Chapter 12

Physical Environments and Their Relationship to Quality of Life

The second major component of the Task Order examined physical environments as they relate to Quality of Life (QOL). The bulk of the environmental work was based on data collection in the 40 facilities for Wave 1. This chapter reports on how each of the 1988 resident's physical environments were assessed at the room, nursing unit, and facility level, describes the nature of these physical environments, and provides some data on the relationship between QOL and environment and on how being in a private room affected QOL. The environment work included detailed case studies of exemplary environments, which have been sent separately to CMS.

Background

Environmental conditions have long been known to affect human growth and development and, ultimately, functioning and QOL (Lawton, 1983; Lawton, Brody, & Turner-Massey, 1978). Many physically or cognitively impaired people have limited ability to manipulate or escape their immediate physical surroundings, and, therefore, the environment of the nursing home, or perhaps the even smaller environment of the nursing unit or their own rooms, becomes their world (Rowles, 1978).

Although criticism of nursing homes as places to live is ubiquitous, little detailed information is available to describe the physical environments in nursing homes today. Even scarcer are data describing the way the environment affects outcomes of interest, including functional status and QOL for residents with various characteristics. Indeed, without the tools to measure physical environments systematically, such outcome data cannot be generated.

The first section of this chapter describes how physical environments were conceptualized for this study, how they were assessed at three levels (facility, nursing unit, and resident's room and bathroom), the development of composite measures derived from the assessment instruments to measure various attributes of the physical environment, and early descriptive results on variation within and across facilities. Physical environments were to be the independent variable and QOL the dependent variable for the resulting analyses. Quantitative and qualitative data include assessments of 1988 room and bath environments, located on 131 nursing units in 40 nursing homes.

The second section provides a brief overview of the ongoing work of developing a typology of nursing home environments using hierarchical cluster analysis, and will provide preliminary data on the relationship between private rooms and QOL.

Theoretical Framework

Nursing homes are, most obviously, places where people live. They are also places where people work and visit. Each user has different priorities for the physical environment. Although residents are the full time users, traditionally nursing homes have been designed in typical hospital layouts of multiple-bed rooms located on long double loaded corridors where the priority is more on supporting the efficiency of nursing services than creating a home for the residents.

The physical environment has the potential to contribute to the QOL of residents by capitalizing on resident strengths while reducing demands, or conversely, environments could create obstacles to residents achieving a higher QOL. As the aging process continues, the gap between the demands of the environment and the older person's competence widens to the point where an environment that once was supportive of limitations is no longer supportive. The

ecological model developed by Lawton and Nahemow (Lawton & Nahemow, 1973) suggests behaviors are a function of the interaction of personal factors with the physical environment. In the spirit of this model, Becker and Steele state that the size, shape, layout, quality, furnishings and equipment in the physical environment "shape our lives, at the same time as our behaviors and values shape the nature of that designed environment, how it is used, and the meaning we attach to it (Becker & Steele, 1995)." Highly competent people can function in environments that are less supportive of their human limitations, whereas less competent people will have more difficulty overcoming environmental challenges.

Conversely, environments can place too little demand on residents, as in some nursing homes where sensory deprivation and lack of control results in boredom, anxiety, and depression. This is compatible with the observation that learned helplessness results from no longer perceiving one is able to make decisions or exercise discretionary behavior affecting one's life (Langer & Rodin, 1976; Seligman, 1976). The environmental docility hypothesis, an outcome of the ecological theory, suggests that the lower the level of competence, the greater the influence of the environment on behavior, although at some point of illness and disability (for example, a vegetative state), the physical environment is unlikely to influence behavior. While studying a dementia special care unit, researchers found that residents with higher cognitive functioning benefited more from an enhanced physical environment than residents in the later stages of dementia (Cohen-Mansfield & Werner, 1998). On the other hand, the environmental docility hypothesis would suggest that people challenged by dementia as well as those challenged by physical conditions such as shortness of breath or extreme mobility difficulties would particularly benefit by a well-designed physical environment. After a review of seventy-one studies on therapeutic design of environments for people with

dementia(Day, Carreon, & Stump, 2000), the authors suggest that the study of environments in long-term care has been too focused on the goal of identifying the relationship between the physical environment and troublesome behavior rather than studying the potential of environmental design to improve general QOL.

Over a lifetime, individuals develop habits or routines in their use of space that provide a sense of "being in place"(Rowles, 1998). As people age, their reduced physical functioning requires changes and often downsizing of the environment to allow continued functioning in a routine or habitual way and continued control over "place," albeit on a smaller scale (Rowles, 1983). Community-dwelling elders make such transitions when they limit the space that they use in their homes, or when they relocate from large homes to small apartments. In the context of the nursing home, the goal still remains for the nursing home resident to achieve a sense of his or her own place in that facility through establishing an environment adapted for his or her routines; it is obviously more challenging to manage one's new space in a way that affords continuity when the space is located in a nursing home rather than a private home.

Attention to the physical environments of nursing homes has largely been expressed by concerns about safety, resulting in regulations mandating minimal expected environmental features on matters such as railings, corridor width, fire retardant materials, and the like. Here too there has been discordance between such environmental requirements and the needs of the users. The weakness of many codes and standards, even as guarantors of safety, is that they are seldom research based, nor do they consider multiple goals. They tend to take into account specific disabilities like cognitive impairment, vision problems and mobility problems without considering the interaction effect of a multitude of frailties common to the elderly person. For example, a code can pursue a single goal such as safety in the rare event of fire by requiring

heavy fire doors that are difficult at best for an elderly resident to maneuver, but the code does not require an automatic door opener, which would enhance functioning all the time.

Thus, we undertook this study with the assumptions that physical environments are critical in enhancing or impeding well-being, and that these physical environments must both nurture the individual's capacity for independence, autonomy, and physical functioning, and also, given that these environments aspire to be the homes of those who dwell there, afford a sense of security, enjoyment, interest, and fulfillment. We recognized the diversity of nursing-home residents and the differing requirements residents might have for their environments. Also given that some residents are extremely limited to their near environments, we required a tool to look at the most immediate physical environment as well as the larger physical environment in which it is nested.

Environmental Measurement in Nursing Homes

Systematic, objective, and reliable ways to characterize physical environments are needed so that they can be studied in relationship to resident outcomes. Instruments available to date have often depended on subjective, global judgments rather than data that are objective, evaluative, and discrete (Cutler, 2000). They tend, for example, to record ratings at the unit level (e.g., items such as "some rooms on the unit are personalized"), which, in turn, makes it impossible to link that observation to any given individual on the unit (who may or may not have a personalized room). Also the measures tend to depend on judgments, rendering them inherently prone to poor reliability, especially when used by persons without specific professional background in design or extensive training on the use of the particular tool.

The most comprehensive environmental evaluation instrument for use in nursing homes is really a battery of instruments; the Multiphasic Environmental Assessment Procedure (MEAP (Moos & Lemke, 1996). This 5-part protocol is designed to evaluate the physical and social

environments in residential settings; though not originally designed to be used with frail older people, it is salient for them. Most other environmental rating tools available to assess nursing homes were designed specifically to study dementia special care units (SCUs). Generally, they attempt to document presence or absence in the environment of characteristics that have been conceptually linked to a good QOL for people with dementia. As defined by Calkins & Chafetz, the major principles for crafting environments on dementia special care units are: regulated stimulation; maximizing awareness and orientation; supporting personal continuity with past; providing secure freedom, and enhancing positive social interaction (Calkins & Chafetz, 1996).

Several scales have been developed to examine the extent to which SCU environments incorporate features thought to be desirable. The Therapeutic Environment Screening Scale (TESS) (Sloane & Mathew, 1990), in its revised TESS+ form (Sloan, Mitchell, Long, & Lynn, 1995) was used in the cooperative evaluation of dementia SCUs sponsored by the National Institute on Aging in the 1990s. This observation scale assesses 8 environmental domains: general design features; maintenance; inventory of spatial amenities and seating capacity; lighting; noise; amenities; programming; and global environment. Similarly, the Professional Environmental Assessment Protocol (PEAP) is an 8-dimension instrument specific to dementia SCUs; it differentiates three levels of the physical setting (fixed or structural features, semi-fixed features and non-fixed features) as they related to the social, organizational, and policy environment. Recent work in 43 SCUs shows that the PEAP actually seems to be a single-dimension scale, which correlates highly with the TESS (Lawton et al., 2000). Although they do not assess the physical environment precisely, both these observational tools go well beyond physical environments to assess the programs and practices that are observed within the environments, and they both require some additional knowledge of policies beyond what is

acquired from the tool.

Also, the Environment Behavior Model for SCU's (E-B Model) assesses 8 environment-behavior concepts (exit control, wandering paths, individual away places, common space, outdoor freedom, residential scale, autonomy support, and sensory comprehendability (Zeisel, Hyde, & Levkoff, 1994). The tool has the advantage of being conceptually grounded, but its use requires extensive training and ultimately rater judgments. For example, exit controls are rated for their immediacy and their unobtrusiveness, common space for quantity and variability, and wandering paths for their continuousness and their way-finding properties. Finally, the Nursing Unit Rating Scale (NURS) is a step further away from direct observation, since it gathers information about how the environment is used to create a milieu for persons with dementia through interviewing nursing staff. The NURS results in measures for 6 domains: separation, stimulation, stability, complexity, control/tolerance, and continuity (Grant, 1996). In sum, the tools in the literature for assessing nursing homes tend to focus on the nursing unit, emphasize dementia SCUs (though most nursing home residents who have dementia live outside dementia SCUs), depend heavily on ratings, and mix assessment of the environment itself and assessment of behavior observed in that environment.

