

Assessing and Comparing Physical Environments for Nursing Home Residents: Using New Tools for Greater Research Specificity

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Purpose: We developed and tested theoretically derived procedures to observe physical environments experienced by nursing home residents at three nested levels: their rooms, the nursing unit, and the overall facility. Illustrating with selected descriptive results, in this article we discuss the development of the approach. **Design and Methods:** On the basis of published literature, existing instruments, and expert opinion about environmental elements that might affect quality of life, we developed separate observational checklists for the room and bath environment, unit environment, and facility environment. We trained 40 interviewers without specialized design experience to high interrater reliability with the room-level assessment. We used the three checklists to assess 1,988 resident room and bath environments, 131 nursing units, and 40 facilities in five states. From the data elements, we developed quantitative indices to describe the facilities according to environmentally relevant constructs such as

function-enhancing features, life-enriching features, resident environmental controls, and personalization. **Results:** We reliably gathered data on a large number of environmental items at three environmental levels. Environments varied within and across facilities, and we noted many environmental deficits potentially relevant to resident quality of life. **Implications:** This research permits resident-specific data collection on physical environments and resident-level research using hierarchical analysis to examine the effects of specific environmental constellations. We describe practice and research implications for this approach.

Key Words: Rooms, Nursing units, Functionality, Privacy, Personalization

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Since the 1950s, nursing facilities have been the most conspicuous residential care environment in the United States. For many physically or cognitively impaired residents with limited ability to influence or escape their immediate physical surroundings, the nursing facility, or even a small section of it, becomes their world (Rowles, 1978). Nearly 2 million people live in nursing facilities, some for years and others for shorter periods of post-hospital rehabilitation, recuperation, or palliative care. Regardless of the length of stay, nursing facility environments are believed to have a powerful negative impact on residents, yet an approach to exploring how specific nursing facility physical environments affect outcomes of interest for particular residents is lacking.

In 1998, the Centers for Medicare and Medicaid Services contracted for a study of the effects of physical environments, including private rooms, on the quality of life of nursing facility residents. Using illustrative descriptive data, in this study we present

one approach to conceptualizing and empirically assessing the environments of individual residents, taking into account their rooms, their nursing units, and their nursing facilities, and aggregating data elements relevant to quality of life into composite indices.

Background

Theoretical Framework

Nursing facilities are dwelling places first and workplaces second. Traditionally, however, they are designed in hospital layouts of multiple-bed rooms located on long double-loaded corridors with the priority on efficiency of workplaces for staff rather than livability for residents.

Physical environments contribute to residents' quality of life by capitalizing on residents' particular strengths while reducing demands (Lawton, 1983; Lawton, Brody, & Turner-Massey, 1978). Poorly designed environments can inhibit functioning and social well-being. The ecological model of Lawton and Nahemow (1973) views behaviors as a function of the interaction of personal factors with the physical environment. All functionally impaired residents, including those with dementia, shortness of breath, immobility, or vision problems, benefit from well-designed physical environments; however, some environments place too much and some too little demand on residents. The lower a resident's competence, the greater the influence of the environment on behavior, although at some extreme point of illness and disability the physical environment is unlikely to influence behavior. In many nursing facilities, sensory deprivation and lack of control over the environment exacerbate boredom, anxiety, and depression, and may induce learned helplessness because of residents' perceptions that they have no control over their lives (Langer & Rodin, 1976; Seligman, 1976).

The physical environment also exercises dramatic psychological impact. Over a lifetime, individuals develop habits for using space that afford them a sense of being in their own place (Rowles, 1998). This familiarity and comfort is enhanced by visual and physical access to meaningful possessions (Tobin, 1996). Reduced physical functioning or social circumstances may require downsizing of the environment while permitting continued control over "place" on a smaller scale (Rowles, 1983). People routinely make such transitions by relocating from homes to apartments or by limiting the household space regularly used. Older people achieve a sense of place by adapting their environments for their own routines and preferences. Unfortunately, creating such spaces and even arranging ready access to valued possessions is challenging in most nursing facilities.

