSU level is minimal. Third, as discussed above, the exact collection of pure-types generated in the current analysis should not be taken as generalizable representations or groups of actual environments (recall that the prevalence of exact pure-types was shown to be very low). We use these pure-types only as a metric by which to assess the relative social and physical properties of the environments in this sample. Fourth, the adoption of the physical impairment scoring methodology of Finch, Kane, and Philip (1995) assumes that preservation of the order of the responses allows application of their associated weights. Lastly, as discussed above, this analysis is based on cross-sectional data and does not address the determinants of living environment choice, i.e. we do not make any inferences regarding the direction of causality between living environment characteristics and health or functioning. As a result, we can make no speculation about the determinants of the observed differences between males and females in living environments. Such differences could be due to important confounding factors such as age or health differences that exist between the male and female samples, or the associations between the living environment scores and the measures of functioning considered here.

As older individuals stay in the community for longer periods of time, traditional empirical representations of "home" need to be replaced by definitions of noninstitutional environments that meaningfully represent the social and physical challenges faced by this rapidly growing segment of our population. Drawn from gerontological theory and based in empirical reality (e.g., as discussed by McFadden (1996)), the comprehensive measurement approach explored here suggests a richness of noninstitutional living environments that is atypical in existing work. The implications of these results for both researchers and policymakers include both the need for evidence of potential synergistic effects of physical and social living environment characteristics in future studies of multidimensional interventions on health, and recognition of the spectrum of accommodating mechanisms that may be employed by community-dwelling elders to adapt their environments. Much additional research is necessary to understand the complex structure of noninstitutional living environments and discover how such environments influence health and function.

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Table 1: Descriptive Statistics (weighted)

	Males			**Females**			**Overall**	**Overall**	**Ho: $\mu_{Males} - \mu_{Females} = 0$**	
	Sample N	**Weighted Mean**	**SE**	**Sample N**	**Weighted Mean**	**SE**	**Min**	**Max**	**t-statistic**	**Prob >|t|**
Age >= 80	2778	0.29	0.01	4316	0.36	0.01	0	1	5.86	0.000
Nonwhite	2777	0.09	0.01	4316	0.10	0.01	0	1	0.51	0.609
Years of Education	2778	11.13	0.12	4316	11.00	0.08	0	17	-1.15	0.255
Total Wealth ($100,000s)	2778	2.23	0.11	4316	1.49	0.07	-0.96	148.20	-8.67	0.000
Self-rated Health (1=Excellent)	2777	3.02	0.03	4313	3.04	0.03	1	5	0.80	0.427
Physical Impairment Score	2348	4.53	0.30	4094	6.98	0.25	0	94.19	7.67	0.000
CES-D Score	2418	1.27	0.05	3933	1.74	0.04	0	8	8.75	0.000
Cognition Score	2301	20.07	0.17	3770	19.97	0.13	1	35	-0.49	0.626

Table 2a: Social Components of Environmental Press: Marginal Frequencies and Grade of Membership Response Probabilities (bold indicates distinguishing characteristic)[a,b]