Measures are needed that allow examination of the environment that any resident experiences with or without dementia on any unit in the facility. We set out to develop tools that would allow us to assess the environment of any resident, beginning with his or her own dedicated space (a bedroom or portion of one and perhaps a portion of a bathroom), the space he or she shares with others on the nursing unit, and the space he or she shares with all residents in the facility. In this study, the term environment was defined as referring to the fixed, semi-fixed, and unfixed components of the physical structure, and the furnishings, fixtures, decor, and

equipment in the building. Although we appreciate that the staff and other residents also constitute part of the overall environment that influences any particular resident, we strove to separate out the physical environment to make it possible to study how different physical environments affect programming, policy, and staff behavior, on the one hand, and resident outcomes, on the other.

Development of Environmental Checklists

Instrument Development

Through review of literature and discussion with experts, we generated a pool of items that were conceptually associated with resident QOL. We did this separately for the "private" space of the resident's room and any bathroom or partial bathroom that the resident used as their primary toilet room; for the nursing unit, which typically contains a nurse's station, one or more shower or tub rooms, one or more sitting or dining spaces, and corridors; and for the overall nursing home facility. Regarding the latter, we excluded "backstage" spaces such as the commercial laundry and kitchen, the staff offices, mechanical rooms and the like, since our emphasis was on the living environment experienced by the residents. The environmental items thus generated were often hypothesized to be related to more than one QOL domain. All items were observable and clearly defined; most were visual observations though we included some observations made through hearing and smell. Almost no equipment was needed, though a tape measure was used to measure the size of closets and resident's personal space, to check heights of switches or flat surfaces if in doubt as to whether they fell in desirable ranges, and to measure walking distances from the resident's unit to other indoor and outdoor spaces. We also developed a lighting protocol, for which a light meter was used to take specific readings of lighting levels. We excluded from our tool any environmental measures related to the minimum

regulatory requirements for nursing homes.

The room and bathroom tool developed through this procedure consists of 114 items, all of which were assessed for each of the 1988 residents in our sample. (For Room and Bath Environmental Checklist, see Volume 2, Appendix G). For example, the results for items such as having a window view, having a bedside chair, the length of the walk to the bathroom or closet, or whether the resident crossed someone else's space to get to the bathroom could differ for residents occupying the same room. Almost all the items required a yes or no answer; some required choosing from a simple multiple-choice option, providing a measurement, or a count (e.g. number of other residents using the toilet room). We used the "fist test" to assess light switches and drawer pulls; that is, if the assessor could operate those controls with a closed fist, they passed the fist test and were more likely to be able to be controlled by a resident.

The nursing unit tool, which included 229 items, tapped the environments shared by all residents on the unit. (For Unit Environmental Checklist, see Volume 2, Appendix H.) The tool took into account the nursing station, corridors, common tub/shower room, lounge and dining spaces, access to outdoors spaces, noise on the unit, and distances from the unit to the facility entrance, to the main dining room, to lounges and to the shower/tub room. Again the items are largely dichotomous–e.g., a feature or characteristic was present or absent, though a few of the items required a tape measure, or a count (e.g. number of lounges, number of shower/tub rooms). The protocol for assessing any sitting or dining areas on the unit were repeated for all such areas. Thus, we had available a simple measure of whether there were dedicated spaces for dining or recreation or a combination of both on the unit, as well as detailed information about the features of decoration and furnishings in each space.

The 243-item facility-level measure included all other indoor and outdoor spaces

potentially used by residents, family members, volunteers and visitors. (For Facility Environmental Checklist, see Volume 2, Appendix I.) This included detail about the grounds, the neighborhood, and the parking. Again, if more than one lounge or dining room was available, each was assessed separately. Special note was made of innovative or exemplary spaces, for example restaurants or "main streets" that served as community wide gathering places, contemplation rooms, and nursing units organized and designed as small households.

A separate lighting protocol was done at the same time as the unit and facility assessments to measure the amount of light in foot candles. This entailed light meter readings in a sample resident room and bathroom on each of the 131 units as well as 4 readings at each of the following unit locations; nurse's station, shower/tub room, main activity space, dining area and corridors. In addition, facility level measurements were completed in corridors, reception/entrance area, activity lounge and dining areas where present. Detailed instructions were used for the protocol to control the circumstances of each measure. The protocols included features that were commonly expected to be present in nursing homes, less common features (fireplaces, thermostats to regulate temperature in resident rooms), and features we thought would be uncommon (e.g. bathrooms in public spaces that were accessible for residents, toilet rooms that lock from the inside, double beds, or computers in residents' rooms).

Data Collection

The three environmental checklists were completed for the room and bath, the unit, and the facility, respectively. The room and bath data were collected by the 40 research interviewers who also interviewed residents and staff members, and performed a variety of observational protocols during their approximately 3 weeks in each facility. Typically, the room and bath protocol was done immediately after the resident interview was completed. The research

interviewers for each state were trained to almost perfect inter-rater reliability before they went into the field. This was accomplished in phases, including: classroom training with extensive use of slides, photographs, and room diagrams that identified items in the assessment tool, and practical experience in nursing homes. In the final phase of training, the interviewers did a room and bath observation with the trainer present and independently completing the form. A condition of training was to achieve a .9 reliability with the trainer as the gold standard before going into the field. Once the interviewers were in the field, they were able to telephone the lead environmental investigator to resolve any difficulties that might arise in atypical rooms. As rulings were made in specific cases, these rules were communicated to the other interviewers.

A formal inter-observer reliability test was conducted for the assessments in 60 rooms in 30 different nursing homes (not shown). This was performed by having a second observer visit the room and bath at the same time as the assigned observer or on the same day to complete a second protocol. Kappa statistics were used to measure agreement between measurements obtained by different observers for most items (excluding dimensions). The kappas were calculated separately for single and shared rooms, since the assessments are somewhat more challenging in the latter. Of the 101 single room items tested by 24 pairs of raters, 97 items (96%) yielded significant kappas. Of the significant kappas, only 1 item was in the poor range (<0.4); 10 items (10%) were in the range of 0.4-0.6, 29 items (30%) were in the range of 0.6-0.8, 57 items (58%) were above .8, and for 41 items (42% of the total) we achieved 100% agreement for all pairs of raters. Test results for shared rooms were slightly lower than for single rooms. Of the 110 shared room items tested with 36 pairs of raters 96 items (87%) yielded significant kappas. Of the significant kappas, 4 items (4%) fell below .4, 19 items (20%) were in the range of 0.4-0.6, 27 items (28%) were in the range of 0.6-0.8, 47 (48%) were above 0.8, and of these we achieved

100% agreement among all raters on 31 items (32% of the total) items. The few items with insignificant kappas or kappas in the poor range were flagged for deletion or revision and clarification.

The lead environmental investigator (Lois Cutler) visited all 40 facilities and completed the unit and facility level observational checklists. During that visit, she also conducted a more qualitative appraisal to identify any innovative designs that might be worthy of a more detailed evaluation study. After each visit, detailed field notes about each facility were completed to serve as a basis for identifying exemplary features.

Analysis

To reduce the data for analytic purposes, the environmental team grouped items to develop composite measures of relevant environmental constructs using the data in the 3 assessment tools. Prior to the development of these composites, an environmental team (Cutler, Lawton, Kane, and Grant) developed a rational scheme for coding individual environment features as they relate to QOL domains. Each rater assigned each item from the assessment tools to a primary QOL domain and secondary ones, when applicable. Initial concurrence was high, and discrepancies were resolved in team discussion. After this initial step, the team combined items to develop composite measures of relevant environmental constructs. For example, items that were judged to be related to functional competence were incorporated into the composite measures of function-enhancing features at each of the 3 levels, and clutter items were incorporated into a measure of clutter at the unit level. Items related to autonomy were incorporated into the composite measure of features potentially controlled by residents, and items that we thought were related to meaningful activity, enjoyment, comfort, and relationships were incorporated into measures of “life-enriching features” at all three levels. Of the QOL

domains we studied, privacy has the clearest environmental analogue. We employed some simple measures of privacy (e.g. having a single room, number of people sharing a room, number of people sharing a bath) but also developed composite measures, including a measure of visual separation in the resident's room. In some instances, we could not relate the scales so readily to a single domain. Similarly, the distance measures and the lighting measures might impact functional competence and security most directly, but could also affect meaningful activity, enjoyment, and relationships.

The resultant scales are typically additive, created by assigning a point to each positive manifestation present without any attempt at present to weight the items according to their relative importance. Because they were designed to conceptually reflect the items that belong to a construct (e.g. clutter, function-enhancing features, life enriching features, personalization), their validity did not rest on Chronbach alpha correlation, which show how the items cluster together in a facility. We determined alpha reliability of the measures, however, because only scales with acceptable alpha reliability are likely to show relationships to QOL outcomes. For some later analytic purposes, therefore, we will need to drop items from the scales. For this presentation, items are retained to clarify which features were rare in our nursing home sample.

Using single items and scales, we then examined the extent of environmental variation within and across facilities. We also examined the narrative case study reports to characterize exemplary features and differing forms of privacy.

Descriptive Findings

The 40 facilities housed from 49 to 274 residents, and the 131 nursing units in the study housed from 10 to 70 residents; 21 of these nursing units were classified by the facility as a dementia special care unit. Eighteen facilities were 1 story; 7 facilities had 2 stories, 7 had 3

storeys, another 7 had 4 stories, and 1 was 6 stories high. The number of residents in these facilities ranged from 49 to 274 with a mean of 125 residents. Total units in facilities ranged from 1 to 5 units. Consistent with our over-sample for private rooms, 580 (29%) of the residents lived in a private room: 1155 (58%) residents shared a 2-bed room, 177 (9%) a 3- bed room and 76 (4%) residents a 4-bed room. The prevalence of residents in rooms with 3 or more beds varied widely by state. In California, 35% of the sample lived in rooms with 3 or more beds, compared to 10% for Florida, 8% for New Jersey, 7% for New York and 5% for Minnesota. The square footage of space per resident in resident rooms ranged from 411 square feet per person to 75 square feet per person.