Attention to the physical environments of nursing facilities has largely been expressed by concerns

about safety, resulting in regulations mandating minimal expected environmental features such as railings, corridor widths, and fire-retardant materials. The weakness of many codes, even as guarantors of safety, is that they are seldom research based or directed at multiple goals. They tend to take into account specific disabilities such as cognitive impairment, vision problems, and mobility problems without considering the interaction effects of tangible physical features and multiple disabilities on a range of desired outcomes. For example, regulatory codes typically require heavy fire doors that are difficult for residents to maneuver, but they do not require an automatic door opener, which would enhance both safety and overall functioning.

Environmental Measurement in Nursing Homes

The most comprehensive environmental evaluation instrument for use in nursing facilities, the Multiphasic Environmental Assessment Procedure (MEAP; Moos & Lemke, 1996), is a battery of five major rating instruments (each with subcomponents) covering the broadest definition of environment, going beyond the physical. Used in its entirety, the MEAP generates copious information on dominant resident and staff characteristics, the physical environment, and the policies and programs of the nursing facility. When combined with information about a particular resident, the MEAP data can be used to estimate an individual's fit with the setting. Most other environmental rating tools for nursing homes specifically assess dementia special care units. Calkins and Chafetz (1996) suggest major principles for crafting environments on dementia special care units: regulating stimulation; maximizing awareness and orientation; supporting personal continuity with past; providing secure freedom; and enhancing positive social interaction. Several scales examine the extent to which special care unit environments incorporate such theoretically desirable features. The Therapeutic Environment Screening Scale (TESS; Sloane & Mathew, 1990) in its revised TESS+ form was used in the 1990s in the cooperative evaluation of dementia special care units sponsored by the National Institute on Aging to assess eight environmental domains: general design features; maintenance; inventory of spatial amenities and seating capacity; lighting; noise; amenities; programming; and global environment (Sloane, Mitchell, Long, & Lynn, 1995). The Professional Environmental Assessment Protocol (PEAP) is an eight-dimension instrument specific to dementia special care units that, in a study of 43 units, performed as a single-dimension scale and was correlated highly with the TESS (Lawton et al., 2000). Neither the TESS nor the PEAP assesses the physical environment precisely, and both go beyond physical environments to include programs and practices within the environments. The Environment Behavior

Model (Zeisel, Hyde, & Levkoff, 1994) for special care units assesses eight conceptually derived environment concepts (exit control, wandering paths, individual away places, common space, outdoor freedom, residential scale, autonomy support, and sensory comprehensibility). The Environment Behavior Model requires extensive training and ultimately rater judgments (e.g., exit controls are rated for their immediacy and their unobtrusiveness; common space for quantity and variability). The Nursing Unit Rating Scale (Grant, 1994), which measures separation, stimulation, stability, complexity, control, and continuity of unit environments for people with dementia, is based on interviews with the charge nurse and measures care practices and policies, not environments per se. In summary, extant tools for assessing nursing facility environments focus on nursing units rather than rooms of specific individuals; emphasize dementia special care units (though most residents with dementia are on regular units); depend heavily on subjective ratings; and mingle assessment of the environment with the behavior observed in that environment (Cutler, 2000).

Methods

Environmental Checklists

We developed environmental checklists to assess the physical environments experienced by any resident with or without dementia. The three checklists specifically assessed a resident's own room and toilet area; each nursing facility unit; and the common facility space. For this study, we define environment as the fixed, semifixed, and unfixed components of the physical structure, and the furnishings, fixtures, decor, and equipment. This purview excluded "backstage" spaces such as the commercial laundry and kitchen, the staff offices, and mechanical rooms.