Social Components of Environmental Press		Males (N=2,778) Unweighted Marginal Frequency	Males Estimated Pure Type Response Probabilities I	II	III	IV	V	Females (N=4,316) Unweighted Marginal Frequency	Females Estimated Pure Type Response Probabilities I	II	III	IV	V
Coupled	No	0.27	0	0	**1**	**0.95**	0.31	0.66	0.58	0	**1**	**1**	0.84
	Yes	0.73	**1**	**1**	0	0.05	0.69	0.34	0.42	**1**	0	0	0.16
Future Help from Friends/Relatives	No	0.45	0	**1**	0	0.21	**0.8**	0.36	0	**1**	0	0	0.73
	Yes	0.43	**1**	0	0.24	0.45	0.2	0.38	**1**	0	0	0.21	0.27
	Already get help	0.12	0	0	**0.76**	**0.34**	0	0.25	0	0	**1**	**0.79**	0
60+ community	Not in a 60+ community	0.92	1	1	1	0.22	1	0.89	1	1	1	0	1
	In a 60+ community, but don't have any services	0.06	0	0	0	**0.63**	0	0.08	0	0	0	**0.76**	0
	In a 60+ community, have services	0.02	0	0	0	**0.15**	0	0.03	0	0	0	**0.24**	0
Single/Partered male in hshld?	Yes	0.11	0	0	**1**	0	0	0.12	0	0	**1**	0	0
Single/Partered female in hshld?	Yes	0.08	0	0	**1**	0	0	0.13	0	0	**1**	0	0
Married male living in household?	Yes	0.02	0	0	**0.22**	0	0	0.03	0	0	**0.26**	0	0
Married female living in household?	Yes	0.02	0	0	**0.24**	0	0	0.03	0	0	**0.3**	0	0
Child (of FamR) living in household?	Yes	0.12	0	0	**1**	0	0	0.16	0	0	**1**	0	0
Step-child (of FamR) living in household?	Yes	0.01	0	0	**0.09**	0	0	0.00	0	0	0	0	0
Grandchild (of FamR) living in hshld?	Yes	0.04	0	0	**0.59**	0	0	0.07	0	0	**0.88**	0	0
Sibling (of FamR) living in hshld?	Yes	0.01	0	0	**0.11**	0	0	0.02	0	0	**0.15**	0	0
In-law (of FamR) living in hshld?	No	0.97	1	1	0.65	1	1	0.96	1	1	0.58	1	1
In-law (of FamR) living in hshld?	Yes	0.03	0	0	**0.35**	0	0	0.04	0	0	**0.42**	0	0
Nonres single/partnered male child?	No	0.73	0.53	0.69	0.73	0.81	**1**	0.78	0.52	0.77	0.94	0.84	1
	Yes	0.27	0.47	0.31	0.27	0.19	0	0.22	**0.48**	0.23	0.06	0.16	0
Nonres single/partnered female child?	No	0.71	0.41	0.91	0.8	0.6	**1**	0.72	0.34	**1**	0.91	0.66	**1**
	Yes	0.29	**0.59**	0.09	0.2	0.4	0	0.28	**0.66**	0	0.09	0.34	0
Male married NonRes child?	No	0.41	0	0	**0.98**	0.55	**1**	0.46	0	0	**1**	0.54	**1**
	Yes	0.59	**1**	**1**	0.02	0.45	0	0.54	**1**	**1**	0	0.46	0
Female married NonRes child?	No	0.42	0	0	**1**	**0.65**	**1**	0.48	0	0	**1**	0.62	**1**
	Yes	0.58	**1**	**1**	0	0.35	0	0.52	**1**	**1**	0	0.38	0
NRchild <10 miles away?	No	0.51	0	**1**	0.42	0.63	**1**	0.51	0	**0.8**	**0.97**	0.39	**1**
	Yes	0.49	**1**	0	0.58	0.37	0	0.49	**1**	0.2	0.03	0.61	0
NRchild >10 miles away?	No	0.25	0	0	0.4	0	**1**	0.32	0	0	**0.82**	0.09	**1**
	Yes	0.75	1	1	0.6	1	0	0.68	**1**	**1**	0.18	0.91	0

[a]The "non-relative" and "parent" coresident types were included in the GoM analysis, but did not subsequently contribute distinguishing characteristics to any of the profiles and are therefore not included in the table. [b]For yes/no variables, the "no" response is not included in the table where it did not contribute any distinguishing characteristics to any of the profiles.

Table 2b: Physical Components of Environmental Press: Marginal Frequencies and Grade of Membership Response Probabilities (bold indicates distinguishing characteristic)[b]