Privacy and ease of access to bathrooms is a prime consideration for residents and for staff in their care-giving duties. The number of residents with whom a resident shared a toilet room ranged from a high of 20 residents to a low of 0 for the 501 residents who had a private bathroom. All told 26% had a private bathroom (fewer than the 29% with private bedrooms), 42% shared a bathroom with 1 other person, 5% shared with 3 residents, 18% shared 4 other residents, and 11% shared with 5 to 20 other residents. The distance that residents needed to travel to use their primary toilet room ranged from 2 to 82 feet. Access to a bathroom for 250 residents required that they travel outside their immediate room to a shared bathroom down the corridor. A tub or shower was located in 498 of the resident's toilet rooms, including in those of 235 who shared toilet rooms. We have no data on whether these showers or tubs were in good working order or whether they were utilized. Many were located in bathrooms too small to accommodate both a wheelchair and an aide, and many shower stalls had a high shower lip. Several facilities were initially built as housing for a younger population and then renovated into nursing homes. These facilities did not have the level of function enhancing features commonly

found in buildings that were designed as nursing homes.

Lounge space on units varied from 20 units that lacked even a single lounge located directly on the unit to 7 units that had 4 separate lounges on the unit. One facility with 3 units and all private rooms also had 4 lounges per unit. This lounge space was infrequently used by residents as they tended to stay in their own private rooms. At the other extreme, a 152 bed facility with the majority of 3 plus person rooms (including 6 person rooms) and no private rooms also had limited shared space.

The residents on 33 units must travel to a different unit or central location for dining, whereas 83 units contained at least a single dining room and 1 unit had a total of 6 dining options. When a unit had multiple dining spaces, occasionally residents were assigned to a single option, but often they could alternate among dining rooms and seating arrangements. In a few instances, residents could choose to sit in a different dining room for each meal and the food was delivered to the resident wherever they chose to dine. At the other extreme, capacity in the dining room of one facility could only accommodate 66% of the residents so residents were required to eat from trays in their rooms. In another facility, a recently designated SCU unit lacked dining capacity so tables were placed in the corridor during meal time to accommodate diners. One of the obstacles to residents eating at times other than scheduled dining times is the lack of refrigeration and food warming capabilities directly on the unit. One or more full kitchens were located on 31 of the units, typically those that embraced cluster concepts of care. One innovative facility was organized into households with 8-10 residents. For administrative purposes, 4-6 households comprised a nursing unit, and each household had a full kitchen with refrigerator, stove, oven, dishwasher, and microwave.

Bathing is a common function that is often a source of agitation for both residents and staff

(Hoeffer, Rader, MeKenzie, & Stewart, 1997; Rader, 1996). Many reasons can cause this agitation including: inadequate ventilation, low light levels, improperly used as storage areas, and possibly, it does not receive attention because it is not routinely viewed by visitors. One hundred and seventy-six tub/shower rooms were deemed functional but many were neglected in maintenance and lacked decorations. Ten units lacked a shower/tub room directly on their unit necessitating residents to travel longer distances to a shower/tub room. The distance from the farthest resident room to the shower/tub room he/she used ranged from 20 feet to 270 feet. Heat lamps were observed in only 13 percent of the rooms and not a single towel warmer was noted.

Composite Indices

The data set yielded from the procedure described above contains an enormous number of individual elements. Although some discrete elements (such as being in a private room) are useful as independent variables hypothetically related to QOL, it was necessary to determine ways to combine the data into a manageable number of variables. In our first effort to accomplish this task, we developed 20 composite indices: 8 scales at the room/bathroom level included personalization, function-enhancing features, life-enriching features, environmental control, storage, maintenance, visual separation among roommates, and a hierarchical scale for privacy; 7 scales at the unit level included clutter in corridors, noxious noise, function-enhancing features, life-enriching features, unpleasant odors, pleasant odors, and maintenance; and 5 scales at the facility level included function-enhancing features, life-enriching features, outdoor space and equipment, facility-wide amenities and maintenance. In addition we developed indices for adequacy of lighting at all three levels. We also worked on summary measures of the dining and bathing experiences, respectively, but at this point are not satisfied that we have tapped agreed-upon normative features related to the wide range of dining and bathing arrangements, which

encompass all 3 levels of organization–room and bath, unit, and facility. Table 12.1 describes each index.

Table 12. 1. Composite Index Characteristics at 3 Levels

Scale (theoretical score)	# Items	Median	Mean	Standard Deviation
Room and bath **(n = 1988)**				
Visual separation	5	3	2.72	1.86
Personalization	7	2	2.27	1.55
Room function enhancing features	4	2	2.23	0.79
Bathroom function enhancing features	8	4	4.06	1.42
Life enriching features	15	5	4.82	2.15
Environmental controls	13	6	5.70	2.03
Storage	7	4	3.99	1.11
Maintenance	3	3	2.71	0.58
Unit **(n = 131**)				
Function enhancing features	7	4	3.47	1.20
Life enriching features	16	10	8.82	4.46
Clutter	10	3	3.54	2.53
Outdoor features	10	0	3.33	4.15
Bathing environment	13	8	7.22	3.47
Dining environment	9	4	3.40	2.44
Maintenance	6	6	5.3	1.19
Facility **(n = 40)**				
Function enhancing features	13	8	8.35	2.27
Life enriching features	15	7	7.68	2.72
Facility amenities and services	10	3	3.40	2.20
Outdoor amenities	10	9	8.20	1.87
Maintenance	5	5	4.83	0.45

Tables 12.2, 12.3, and 12.4 present descriptive data at the room, unit, and facility levels respectively for almost all the environmental elements collected, including those used for the composite measures.

Table 12.2. Composite Indices and Frequency of Index Items at the Room Level

Item	%	Item	%
Personalization index		***Bathroom function index***	
Personal photos	84.9	Grab bars next to toilet	86.8
Door personalization	38.6	Min 3' adjacent to toilet	82.8
Resident's own chair(s)	29.7	Sink has wheelchair clearance	82.4
Individual bedspread	28.6	Toilet seat 17" + from floor	62.3
Resident's own lamp(s)	18.4	Bathroom door lever style	37.5
Resident's own bureau	18.4	Sink has lever hardware	31.5
Individual drapes/curtains	8.0	Grab bars extend 4" in front of toilet	12.7
Life enriching feature index		Tilted wall mirror	10.0
Outdoor view from bed	91.6	***Environmental controls***	
Chair(s) in sleep area	77.0	Environmental controls	98.6
Flowers (natural or artificial	61.3	Adjustable drapes or blinds	96.0
Resident's own TV	59.8	Call button within 18" of pillow	95.7
Hobbies/ interests	43.2	Window can be opened	75.4
Religious items in room	37.6	Bathroom door can be locked	56.7
Living plant in room	32.7	Adjustable heating in room	52.4
Resident radio, CD, tape deck	32.2	Adjustable air conditioning	45.6
Resident's telephone	28.5	Light fixture on rheostat	23.0
Desk or flat work space	12.5	Task light switch 18" from pillow	10.7
Resident bird, fish, pet	2.3	Entry door locks from inside	5.4
Refrigerator in room	1.5	Pressure or rocker type light switch	4.4
Bed larger than single	1.0	Heat lamp in bathroom	3.4
Microwave or hot plate	.7	Pressure/rocker switch in bathroom	3.0
Personal computer	.4	***Storage***	
Visual separation		Private closet	96.8
Closet w/o crossing other's space	71.0	Drawer type storage	93.4
Bathroom w/o crossing other's space	65.4	Night stand by bed	84.0
Entrance w/o crossing other's space	64.3	Counter space around sink	41.3
Foyer or shared entrance separate the sleeping areas	37.9	Locking storage	37.1
Decorative screens or dividers	33.4	Table or shelf by chair	37.1
Room function index		Enclosed storage in bathroom	9.3
Level change at threshold	91.8	***Cleanliness/maintenance***	
Min 4 ft' clearance side of bed	76.2	Floor covering well maintained	94.8
Entry door lever or push style	47.9	Wall covering well maintained	90.3
Closet rods located 3-4' from floor	6.9	Bathroom well maintained	85.7