Through a review of the literature and discussion with experts, we generated a pool of environmental items, particularly those conceptually associated with a holistic notion of resident quality of life that encompasses autonomy, dignity, privacy, meaningful activity, enjoyment, relationships, comfort, security, functional competence (defined as being as independent as possible and desired), and spiritual well-being (Kane, 2003).

To evaluate the face validity of the items, we undertook a cognitive rating process whereby four environmental experts assigned each of the candidate items to one or more quality-of-life domains that the item could potentially influence. When disagreements occurred, the raters discussed the issue and reached consensus. Many items were rated as related to multiple quality-of-life domains. For example, distances to be traversed, the adequacy of lighting, and the presence of handrails may be most related to functional competence but could also influence

meaningful activity and comfort. Similarly, a private room or visual barriers between roommates in a shared room would most clearly affect the privacy outcome, but it could also affect relationships and meaningful activity.

We developed checklists to assess each environmental level: room, unit, and facility. All items were observable and clearly defined. Most items required dichotomous responses, some had multiple-choice options, and only a few required a measurement or a count (e.g., number of other residents using the toilet room). We used a tape measure to measure the square footage of closets and resident personal space, and heights of switches or flat surfaces, and we used a walking tape to measure long distances (e.g., from the units to the nearest outdoor space and common indoor spaces). Checklists included features in nursing homes that were expected to be common, less common (e.g., thermostats to regulate temperature in resident rooms), and uncommon (e.g., double beds or working fireplaces, or resident-accessible bathrooms in lobby areas).

We applied a 112-item room checklist to each individual resident in the sample. The results for many items (e.g., a window view, a bedside chair, distance from bed to bathroom or closet, crossing someone else's space to get to the bathroom, and all personalization items) could differ for roommates. We used the "fist test" to assess the operability of light switches and drawer pulls (that is, the assessor's ability to operate them with a closed fist). A 140-item unit checklist included the nursing station, corridors, common tub and/or shower rooms, lounge and dining spaces, access to outdoors spaces, and distances from the unit to the facility entrance, the main dining room, lounges, and the shower or tub room. Again, the measures were mainly dichotomous, with a few items requiring a tape measure or a count. We repeated the specific protocol for at least two tub and/or shower rooms and three lounge or social spaces on each unit. The 134-item facility-wide checklist included all common indoor and outdoor spaces potentially used by residents, family members, volunteers, and visitors, including the grounds, neighborhood, and parking. As in the unit assessment, if multiple lounges or dining rooms were present, we assessed each separately.

Field Work

Participants.—We applied the environmental checklists during Wave 1 of a national study to develop quality-of-life measures for nursing facilities. We designed the sampling, described elsewhere (Kane et al., 2003), to achieve an even division of urban and rural and large and small facilities, to include some facilities with plenty of private rooms, and include sufficient residents living in private rooms to study that variable. Briefly, we randomly selected eight nursing facilities in catchment areas in each of five

states (California, Florida, Minnesota, New Jersey, and New York). Prior to sampling from nursing facilities accepting Medicare or Medicaid and with 50 or more beds in the catchment areas, we had one home selected by experts in the state as an exemplar of a facility thought to offer an unusually high quality of life. We randomly selected up to two nursing facilities in each state from a separate list of those in the catchment areas with 70% or more private rooms. We slotted the facilities selected as exemplars or for privacy by size and rural or urban status, and we randomly selected the remaining homes in the state to fill the rest of the cells. This procedure resulted in a sample of nursing homes that ranged widely in age, size, chain versus nonchain, and freestanding versus part of a campus, but that overrepresented nursing facilities with private rooms by design, and as a result somewhat overrepresented nonprofit facilities. Among nonprofit ownership are sectarian homes, several nonsectarian philanthropic organizations, several county homes, and several hospital-owned homes. One home was located in a continuing care retirement community.