Physical Components of Environmental Press		**Males (N=2,778)**						**Females (N=4,316)**					
		Unweighted Marginal Frequency	Estimated Pure Type Response Probabilities					Unweighted Marginal Frequency	Estimated Pure Type Response Probabilities				
			I	**II**	**III**	**IV**	**V**		**I**	**II**	**III**	**IV**	**V**
Type of home	Single house	0.73	**1**	0.61	0.92	0	**1**	0.66	**0.94**	0.59	**0.9**	0	**0.94**
	Mobile home	0.08	0	**0.39**	0	0	0	0.07	0	**0.41**	0	0	0
	2 fam home or duplex	0.04	0	0	**0.08**	**0.23**	0	0.05	0.06	0	**0.1**	0.03	0.06
	Apartment/Condo/ Townhouse/Other	0.15	0	0	0	**0.77**	0	0.23	0	0	0	**0.98**	0
Living space arrangement	Single story	0.63	0.53	**1**	0.46	0	**0.89**	0.60	0.56	**0.99**	0.5	0	0.81
	Multistory, have elevator, and living space is all on 1 floor	0.06	0	0	0	**0.48**	0	0.08	0	0	0	**0.52**	0
	Multistory, don't have elevator, but living space is all on 1 floor	0.12	0.12	0	0.16	**0.52**	0	0.16	0.14	0	0.2	**0.47**	0.1
	Multistory, have elevator, living space not on 1 floor	0.00	0	0	0	0	0	0.00	0	**0.01**	0	**0.01**	0
	Multistory, no elevator, living space not on 1 floor, bathrooms on all floor	0.11	**0.24**	0	**0.29**	0	0	0.08	**0.19**	0	**0.17**	0	0
	Multistory, no elevator, living space not on 1 floor, bathrooms not on all floor	0.07	0.1	0	0.09	0	0.11	0.07	0.11	0	0.14	0	0.1
Own or rent home?	Own (at least part)	0.80	1	1	0.16	0	1	0.68	**1**	**1**	0	0	**1**
	Rent, relative owns	0.06	0	0	**0.84**	0	0	0.10	0	0	**1**	0	0
	Rent, relative does not own	0.14	0	0	0	**1**	0	0.21	0	0	0	**1**	0
Modifications: ramps?	Yes	0.07	0	0	0	**0.67**	0	0.09	0	0	0	**0.57**	0
Modifications: rails?	Yes	0.08	0	0	0	**0.63**	0	0.11	0	0	0	**0.63**	0
Wheelchair modifications?	Yes	0.10	0	0	0	**0.82**	0	0.13	0	0	0	**0.75**	0
Modifications: Bathroom bars?	Yes	0.23	0.18	0	0.09	**1**	0.18	0.29	0.08	0.38	0.18	**1**	0.12
Hshld modifications: Call device?	Yes	0.07	0	0	0	**0.76**	0	0.12	0	0	0	**0.93**	0
Number of rooms	1 to 3	0.10	0	0	0	**1**	0	0.16	0	0	0	**1**	0
	4 to 6	0.68	0.6	0.81	0.59	0	**1**	0.65	0.59	**0.89**	0.61	0	**1**
	Greater than 6	0.22	0.4	0.19	0.41	0	0	0.19	**0.41**	0.11	**0.39**	0	0
Have own kitchen?	No	0.01	0	0	**0.07**	**0.03**	0	0.02	0	0	0	0	0
Physical condition of home	Excellent	0.25	0	**1**	0	0.16	0	0.22	0	**1**	0	0.25	0
	Very good	0.34	**0.69**	0	0.01	0.4	0.27	0.33	0.48	0	0.07	0.47	0.4
	Good	0.28	0.31	0	0.41	0.35	0.42	0.30	0.37	0	0.29	0.27	0.45
	Fair	0.11	0	0	**0.27**	0.09	**0.31**	0.12	0.15	0	**0.35**	0.01	0.14
	Poor	0.03	0	0	**0.31**	0	0	0.03	0	0	**0.28**	0	0
Live in home for 10+ years	No	0.25	0	**0.62**	0.22	**0.91**	0	0.27	0	**0.57**	0.5	**0.87**	0
	Yes	0.75	1	0.38	0.78	0.09	1	0.73	**1**	0.43	0.5	0.13	**1**
Neighborhood safety	Excellent	0.26	0	**1**	0	0	0	0.24	0	**1**	0	0	0
	Very good	0.33	**0.68**	0	0	0.41	0.3	0.32	0.56	0	0.05	0.37	0.43
	Good	0.28	0.32	0	0.55	0.23	0.46	0.29	0.34	0	0.39	0.31	0.46
	Fair	0.10	0	0	**0.22**	**0.21**	**0.24**	0.12	0.1	0	**0.29**	0.23	0.11
	Poor	0.03	0	0	**0.23**	**0.15**	0	0.04	0	0	**0.27**	**0.1**	0
Urban MSA?	Rural (no)	0.25	0.17	**0.56**	0.15	0	0.22	0.25	0.35	0.46	0.01	0	0.21

Table 3: Weighted Distribution of Individuals Among Living Environment Pure-type Mixes

	Males		**Females**		
	Weighted Population	**% of Weighted Male Population**	**Weighted Population**	**% of Weighted Female Population**	**Total Weighted Population**
Total	8,535,235	100.0%	12,723,685	100.0%	21,258,920
		Mix Category			
Pure-types					
I	276,147	3.2%	334,712	2.6%	610,859
II	33,505	0.4%	29,571	0.2%	63,076
III	0	0.0%	4,987	0.0%	4,987
IV	55,320	0.6%	171,191	1.3%	226,511
V	171,701	2.0%	241,301	1.9%	413,002
Total	536,673	6.3%	781,762	6.1%	1,318,435
Two Type Mixes					
I & II	741,747	8.7%	768,444	6.0%	1,510,191
I & III	170,337	2.0%	337,184	2.7%	507,521
I & IV	100,191	1.2%	299,382	2.4%	399,573
I & V	762,521	8.9%	828,317	6.5%	1,590,838
II & III	45,519	0.5%	78,857	0.6%	124,376
II & IV	116,288	1.4%	242,653	1.9%	358,941