Table 12.3. Composite Indices and Frequency of Index Items at the Unit Level

Unit Level Items	**%**	**Unit Level Items**	**%**
Function enhancing features		***Noxious stimuli***	
Handrails both sides of corridor	99.2	Auditory alarms	42.0
Handrails contrasting color	71.0	Intercom or paging	32.8
Contrast between walls & floor in corridor	62.6	Screaming by residents	19.8
Dull finish floors	60.3	Musak	16.8
Seating along corridor	48.9	Screaming by staff	9.2
Contrast between walls	3.1	Feces odor	16.0
Automatic door opener	1.5	Other unpleasant odor (beyond listed types)	8.4
Life-enriching features		Strong cleaning odor	5.3
Telephone for resident use	87.8	Garbage	.8
Movable chairs in lounge	81.7	Musty or moldy smell	.8
Flowers in lounge	78.6	***Pleasant Odors***	
Activity equipment (not games)	69.5	Pleasant food odors	19.8
Television in 1 lounge	76.3	Other pleasant odors	15.3
Living plants in 1or more lounge(s)	64.9	***Bathing/showering environment***	
Large print material in 1or more lounges	50.4	Tub/shower room on unit	92.4
Games visible in one or more lounge	53.4	2 or more tub/shower rooms on unit	38.2
Musical instrument(s)	54.2	Shower threshold< ½	82.4
Orientation boards	48.1	Main tub room door able to be locked	72.5
Arts and crafts	36.6	Sink in shower/tub room	64.1
Animal (dog, cat, bird, not fish)	22.1	Clearance below sink	58.8
Daily newspaper	30.5	Sink with lever hardware	55.7
Clutter in corridors		Jacuzzi or whirlpool	51.1
Hoyer lifts, commodes, medical equipment	58.0	Toilet in shower/tub room	63.4
Laundry carts	48.1	Toilet in separate enclosure	38.2
Housekeeping carts	48.1	Showers and/or tubs in separate enclosures	38.2
Other clutter (besides listed types)	46.6	Heat lamp in shower room	15.3
Clean linen carts	40.5	Sink mirror for wheelchair users	12.2
Medicine carts	32.1	***Maintenance***	
Food tray containers	26.7	Corridor floors well maintained	96.2
Incontinence product disposal	22.1	Corridor walls maintained	95.4
Trash containers	17.6	Shower room walls maintained	86.3
Weight scales	14.5	Lounge walls maintained	81.7
		Lounge floor clean	80.2
		Shower room floors clean	73.3

Table 12.3. Cont'd

Outdoor features		***Dining environment***	
Outdoor access off unit	44.3	Pictures on wall	72.5
Outdoor seating	39.7	Windows in dining room	69.5
Outdoor table	35.9	Contrast between dishes and table	48.9
Seating covered	33.6	Table cloth or place mats	22.9
Covered patio	33.6	Posted menu	38.2
Outdoor flower garden	33.6	Centerpieces or flowers	26.7
Outdoor area secured	33.6	Kitchen for resident use	23.7
Covered table	32.1	Room used for dining only	11.5
Hard surface walking path	26.0	Menu lettering more than ½ inch	9.9
Raised garden planter	20.6		

Table 12.4. Composite Indices and Frequency of Index Items at the Facility Level

Facility Level Items	**%**	**Facility Level Items**	**%**
Function enhancing features		***Life-enriching features***	
Floors avoid high contrast	97.5	Flowers in lounge	97.5
Handrails on both sides of corridor	77.5	Lounge with moveable chairs	95.0
Handrails contrast with wall	75.0	Lounge with window	95.0
Corridor walls contrast with corridor floors	72.5	Musical instruments	77.5
Corridor floors dull finish	70.0	Games and/or cards	60.0
Contrast between chairs and floor in lounge	85.0	Arts and crafts	50.0
Wayfinding signs present	35.0	Daily newspaper	45.0
Large lettered clock present	80.0	Dog or cats	37.5
Handrails extend around corners	50.0	Computers for resident use	30.0
Lobby toilet that may be used by residents	47.5	Orientation board	42.5
Automatic door opener	47.5	Arts and crafts	50.0
Large print material in lounge	67.0	Jigsaw puzzle in use	30.0
Covered drop-off	30.0	Exercise equipment	5.0
Amenities and services		Popcorn machine	20.0
Beauty shop/barber shop	97.5	Balls & other large motor skill equipment	32.0
Library, reading room, or book cart	62.5	***Outdoor amenities***	
Chapel or meditation room	40.0	Flower garden	97.5
Gift shop that is accessible to residents in w.c.	32.5	Moveable seating	95.0
Coffee shop or snack bar for residents/ family	30.0	Bird feeder or bird bath	92.5
Children's play area	30.0	Outdoor table with chairs	92.5
Cafe/restaurant for light meals	15.0	Hard surface wandering path	87.5
Children's day care on premises	15.0	Recreational activities (e.g. horseshoes)	82.5
Greenhouse/sunroom/solarium	12.5	Covered seating	82.5
Maintenance		Covered picnic area	82.5
Corridor floors clean	100	Raised garden planters	52.5
Corridor walls maintained	97.5	Secured outdoor area	65.0
Lounge floors clean	97.5		
Lounge walls maintained	97.5		
Facility grounds maintained	90.0		

Room and Bath Composite Indices

Visual Separation was developed to reflect the level of privacy and territorial control afforded by the physical environment for residents in multiple bed- rooms. Only 5% of the residents in shared rooms experienced all 5 of the visual separation items for a perfect score of 5, whereas 20% scored 0 on that scale.

Bed Separation is a 5 item hierarchical index that identifies the bed arrangement on a range from the optimal private room (29.2%) to the least desirable arrangement of 3 or more beds in a room placed side by side (6%); 46% of the residents were in double rooms with beds placed side by side.

Personalization refers to the extent of personal belongings, furnishings and decorations present in the resident room. Clearly, a higher score on this index is a function of individual and familial resources as well as facility policy; we would expect the latter to be more at play if almost no residents have individualized personal items in their rooms and if the furnishings, decor, and room arrangements do not vary within the facility. Other than individualized photos (present for 85% of the 1988 residents), personalization of space was minimal. Only 18% brought their own bureau and 30% brought one or more chairs. The mean was 2 on a possible score of 7 and 10% scored 0. As expected, multi-bed rooms are less personalized than private or semi-private rooms.

Life-enriching Features identifies 15 items in a resident's room that have the potential to provide the resident with meaningful activity, comfort, relationships and/or enjoyment. Most of the residents (92 %) had a view of the natural environment. At another extreme, only 13% had a horizontal work or desk surface. Flowers, especially artificial ones were relatively common (61%), but living plants were less so (33%). Many (41.2%) of the residents did not have a

television under their control, a high number even considering that some NFs adhered to the philosophy that no televisions should be available for people on dementia units. A surprising 23% did not have even one chair for their own or a visitor's use, and only 29% had their own telephone. Among rarer instances, 3% had a pet (dog, cat, bird or fish), 1.5 % had a refrigerator, 1% had a double bed, 8 residents (.7%) had a personal compute and the same number had a microwave. Thirteen residents lacked a single life enriching item, 30 percent had less than 4 items and 6 residents (0.3%) had 11 of the 15 items.

Function-enhancing features is a 8-item index which measures how well the resident's room and bath supports the needs of frail persons using wheelchairs, walkers, or other devices. The mean score of 3.6 suggests that the rooms in the sample could be more supportive of resident functioning. Lever type hardware, was found on only 47% of the entry doors, 38% of bathroom doors, and 31% of sink faucets. Although the majority of the sample use a wheelchair, only 7% of the closet rods were located 36 to 48 inches from the floor, a height considered wheelchair accessible.

The 17 item Environmental Control index measures the degree to which the physical environment has the potential to be manipulated by the resident (recognizing that some residents will be unable to manipulate any environmental control); fifty-two (52%) had adjustable heat, and 46% had adjustable air conditioning. The call button was located within 18 inches of the bed pillow for 96% of the residents, and the on/off switch for task lighting was located within easy reach for 75%. Regarding lighting controls, 23% had potential to control the intensity of the light with a dimmer switch, 68 residents (3%) had control of a heat lamp in the bathroom, and only 3% of the residents had light wall switches of the pressure or rocker type.

Storage was measured by a 7 item index; the mean for the sample score was 4. Seven

residents had only one type of storage whereas 18 residents had all 7 items. Private closet type storage, drawer type storage and a night stand were common to most rooms. Only 37% percent of the residents had storage space that could be locked. Ample storage space in bathrooms has the potential of increasing staff efficiency by requiring fewer trips to a central storage location. Only 41% had counter space available around the bathroom sink, and only 9% had storage space in the bathroom sufficient to store a supply of incontinence products. Maintenance in resident rooms was measured by a 3 item scale that included upkeep of the floors, upkeep of walls, and cleanliness in the bathroom. Overall, maintenance was found to be good with little variation.

We performed an analysis of variance (ANOVA) to test the difference of means on the room scales between those in single rooms, double rooms, and rooms with 3 or more residents. Table 12.5 shows that in all cases the means are significantly different from each other; those in shared rooms are likely to have lower scores on the composite scales.

Table 12.5. One-Way ANOVA on Composite Scale Mean Differences between Room Types

Scale	**Mean in Private Room**	**Mean 2 Beds**	**Mean 3+ Beds**	**Overall F**
Personalization - 7	3.17	1.99	1.45	180.60
Life Enrichment - 15 items	6.19	4.51	3.12	261.98
Function Enhancing - 12 items	6.31	5.97	4.67	107.06
Environmental Controls - 17 items	7.70	7.19	5.71	91.95
Storage - 7 items	4.40	3.91	3.38	87.07
Maintenance - 3 items	2.80	2.71	2.47	29.79

All means are significantly different from each other according to Tukey's HSD statistic.

Unit Composite Indices

Unit level indices were developed from data collected in individual assessments of the 131 units. Function enhancing features largely refers to corridors and items that facilitate ease of movement within and between units. Even though 99% of the units had handrails on both

sides of the corridor, they were often obscured by clutter (as shown in a separate scale). Light levels in the corridors were problematic with only 5% of the unit corridors registering an average level above 75 foot candles, a level even less than the desired minimum of 100 foot candles. Automatic door openers to exit the unit were found on only 2 units.

Clutter is measured by presence of 10 types of clutter. No clutter was found on 12 units and all 10 types were found on 3 units. Hoyer lifts, commodes, and other medical equipment were the most common type of corridor clutter, found on 58% of the units. Incontinence product disposal containers were identified in 22% of the unit corridors, often resulting in unpleasant odors. Items such as animal cages, leg prostheses, clothes hangers, and even a game of bowling were observed in the corridors.