The study aimed for a sample of 50 residents per nursing facility, drawn equally from those in the more or less impaired half of the population in terms of cognitive functioning, the latter determined by abstracting data from their most recent Minimum Data Set assessments. In each nursing facility, we oversampled for 20% residents in private rooms, though often such a proportion was impossible. The sampling procedure yielded 1,988 residents (and, thus, 1,988 resident room environments); exclusions of people who were younger than 65 years of age or who were comatose led to fewer than 50 participants in a few small nursing facilities with low occupancy. We sampled residents as evenly as possible in up to five nursing units. The average number of units per facility was three and only five facilities had more than five units. We automatically chose any dementia special care units or Medicare rehabilitation units, and we randomly selected the remaining sample. This procedure yielded 131 distinct nursing unit environments.

Data Collection.—L. Cutler completed the facility- and unit-level checklists. Forty research interviewers completed the room and bath checklists during a 2- to 3-week period in the nursing facility, during which they performed all study procedures. Prior to going into the field, they were trained by the L. Cutler on the room and bath checklists, with extensive use of slides, photographs, and room diagrams and with a practicum experience in volunteering facilities. To pass the training, each interviewer needed to achieve at least 90% agreement with the trainer on a simultaneous assessment. Once fieldwork began, L. Cutler adjudicated questions by means of the telephone to resolve any issues arising in atypical environments, and we communicated decisions to

the other interviewers to ensure consistent interpretations. We collected data in 1999 and 2000.

Interrater Reliability.—We incorporated a formal test of interrater reliability of the room and bath checklists midway into the ongoing data-collection process. Thus in each of 30 nursing facilities in three states, a second assessor applied the checklist to two randomly chosen room environments simultaneously with or closely after the assigned observer. We used the kappa statistic to measure agreement between paired observers. The assessment of individual room environments is somewhat more challenging in shared versus private rooms because of the additional step of attributing space and possessions to the particular individual; therefore, we calculated kappas on agreement separately for those in private and in shared rooms. Of the 112 checklist items tested by 24 pairs of raters, 97 items (96%) yielded a significant kappa statistic. Of the significant kappas, only 1 item was in the poor range ($\kappa < 0.4$); 10 items (10%) were in the fair range ($\kappa = 0.4\text{--}0.6$), 29 items (30%) were in the good range ($\kappa = 0.6\text{--}0.8$), and 16 items (16%) were in the excellent range, and 100% agreement for all pairs of raters was achieved for 41 items (42%). Interrater reliability for shared rooms, where the assessor needed to separate the environment of the focal resident from any roommates, was slightly lower. 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%) were in the poor range, 19 (20%) were in the fair range, 27 items (28%) were in the good range, and 15 (16%) were in the excellent range, and there was 100% agreement on 31 (32%) items. The few items with insignificant or poor-range kappas were deleted from the measurement tools, revised, or clarified. Because a single assessor rated all units and facilities, we performed no interrater reliability test on those two checklists.

Analysis.—To reduce the large number of individual variables into a manageable and readily interpretable result, we combined variables into higher order environmental categories that might hypothetically be related to quality of life. When a unit had multiple bathing rooms, lounges, or dining areas or the facility as a whole had multiple lounges, we constructed the index by using an “ever-present” rule, meaning that if the desired feature was present in at least one of the multiple spaces, a point was awarded on the index. Within each index, we assigned individual items a value of one for their presence and a value of zero for their absence, and we summed items into an overall index score. The resulting index score, therefore, reflected the number of items that belonged to a given construct. Using both single items and indices, we examined the extent of environmental variation within and across facilities.