II & V	257,292	3.0%	452,431	3.6%	709,723
III & IV	9,001	0.1%	23,095	0.2%	32,096
III & V	77,035	0.9%	221,740	1.7%	298,775
IV & V	152,597	1.8%	405,463	3.2%	558,060
Total	2,432,528	28.5%	3,657,566	28.7%	6,090,094
Three Type Mixes					
I & II & III	440,518	5.2%	508,887	4.0%	949,405
I & II & IV	576,214	6.8%	625,265	4.9%	1,201,479
I & II & V	1,385,837	16.2%	1,662,870	13.1%	3,048,707
I & III & IV	112,394	1.3%	411,791	3.2%	524,185
I & III & V	307,359	3.6%	447,564	3.5%	754,923
I & IV & V	380,909	4.5%	727,640	5.7%	1,108,549
II & III & IV	62,423	0.7%	147,986	1.2%	210,409
II & III & V	144,446	1.7%	232,339	1.8%	376,785
II & IV & V	346,534	4.1%	658,049	5.2%	1,004,583
III & IV & V	101,987	1.2%	250,638	2.0%	352,625
Total	3,858,621	45.2%	5,673,029	44.6%	9,531,650
Four Type Mixes					
I & II & III & IV	237,649	2.8%	399,706	3.1%	637,355
I & II & III & V	306,643	3.6%	464,879	3.7%	771,522
I & II & IV & V	739,351	8.7%	964,357	7.6%	1,703,708
I & III & IV & V	172,511	2.0%	241,965	1.9%	414,476
II & III & IV & V	116,134	1.4%	262,346	2.1%	378,480

Total	1,572,288	18.4%	2,333,253	18.3%	3,905,541
Five Type Mixes					
I & II & III & IV & V	135,125	1.6%	278,075	2.2%	413,200

Table 4: Regression Estimates of the Association Between Living Environment GoM scores and Physical and Mental Health Status Measures[c,d,e]

	Self-Rated Health (Ordered Probit)		**Physical Impairment Score (OLS)**		**CES-D Score (OLS)**		**Cognitive Performance Score (OLS)**	
	Males	**Females**	**Males**	**Females**	**Males**	**Females**	**Males**	**Females**
Age >= 80	0.19*	0.09	3.54**	4.04**	0.18*	0.15	-2.19**	-3.32**
	[2.44]	[1.48]	[4.68]	[8.29]	[2.18]	[1.80]	[12.20]	[14.37]
Nonwhite indicator	-0.04	0.27*	-0.15	-0.23	0.15	-0.15	-2.91**	-3.33**
	[0.30]	[2.21]	[0.15]	[0.26]	[1.41]	[1.02]	[5.87]	[10.41]
Years of Education	-0.11**	-0.11**	-0.25**	-0.11	-0.08**	-0.11**	0.60**	0.68**
	[8.48]	[10.09]	[3.24]	[1.51]	[6.44]	[7.68]	[20.45]	[22.33]
Total Wealth ($100,000s)	-0.04	-0.06**	0.04	0.2	-0.01*	-0.03*	0	0.05
	[1.85]	[3.27]	[0.45]	[1.93]	[2.31]	[2.27]	[0.12]	[1.53]
Pure-type II: Physical Modifications / Weak Social Resources	-0.59*	-0.08	-4.86**	0.99	-0.23	-0.07	0.22	0.27
	[2.56]	[0.50]	[4.08]	[0.97]	[1.20]	[0.39]	[0.40]	[0.57]
Pure-type III: No Physical Modifications / Very Strong Social Resources (Coresidence)	0.63*	1.30**	11.74**	24.52**	1.54**	1.12**	-3.08**	-3.24**
	[2.56]	[6.03]	[4.40]	[11.45]	[4.44]	[5.34]	[3.92]	[4.50]

Pure-type IV: Extensive Physical Modifications (60+ community) / Weak Social Resources	0.23	0.91**	5.21*	9.13**	1.32**	0.86**	-1.28*	-1.45**
	[1.01]	[5.49]	[2.66]	[8.34]	[5.51]	[4.74]	[2.39]	[3.18]
Pure-type V: No Physical Modifications / Very Weak Social Resources	0.44*	0.12	-2.46*	-1.42*	0.32*	0.25	-0.78	-0.55
	[2.21]	[0.73]	[2.18]	[2.02]	[2.13]	[1.87]	[1.53]	[1.31]
Constant			6.48**	3.12**	1.90**	2.70**	14.53**	14.24**
			[6.53]	[3.21]	[10.78]	[14.61]	[33.22]	[29.08]
Observations	2776	4313	2347	4094	2417	3933	2300	3770

[c]Absolute value of z statistics in parentheses; * significant at 5%; ** significant at 1%; [d]Pure-type I (No Physical Modifications/Strong Social Resources) is the (omitted) reference pure-type. [e]Note that pure-type definitions are distinct for males and females.