Noxious noise was measured by 6 different identifiable sounds. A single sound is less problematic, but when the 6 items are combined the level increases dramatically. This scale does not address the sustained high level of noise heard on some units, it simply identifies what sounds were heard during a 2-4 hour span on each unit. It does not address the consistency of the noise or the possible resident and staff response. On some units an ongoing effort was made to keep the noise levels low; on others the sound of auditory alarms was constant. For example, cuckoo clocks and Cockatiel birds announced their presence at regular intervals 24 hours a day, or Musak continued nonstop for everyone to hear. Resident screaming was heard on 20% of the units and staff yelling or screaming on 9%.

Life-enriching features included 16 items that might be potentially enjoyable in lounge or shared spaces that were available to all residents. Large print reading material was found in 40% of the units, a pet lived on 22% of the units, and residents had access to a daily newspaper on 17% of the units.

The Outdoor amenities index included 10 items that have the potential to provide an additional area for residents and family to enjoy. Direct access to outdoor amenities was available on 44% on the units but only 10% of the areas were secure either by fencing or as an enclosed courtyard. Raised garden planters were available on 21% of the units.

We developed separate short indices for pleasant odors and noxious stimuli. The former, such as smells of food or of laundry products, were identified more often than the unpleasant odors. If a washer and dryer were located directly on the unit, that unit was likely to be associated with pleasant smells.

The number of shower/tub rooms on individual units varied from 10 units without any such rooms to 5 units that had 3 such rooms. When multiple shower/tub units were found on the unit, the assessor completed the instrument for the room that staff indicated was most frequently used. (For the most part, shower/tub rooms were similar on a unit.) The distance from the furthest resident room on the unit to the shower/tub room most used ranged from 20 feet to 270 feet. Thirty-one (31%) of the units had poorly maintained shower room floors. On 80% of the units, either there was only one shower or tub in the room or the multiple showers and tubs were in separate enclosures. Toilets were present in 57% of the shower/tub rooms, 37% of them enclosed. Jacuzzi's were found in 44% of the units but heat lamps and sink mirrors were rare.

The number of dining rooms on units ranged from 33 units with 0 dining rooms to 4 units with 3 dining rooms. (Other facilities had central dining rooms, and typically eating occurred at the unit level as well as in the central dining room.) Place mats or tablecloths were used in 40% of the units and in 27% flowers or a centerpiece was placed on the tables. At the unit level, 15% of the dining rooms are devoted strictly to dining with the remainder serving the dual function of lounge and dining space. In one facility the dining/lounge space was reclassified as a day room

and residents spend most of their day in that one room. There was food refrigeration and heating capability in 23% of the unit dining rooms, affording more flexibility in eating times. There was color contrast between dishes and table tops for 49% of the units. Posted menus were located in close proximity to the dining room on 38% of units, but unfortunately the menu lettering was greater than one-half inch for only 13%.

Facility Composite Indices

With the exception of the beauty/barbershop, the 9 items included in the Facility Amenities scale include amenities that all users (visitors, residents and staff) can use. Almost all (98%) had a beauty/barber shop, most often leased to outside vendors. (Several facilities have de-licensed the shop so volunteers can provide hair care for the residents.) Access to books, either through a library cart or a specified room, was available in 63% of the facilities. One facility located in a large Continuing Care Retirement Community had a full time librarian and 3 libraries, one for large print books, one for regular books, and a separate video and book cassette library. Separate chapels or mediation rooms were found in 40% and 15% of the facilities had a café where light meals could be purchased.

Regarding outdoor amenities, at the facility level over 90 % provided designated outdoor space, 65% of which had a secured outdoor area. (Areas were determined to be secure at unit or facility level if they were enclosed either from the location of an inside courtyard or the area was fenced.) All 10 of the items in the outdoor amenity scale were found in 50% or more of the facilities. Maintenance at the facility level achieved a higher score than the room or unit levels.

We itemized 17 Life-enriching Features and 7 Function-enhancing features at the facility level. Many of these replicate the items examined for unit scales. For example, corridor rails and way-finding devices in facility-wide space were features of the latter. Also, a common

concern expressed by residents and confirmed by data is the lack of a toilet for residents to use when they are away from their rooms. For example, 52% of the facilities did not have lavatories at the front door that were accessible and permitted for resident use.

Lighting

Lighting in any room is critical to comfort and safety. Most elderly people require 4 to 5 times more light to distinguish a figure from the background than young people with “normal” vision (Liebrock, 1993). One hundred foot candles (100 fc) is the level of illumination recommended by the American National Standards Institute. As shown in Table 12.6 lighting was often inadequate. The lighting in the resident bathrooms was especially problematic. Attempting to use a toilet with 001 foot candle of light replicates a condition of blindness. Measurements at head of bed were taken with drapes drawn measuring all light available to a resident reclining in bed. Measurements in bathroom were taken with the door shut, turning on all available light fixtures.

Table 12.6. Light Levels

Location	Mean	Median	Standard deviation	Minimum	Maximum
Head of bed*	37 fc	35 fc	20.8 fc	4 fc	95 fc
Bathroom at sink*	25 fc	20 fc	15.6 fc	1 fc	75 fc
Bathroom above commode*	13fc	10 fc	9 fc	1 fc	48 fc
Highest tub/shower room	82.8 fc	68 fc	70.8 fc	7 fc	505 fc
Lowest tub/shower room	16.6 fc	14 fc	13.3 fc	2 fc	85 fc
Highest nurse's station	91.6 fc	84 fc	53.2 fc	10 fc	410 fc
Lowest nurse's station	33.4 fc	25 fc	24.5 fc	5 fc	140 fc
Highest unit corridor	108.7 fc	65 fc	283.8 fc	10 fc	3200 fc
Lowest unit corridor	14.5 fc	13 fc	12.5 fc	1 fc	82 fc
Highest unit lounge	292 fc	116 fc	530.3 fc	15 fc	3100 fc
Lowest unit lounge	24.8 fc	17 fc	27.4 fc	2 fc	132 fc

* Readings taken in one room in unit.

On the units, 3 different light level readings were taken in the shower/tub room, dining room, corridors, nurse's station and lounge. The first reading was taken between the main light fixtures in room or corridor if the area was large and there were several fixtures. If only one fixture was in the area then the reading was taken to the side of the fixture. In both cases the intent was to measure the average amount of light that the users - staff and resident - had available to them as they used the room. The highest level was taken directly under the brightest fixture. The lowest level reading was often in a corner or in the shower room where it tended to be directly under the shower head. Table 12.6 illustrates not only the extent of sub-optimal lighting but also the variation. Although the lowest shower/tub room reading was only 2 foot candles, one shower/tub room had a high of 505 foot candles, an area that was excessively bright. Variation was also considerable in corridor readings, where a particular corridor could be very dark in sections without windows.

Identifying exemplary and innovative environmental features in these 40 facilities was easy; certain features tended to stand out. Although innovative features were clustered in certain

facilities (typically new ones), no facility was a "perfect environment" that was exemplary in all respects. We also found one or more exemplary features worth describing in many facilities with generally conventional or unimpressive physical environments. We found exemplary shared spaces that benefited not only users of the facility but the greater outside community as well. A main street area, complete with a café, ice cream parlor, aviary and gift shop featuring items crafted by residents, welcomed students from the nearby college and elementary school children who regularly visit the residents. A few facilities had fully equipped gymnasiums with state of the art workout equipment that were used by staff and residents. At one facility with an exemplary outdoor and porch area, a resident took great pride in greeting and activating the automatic door for visitors. We noted some unique nurse's stations, which were configured like hotel concierge desks and another one with long horizontal work space where residents could sit alongside staff.

In the sample, 3 facilities built 30 years ago had the foresight to provide all private rooms for the residents; although one of these facilities had dormitory-style toilets and showers that were shared by large numbers. Also in the sample were 2 facilities with an extraordinary degree of privacy in their double rooms: in both cases, the corridor door opened to a vestibule area that contained a shared toilet room, but a floor to ceiling wall separated the remainder of the room. The two sides had individual temperature controls and each had its own window. There was the potential to decorate each side distinctly since neither was visible to the roommate.

The most noteworthy facility in the sample was organized in households of 8 to 10 residents. Each household contained a residential style kitchen, a great room with living and dining area, a smaller living room for more private gatherings, and a laundry room with a residential style washer and dryer. The computer for the MDS was located on a kitchen counter and the charts

were located on a shelf near the recipe books. The nurse's stations were integrated into the dining area, not separated behind a counter.

Developing a Typology of Nursing Home Environments

The rich data we collected on a plethora of attributes of the physical environment at the room, unit and facility level that might be related to QOL posed an analytic challenge. Since there are potentially more attributes than observations of resident QOL, it is not computationally possible to include indicators of every attribute in the same analysis. Therefore some method of data reduction was required. One traditional approach is to use factor analysis. However, in this situation, the majority of variables were dichotomous and many were highly collinear making this method unworkable. We therefore used cluster analysis to identify a typology of physical environments that captured the different constellations of attributes that were associated with one another. This approach makes maximum use of all of the available data to develop a parsimonious set of clusters that can be used for further analysis.

Cluster Analysis

A hierarchical cluster analysis was used to group nursing home facilities and their associated units and rooms into clusters based on the presence or absence of environmental attributes that are hypothesized to be associated with nursing home resident QOL. We first conducted separate cluster analysis at the facility, unit and room levels. The relationship between the resulting cluster solutions revealed that there were associations between room, unit and facility types. We determined that a combined cluster model would result in a more parsimonious set of clusters, further simplifying the analysis. The prevalence of each attribute in each cluster was used to characterize the clusters.

Agglomerative clustering with complete linkage was employed using SPSS Version 11.0.

The complete linkage method was used to yield highly similar and spatially distinct clusters. Initially, nursing home facilities (n=40), units (n=131), and room and bath environments (n=1988) were combined into clusters based on the simple matching similarity measure for binary coded environmental attributes. Because the absence of an attribute may be as important as the presence with respect to nursing home QOL, simple matching was chosen over Jaccard's method to account for and equally weight the joint presence or joint absence of each given variable. The primary limitation of simple matching is potential misclassification of nursing home facilities, units or rooms as similar due to the absence of a characteristic.

Dichotomously coded variables were selected to characterize the clusters representing the presence or absence of various environmental attributes relating to stimuli, amenities and furnishings in the corridors, lounges, dining rooms, baths and personal spaces. Only attributes that were present in 15 to 85% of the facilities, units, or rooms were used in the cluster procedures to avoid attributes that had limited ability to discern different types of nursing home environments.

Facility Variables. At the facility level, 164 attributes associated with the site, entrance, lobby/reception area, lounge area, corridors, services/activities/amenities, outdoors, and noxious stimuli were considered. Using the 15-85% criterion for selection, a subset of 85 variables was selected for the cluster analysis procedure. Facilities could have more than one lounge or social space. The average number was 1.3 (range 0 to 3); 1 facility had none and 31 facilities had two or more. In facilities that had more than one lounge or social space we constructed a set of aggregate variables that captured whether each attribute was present at all at the facility level in any lounge or social space.

Unit Variables. At the unit level, a total of 156 attributes associated with baths, lounges,

corridor, noxious stimuli, and amenities were considered. A total of 89 attributes met the 15-85% criterion for selection and were used in the cluster analysis. Units could have more than one lounge or bathing room. The average number of lounges was 1.6 (range 0 to 4); 20 had no lounge, 62 had 2 or more. The average number of bathing rooms was 1.3 (range 0 to 3); 10 had no bathing room, 50 had two or more. For lounges and bathing rooms we constructed a set of aggregate variables that identified whether each attribute was present at all at the given unit.

Room Variables. At the room level, 93 attributes associated with the nursing home resident's room, its entrance, resting or sleeping space, personal and social space, lighting, furnishings, personalization, decoration, and toilet facility were considered to cluster the residents' rooms. Of those variables considered, 47 attributes were used in the room level cluster analysis.

Determination of the Number of Clusters. We combined data from the facility and unit levels for preliminary cluster analysis. The rationale is that although data were collected separately at the facility and unit levels, many facility attributes are shared across units and several facilities have only one unit. This preliminary analysis led to a 5 facility-unit cluster solution. Separate preliminary analysis was done at the room level, leading to a 6 cluster solution. Examination of the association between the two sets of clusters revealed that a number of the cells were sparsely populated. Not every room type was represented in each facility-unit type, making it impossible to examine the independent effects of each cluster type on QOL. In order to produce a solution that would allow meaningful analysis, we therefore combined variables from all three levels into a single cluster analysis. This led to a parsimonious 6 cluster solution (see Table 12.7) with only one cluster having as few as three facilities.

Table 12.7 shows the number of residents per room in each cluster (approximately 50 rooms were sampled per facility). The smallest is Cluster 1, with only 3 facilities; the largest is Cluster 3 with 11 facilities. Selected descriptive statistics for each cluster are shown on Table 12.8.

Table 12.7. Distribution of Clusters

Cluster	N	%
1	150	7.5
2	250	12.6
3	550	27.7
4	300	15.1
5	488	24.5
6	250	12.6
Total	1988	

Table 12.8. Descriptive Statistics for Clusters

	Cluster Average						Overall Average
	1	2	3	4	5	6	
Residents per Room	1.9	1.4	1.7	2.1	2.3	1.5	1.9
Personal Space in Room per Resident (Square Feet)	141	195	147	126	119	190	148
Total Number of Lounge Areas in Facility	2.7	3.4	2.4	1.8	1.7	3.0	2.4
Total Beds in Facility	148	144	136	101	105	137	125

To aid in interpreting the clusters, we calculated the prevalence of each attribute in each cluster. The overall prevalence of the different attributes varies widely, thus we used z-scores to standardize the prevalence figures. Since the standard deviation is a function of the sample size which varies for facility, unit and room, we used a different criterion for facility, unit and room attributes. Extreme values were defined as 3 SD above or below the mean for facility level attributes, 6 SD above or below the mean for unit level attributes and 9 SD above or below the mean for room level attributes. This is a conservative approach to defining differences that

focuses on strong contrasts. Facility attributes are presented on Table 12.9, unit attributes on Table 12.10, and room attributes on Table 12.11. Clusters that had a high prevalence of a given attribute are marked by a '+' and clusters marked by a low prevalence (greater than 3 SD below the mean) are marked by a '-.' The following paragraphs describe each Cluster in terms of selected attributes found on Table12.9- Table 12.11 (Variables not used in the cluster analysis are not included in these tables.)

Table 12.9. Internal Facility Attributes Associated With Cluster Membership

Attribute	Overall Prevalence	Cluster					
		1	2	3	4	5	6
Category: Site							
residential	0.60	—	—				
mixed use	0.40	+	+				
covered drop off	0.30	+					
Category: General							
one story	0.45	—	—			+	
facility level dining available	0.59		—		+	+	
dining alternatives	0.16						+
dining assistance available	0.42	—					
Category: Main Entrance							
automatic door opener	0.48	+	+		—	—	+
vestibule	0.63	+			—	—	+
door unlocked- no staff	0.15						
door unlocked- monitoring	0.65					—	
Category: Lobby/Reception Areas							
receptionist desk	0.78	+				—	+
directory of residents	0.33		+			—	
visitor sign-in/ sign-out	0.37	—		+			
public toilet	0.48			+	—	—	+
wayfinding	0.35	+	+	—			+
public telephone in lobby	0.77	+			—		+
Category: Lounge/ Social Space							
multipurpose room	0.63	+	+	—			
separate activity room	0.42	+					
separate sitting room/ parlor/ living room	0.40	—		+			
other	0.45		—	+	—	—	+
games and/or cards	0.60	+					—
arts and crafts	0.50	+	+				—
large motor skills equipment	0.32	+					—
musical instruments and other equipment	0.77	+					
popcorn machine/ refreshments laid out	0.20	+	+		—		—
jigsaw puzzle	0.30	+					—
kitchenette in lounge area	0.30	+	+		—		
strong color contrast between all chairs and floor	0.85	—			—		
single chair adjacent to table with lamp	0.47		—	+		—	
current daily newspaper for shared use	0.45		—			+	
choice of one, two, or multiple person seating	0.78						+
at least one piece of reading material is in large print	0.67	+					
Television	0.70	+					—
large clock with large lettering	0.80	+	+				—
orientation board that communicates day and date	0.43						
living plants in lounge area	0.85				—		

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Attribute	Overall Prevalence	Cluster					
		1	2	3	4	5	6
Category: Corridors/ Stairs							
window view in corridor	0.77						
wall finishes differ between corridors	0.20	—	+				—
floor finishes differ between corridors	0.15						
handrails on both sides	0.78		+	—			+
handrails continue around corner	0.50	—					
handrails contrasting color with walls	0.75	+					
seating along corridors	0.65		+		—	—	+
color contrast between walls & floors	0.73		+		—		
Category: Amenities							
wheelchair accessible gift shop	0.33	—	+	—		—	+
coffee or snack bar	0.30	—	+				+
volunteer lounge	0.18		+				+
café for light meals	0.15		+				+
laundry room residents can use	0.15						+
library	0.57	+		—	+		
aviary / birdcage	0.38	+	+			—	
aquarium / fish tank	0.50	+					
dog or cats that live in	0.38	—			+	—	
residents cannot be viewed in beauty shop	0.75		+				
resident access to computer	0.30	—	+			—	+
separate chapel or meditation room	0.40	+	+			—	+
religious artifacts	0.60	+	+	—			+
vigil room	0.18		+				+
intergenerational activities	0.15	+					+
provisions to entertain kids	0.30	+				—	+
electric wheelchairs	0.57						+
Category: Outdoor Access							
covered seating	0.82						
covered outdoor area	0.73	—					+
secured outdoor area	0.65	—	—			+	
raised garden planters	0.52						
outdoor recreational activities	0.82	—					
Category: Noxious Stimuli							
auditory alarms	0.18						
intercom or paging	0.38	—					
loud Speaker or musak	0.15						
pleasant food smells	0.40			—	+		+

Table 12.10. Internal Unit Attributes Associated With Cluster Membership

Attribute	Overall Prevalence	Cluster					
		1	2	3	4	5	6
Category: Shower/ Tub Room							
swing door tub	0.20						+
Jacuzzi/ whirlpool bath	0.51						
Hoyer lift available with tub	0.52						
sink located in tub/shower room	0.65				—		
clearance below sink for wheelchair access	0.60				—		
lever faucet meets the fist test	0.55			+	—		
more than one tub or shower in room	0.55			+	—		
individual enclosures for each tub or shower	0.28	—					
shelves for temporary storage of personal items	0.42						
hooks for temporary storage of personal items	0.59						
toilet located in tub/shower room	0.64						
toilet in tub/shower room is in separate enclosure	0.42	—					
vertical/horizontal grab bars in shower	0.59		+		—		—
heat lamp for heating in ceiling	0.15						
main bathing room door locks from inside	0.74				—		
threshold level change into shower is <1/2 inch	0.81				—		
Category: Lounge/Social Space							
multipurpose room	0.71	—		+			
separate activity room	0.16						+
separate sitting room/ parlor/ living room	0.17						
kitchenette in lounge area	0.24						+
games and/or cards	0.52	—				—	
arts and crafts	0.37						
large motor skills equipment	0.22						
musical instruments and other equipment	0.53			+			
floor avoids high contrasting patterns	0.82						
some moveable seating is supplied	0.82	—				—	
choice of one, two, or multiple person seating	0.49					—	+
strong color contrast between all chairs and floor	0.67	—					+
single chair adjacent to table with lamp	0.31						+
current daily newspaper for shared use	0.31	—					+
at least one piece of reading material is in large print	0.50	—				—	+
television	0.76			+		—	+
one seat in room with out TV	0.47						+
television turned off if no one is watching	0.77	—				—	+
large clock with large lettering	0.57						
window with view to outdoors	0.82						
orientation board that communicates day and date	0.52		—	+			
flowers in lounge area (natural or artificial)	0.79	—					
living plants in lounge area	0.65		+		—		

Table 12.10. Page 2 Cont'd

Attribute	Overall Prevalence	Cluster					
		1	2	3	4	5	6
Category: Corridors							
no door separating	0.65			—		+	
elevator off unit	0.31			+		—	
unit unlocked	0.83						
alarm triggered by resident wearing device	0.16			+			
elevators monitored by staff	0.26		+			—	
window with direct outside view	0.60						
handrails continue around corners	0.49						
handrails contrasting color with walls	0.72						
seating along corridors	0.47						
color contrast between walls and floors	0.63						+
Hoyer lifts/ commodes/ medical equipment	0.64				—		
other clutter	0.51						
laundry carts	0.53					+	—
housekeeping carts or equipment	0.51						
linen carts	0.44	—					
large trash containers	0.18						
incontinence product disposal	0.28		—	+			
food trays	0.29	—					
medicine cart	0.34						—
Category: Noxious Stimuli							
auditory alarms	0.46		—				
screaming or calling out by residents	0.23						
TV/radio	0.63		—				
intercom/paging	0.35	—					
musak	0.14						
feces	0.19						
food smells	0.20						+
Category: General Amenities							
staff lounge on unit	0.16						
separate examination/ treatment room on unit	0.22						
direct access to outdoor amenities	0.49				—		+
unit has a pet	0.23						
dining on unit	0.69			+		—	
special Care Unit	0.14						

Table 12.11. Internal Room Attributes Associated With Cluster Membership

Attribute	Overall Prevalence	Cluster					
		1	2	3	4	5	6
Category: Room Type							
Private room	0.29		+		—	—	+
Double room	0.58		—				
3 residents in a room	0.09		—	—		+	—
4 residents in a room	0.04	—	—		+	+	—
Category: Room Entrance							
Signage identifying resident's name 5/8" or larger.	0.35	+		—	—		
Signage identifying Resident's name in raised or recessed letters	0.15	+	—	—			
Personalized wall or door	0.39				—		+
Lever type or push release hardware that passes fist test	0.48		+	—	+	—	+
Category: Resting/ Sleeping Space							
4 feet of clearance on either side of Resident's bed	0.76		+		—		
2 walls large enough to accommodate bed in room or resident's section	0.76	—	+	+	—	—	+
Resident has night stand by bed	0.84			—		+	
Category: Personal and Social Space							
Chairs in Resident's sleeping area for own/visitor use	0.77		+			—	+
At least one of Resident's chairs has armrests	0.73		+	+		—	+
Table or shelf unit adjacent to at least one chair	0.37		+		—	—	+
Resident has own TV	0.60		+			—	+
More than one TV in room	0.19						
Resident has radio/cassette/phonograph/CD player with external speaker next to bed	0.32		+		—		+
More than one radio/cassette/phonograph/CD player in room	0.18					+	
Resident has own lockable storage in room	0.37		+	—		—	+
Resident has own telephone in room	0.29		+		—	—	+
Resident can operate heating	0.52	—	+	+	—	—	+
Resident's room is air conditioned	0.78		+		+	—	+
Air conditioner in room can be adjusted	0.46	—			+	—	+
Category: Lighting							
On/off switch for fixed task lighting within 18" of resident's pillow	0.75	+	—			+	—
Moveable task lighting provided at resident's bed	0.16		+			—	
One or more lighting fixtures on a dimmer switch	0.23	+	—				
Night light in resident's room	0.52					—	+
Category: Furnishings/Personalization/Decoration							
Resident has brought own bureau	0.18						
Resident has brought one or more chairs	0.30	+	+		—	—	+
Resident has brought lamps	0.18		+		—	—	+
Resident has individualized bedspread	0.29	+	+			—	
Wall has paintings, photos, other items individual to resident	0.85	+			—		
Signs of hobbies or interests	0.43				—		
Resident has flowers	0.61					—	+
Resident has living plants	0.33	+			—	—	+
Religious items in room	0.38					—	

Table 12.11., page 2

Attribute	Overall Prevalence	Cluster					
		1	2	3	4	5	6
Category: Resident's Toilet Room							
Bathroom between 2 resident rooms	0.28		+	—			—
Bathroom door can be locked from inside	0.57	+			+		—
Bathroom door opens outward	0.83	+	—	+		+	—
Bathroom door is lever type or push release hardware that passes fist test	0.38						
Counter space surrounding or near sink for personalization	0.41					—	+
Sink has single lever faucet that meets that fist test	0.31	+	+		—		
Toilet seat about 17" high	0.62	+	+			—	
At least 3 feet adjacent or in front of toilet for transferring	0.83	—	+	+	—	—	+
Cloth towels	0.29				—	—	+
Residential fixtures	0.15						+
Room has full bath	0.25	—	+		+	—	—
Floor covered with ceramic tile	0.49	—	—	+	+	—	+

Cluster 1. Cluster 1 is characterized by a high prevalence of a receptionist desk, wayfinding and public telephones in the main lobby. There is a high prevalence of separate activity rooms with games, arts and crafts, large motor skills equipment, musical instruments, popcorn machines and other refreshments, kitchenettes, jigsaw puzzles, large print reading materials and clocks, and a television set. In the corridors, there is a low prevalence of handrails that continue around corners but a high prevalence of handrails in contrasting colors to the walls. There is a high prevalence of libraries, bird cages, aquariums, chapels, religious artifacts, and intergenerational activities, but a low prevalence of dogs and cats or wheelchair accessible gift shops. These facilities are less likely to have outdoor areas that are accessible, covered or secure. Lounges at the unit level are unlikely to have games, moveable seating, large print reading material, or flowers. Corridors are unlikely to be cluttered with linen carts or food trays and there is a low prevalence of intercom or paging sounds. Resident rooms have a high prevalence of large print signage, dimmer switches on lights, and personalization. Rooms are unlikely to have heating or air conditioning controls. Bathrooms have a high prevalence of lockable doors, clearance under the sink, high toilets and lever type faucets. They are unlikely to have space to transfer,

however. This cluster is about average in terms of the size of the facility, the number of lounges, the number of residents per room, and the amount of room space per resident.

Cluster 2. Cluster 2 is characterized by a high prevalence of resident directories, and wayfinding in the facility entrance. Facility level lounges have arts and crafts, popcorn machines or other refreshments, kitchenettes, and large clocks with large lettering. In the corridors, there is a high prevalence of handrails on both sides, seating and contrasting colors between walls and floors. There is a high prevalence of wheelchair accessible gift shops, coffee or snack bars, lounges for volunteers, aviaries, computers, chapels, religious artifacts, and pleasant aromas. Bathing rooms have a high prevalence of grab bars, and there are often living plants in lounge areas. Units in Cluster 2 have a low prevalence of incontinence disposalcontainers in the corridors, auditory alarms or sounds of television or radios. Resident rooms are likely to be private, with lever type releases on the doors, seating options, televisions for each resident, environmental controls, and moveable task lighting at the bedside. There is a high prevalence of personalization and living plants. Toilet rooms have a high prevalence of lever type hardware, clearance below sinks, high toilets, and space for transferring. Although this cluster is characterized by the largest facilities in terms of total beds, this cluster has the fewest residents per room, the highest amount of space per resident, and the highest number of lounges overall.

Cluster 3. Cluster 3 is characterized by visitor sign books and public toilets but a low prevalence of wayfinding. These facilities tend to have separate parlor or living rooms at the facility level, but lack handrails on both sides of corridors, wheelchair accessible gift shops, libraries, religious symbols, or pleasant odors. Bathing rooms tend to have more than one bath or shower and lever type faucets. Units tend to have multipurpose rooms for activities with musical instruments, televisions, and orientation boards. There is a high prevalence of

incontinence disposal containers along the corridors. Resident rooms have poor signage, and are unlikely to have lever type door releases or lockable storage. Rooms tend to have chairs with armrests and heating controls. The toilet rooms have adequate space for transferring. This cluster tends to have dining available on the unit. Facilities in this cluster are intermediate with regard to total number of residents, personal space in resident rooms, the number of lounges and the number of residents per room.

Cluster 4. Cluster 4 is characterized by a low prevalence of public toilets or telephones in the lobby, lounges are unlikely to have snacks, a kitchenette, or live plants. There is a low prevalence of seating along corridors. Bathing rooms at the unit level are unlikely to have sinks or lever type faucets, grab bars or lockable doors. Resident rooms are unlikely to be private, have poor signage, and a lack of personalization either on the door or in terms of furniture. There is a lack of radios and telephones in resident rooms, and low prevalence of living plants. The toilet rooms in resident rooms can be locked from the inside, but are unlikely to have lever type door releases or sinks, and there is a lack of space for transferring. This cluster has relatively small facilities in terms of total beds, but has a high number of residents per room, a low level of personal space and few lounges.

Cluster 5. Cluster 5 is characterized predominantly by low prevalence of many facility level features such as a reception desk at the main entrance, a directory of residents, birds or fish, seating options, or a chapel. At the unit level, there is a low prevalence of games or cards in the lounge, a lack of large print reading material, and seating options. There are secured outdoor areas. There is a high prevalence of laundry carts, housekeeping carts, medicine carts and weight scales in the halls as well as the sound of yelling by staff and odors from cleaning solution, urine and feces (not tabled). There is a low prevalence of private rooms and rooms are unlikely to

have accessible door releases, lockable storage, environmental controls, moveable lighting near bed, night lights, personalization, plants. The resident bathrooms have few function enhancing features. Dining is not available at the unit level, but is available at the facility level. This cluster has relatively small facilities in terms of total beds, but has the highest number of residents per room, the smallest amount of space per resident, and the smallest number of lounges.

Cluster 6. Cluster 6 is characterized by a receptionist desk at the main entrance, public phone and toilet, and wayfinding. There is a choice of seating in the lounge, handrails on both sides of the corridors, and seating in corridors. There is a high prevalence of wheelchair accessible gift shops, coffee or snack bars, laundry rooms for residents, access to computers, chapels, religious artifacts, intergenerational activities, electric wheelchairs, covered outdoor areas, and pleasant aromas. Units typically have separate activity rooms with kitchenettes, choices of seating, large print reading material, contrasting colors, and televisions are turned off when no one is watching. There are good aromas, and a low prevalence of clutter in the unit corridors. Resident rooms are likely to be private, with personalization on the door, lever type door releases, choices of seating, environmental controls, night lights, and residents often brought their own furniture. The bathrooms often had counter space, clearance below sink for a wheelchair, space near the toilet, cloth towels and residential style fixtures. This cluster has a low number of residents per room, a large amount of room space per resident, and a large number of lounges.

QOL and Cluster Membership. We used one-way ANOVA to examine whether cluster membership was associated with QOL outcomes (See Table12.12). There was a statistically significant association with each of the 11 domains of QOL and the 14 item short form. We used Tukey's HSD statistic to examine each pair of means to identify significant differences. One

clear finding is that Cluster 5 has lower QOL scores across all domains. This is consistent with our overview, which suggests that facilities, units and rooms in this cluster have few positive attributes, low levels of privacy and space. Clusters 1 and 2 tend to have the highest levels of QOL overall. Cluster 2 has more private rooms and is higher on the Privacy domain, while Cluster 1 has more activity related features at the facility level and is higher on the Meaningful Activity domain. Cluster 6, which has a high level of personal space and a high prevalence of private rooms has the third highest Privacy score.

Table 12.12. Average QOL By Cluster

Domain	Cluster						ANOVA (p value)
	1	2	3	4	5	6	
Comfort	3.05	3.12 (5)	3.09 (5)	2.97	2.90	3.08 (5)	
Functional Competence	3.45 (5)	3.25	3.31	3.20	3.16	3.23	0.017
Privacy	3.46 (5)	3.49 (4,5)	3.35	3.29	3.20	3.42 (5)	0.001
Dignity	3.67	3.72 (5)	3.70 (5)	3.69	3.60	3.70	0.017
Meaningful Activities	2.95 (3,5)	2.69	2.65	2.75	2.63	2.69	0.010
Enjoyment	3.39 (5)	3.23	3.25	3.18	3.08	3.35 (5)	0.002
Individuality	3.09 (3,4,5)	2.95 (5)	2.79	2.75	2.68	2.90	0.008
Relationships	3.27 (5)	3.09	3.10	3.04	2.96	3.09	0.001
Security	3.45 (5)	3.44	3.44	3.40	3.25	3.49 (5)	0.001
Spiritual Well-Being	3.35 (5)	3.24 (5)	3.20	3.03	2.98	3.31 (4,5)	0.001
Autonomy	3.34	3.35 (5)	3.37	3.29	3.18	3.34	0.006
QOL-14	3.41 (3,4,5,6)	3.30 (4,5)	3.20 (5)	3.17	3.08	3.20 (5)	0.001

Note: Number in parenthesis indicates significant pair-wise difference $p<.05$ based on Tukey's HSD. Differences are only listed once.

Summary and Next Steps for Cluster Analysis

We used cluster analysis to identify 6 distinct types of nursing home environment based on facility, unit and room attributes. These 6 clusters have distinguishing characteristics, such as the amount of personal space, prevalence of private rooms and availability of activities. There is a significant association between cluster membership and resident QOL, validating our approach.

We believe that this analysis will lead to the identification of specific environmental attributes that are associated with higher levels of resident QOL.

We selected a 6 cluster solution based on the goal of retaining a large number of facilities per cluster. Only one cluster has as few as three facilities, thus assuring that each cluster has a large sample of residents. However, this may have led to heterogeneous clusters with regard to facility attributes. Even though the clusters are distinct in many ways, facilities may be grouped together in ways that obscure other differences that may be relevant to QOL. Preliminary analysis suggests that an 11 cluster solution has no clusters with fewer than three facilities per cluster, while a 12 cluster solution results in one cluster with only one facility. Further analysis will examine the 11 cluster solution to determine if there are meaningful differences between the clusters.

As this report goes to press we have begun a different and more promising approach to cluster analysis using the composite indices rather than individual items as variables and adding some of the continuous variables such as distances. We expect this effort to generate more workable clusters.

Privacy

In Wave 1, 29% of the residents were in private rooms and in Wave 2, 20% were in private rooms; 13% of the Wave 1 and 14% of the Wave 2 residents lived in rooms that housed 2 or more residents. Table 12.13 shows that distribution. We already showed that residents in private rooms were more likely to experience function enhancing and life-enriching environmental features and were more likely to be able to exercise control over their lives.

Table 12.13. Prevalence of Private Rooms and Number of Roommates

		Wave 1			Wave 2			Both Waves	
		n	%		N	%		n	%
Private room									
	No	1392	71		1338	80		2730	75
	Yes	576	29		329	20		905	25
Number of Roommates									
	0	576	29		329	20		905	25
	1	1139	58		1101	66		2240	62
	2	175	9		187	11		362	10
	3 +	78	4		50	3		128	4

Table 12.14 combines both Wave 1 and Wave 2 samples to examine how being in a private room and number of roommates affected QOL. The analyses presented control for a very large number of resident characteristics that might affect QOL. Even after those controls, being in a private room and having fewer roommates were associated with better QOL on three of the domains. More analyses are planned on this topic.

Table 12.14 Effect of Private Room and Number of Roommates on Quality of Life

	Private Room			Number of Roommates	
Domain	Coeff.	P		Coeff.	P
Comfort (n=2967)	0.04	0.13		-0.02	0.20
Privacy (n = 2765)	**0.31**	**<.0001**		**-0.17**	**<.0001**
Functional Competence (n = 2844)	**0.09**	**0.01**		**-0.05**	**0.03**
Autonomy (n = 2849)	0.04	0.14		-0.02	0.41
Dignity (n = 2833)	0.02	0.44		-0.02	0.14
Security (n = 2757)	0.01	0.64		-0.03	0.10
Relationships (n = 2770)	-0.03	0.44		0.01	0.78
Individuality (n = 2669)	0.00	0.90		0.00	0.95
Meaningful Activities (n = 2727)	**-0.08**	**0.03**		**0.05**	**0.05**
Enjoyment (n = 2675)	-0.05	0.17		0.01	0.69
Spiritual Well-Being (n = 2767)	-0.05	0.13		0.01	0.71

Note: Analyses control for age, gender, race, visual impairment, cognitive function, physical function, length of stay, bladder and bowel continence, depression, hip fracture, and restraints. Analysis was done using hierarchical modeling to adjust for unmeasured facility level random effects. Sample includes both Wave 1 and Wave 2.

Discussion

We have described the instruments used to assess physical environments for 1988 resident room and baths in 131 units in 40 facilities, and the way the resultant data was combined into composite indices. First, the work demonstrates that it was possible for persons not expert in environmental design to reliably assess physical environments using largely objective items. This large-scale application pointed to several areas where the protocols need to be refined, especially to gather accurate information about the dining and bathing environment that can be assigned to the individual resident. Generally, however, we were able to assemble rich information about these nursing homes and to describe a given resident's environment at three levels.

Together, the descriptive findings tell of 40 varied physical environments, and of 131 units that vary within them. The caveat, of course, is that the 40 nursing homes described here cannot

be generalized back to the nursing homes in their states, not only because of the small sample size in any state but also because of the method of selection, where we deliberately over-sampled some facilities with high proportions of private rooms.

Nonetheless, the environmental deficits described in this sample are all the more discouraging because the sample was designed to capture at least some better-than-average environments. The problems include low light levels, lack of lounge space, bathrooms shared by up to 20 residents, long distances to reach some of them, corridor clutter, noise, and general absence of life-enhancing features. The findings also highlight the disparity in amenities found in a private room versus shared rooms. Yet in the same group of facilities, we also identified positive environmental features well worth further detailed study.

We also presented early cluster analysis and showed some relationships between those environmental clusters and resident QOL. Finally, we showed a relationship between private rooms and QOL.

Work is ongoing to refine the cluster analysis protocols using composite scales rather than individual items, and also adding other variables such as continuous variables measuring distances and square footage. In all this work, we will continue to take into account the nested features of the environment (rooms in units in facilities) and take advantage of hierarchical analysis tools. Also of interest is to examine how resident characteristics might interact with environmental characteristics to generate resident outcomes. For example, some residents may depend much more than others on their immediate environment and some may be able to glean little benefit from improved environments.

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