Results

General Descriptive Findings

The size of the 40 nursing facilities ranged from 49 to 274 beds, and the size of the 131 units ranged from 10 to 70 beds; 21 nursing units were classified as dementia special care units. Eighteen facilities were one story, and the rest ranged from two to six stories high. Consistent with the oversampling for private rooms, 580 (29%) of the residents lived in private rooms; 58% of the residents shared two-bed rooms, and the remainder were in rooms with three or more beds. The bedroom space per resident ranged from 75 to 411 ft² (approximately 7 to 38 m²) per person. Of the 40 facilities, 17 were built before 1970 (many with histories reaching to the beginning of the century), and 16 were built between 1970 and 1979. In contrast, 7 were opened in the 15 years before data collection in 1999, and 5 of the older group received major renovations in the 10 years before data collection. The facilities with a preponderance of private rooms ranged in age, but all were nonprofit facilities.

The number of residents using a toilet room ranged from 1 to 20. Only 25% of the 1,988 residents had private bathrooms (i.e., 19% of private rooms lacked private toilet rooms); 42% shared a bathroom with one other person, 5% shared with 3 residents; 18% shared with 4 other residents, and 9.6% shared with 5 to 20 other residents. Residents needed to travel from 3 to 82 ft (0.91 to 25 m) to reach their primary toilet rooms; 251 residents (13%) needed to travel outside their immediate room to a shared bathroom down the corridor. A tub or shower was located in 25% ($n = 499$) of the resident's toilet rooms, nearly half of those ($n = 236$) in shared toilet rooms. However, some of the showers located in residents' rooms seemed inoperable or unused, and they were not designed to facilitate assisted bathing with an attendant in the room. Overall, 82% had wheelchair clearance under their toilet room sinks, but only 10% had a mirror suited to a wheelchair user. The distance from the farthest resident room to the nearest shower or tub room ranged from 20 to 270 ft (6 to 82 m).

Of the 131 units evaluated, 15% lacked even one lounge space; the remainder had from two to four lounges. The mean facility and unit lounge space per bed was 20.18 ft² (1.87 m²) and ranged from 2.72 to 75.51 ft² (0.25 to 7 m²). Residents in private rooms had significantly more lounge space per bed (22.47 ft² or 2 m²) than those in rooms with one roommate (19.67 ft² or 1.82 m²) or with two or more roommates (17.27 ft² or 1.60 m²). Eighty-three units contained a least one dining room, but residents did not always eat in the dining room on the unit. In contrast, one unit had six distinct dining options.

One innovative facility had recently been renovated into households with between 8 and 10 residents in each. For administrative purposes, four to six households comprised a nursing unit. Each household had

a full kitchen with refrigerator, stove, oven, and dishwasher. At the other extreme, the capacity in the single dining room of one facility could only accommodate about two thirds of the residents, so many ate from trays in their rooms or in the corridors.

Environmental Indices

We constructed 20 indices to measure higher order environmental constructs. (The complete checklists, index items and their frequencies can be found in Volume 2 of a report on the Web site of the Centers for Medicare and Medicaid Services at <http://www.cms.hhs.gov/quality/nhqi/>).

Room and Bath Indices.—The five-item Room Visual Separation Index reflects the level of privacy afforded by the physical environment for residents in multiple bedrooms; those in private rooms automatically received a perfect score. Two facilities had unusual double-room configurations with an almost complete floor-to-ceiling wall separating the two sides of the room, and a window for each resident; only the bathroom and closet areas were shared but each resident accessed those shared spaces without traversing the other resident's space. Sample members in shared rooms in those two facilities accounted for all but one of the perfect visual privacy scores apart from those in single rooms.

The Room Personalization Index included seven items that reflect the extent of personal belongings, furnishings, and decorations in the resident's room area. Individualized photos were present for 85% of the room environments, but all the other index items had a prevalence of 39% or lower. For example, only 18% of residents had brought their own bureaus, and only 30% had brought one or more chairs.

The Room Life-Enriching Features Index included 15 items that could enhance a resident's meaningful activity, comfort, relationships, and enjoyment. Most of the residents (92%) had a view of the natural environment. At the other extreme, certain theoretically possible features were almost nonexistent; 4% of residents had a personal computer, 1.5% had a refrigerator in the room, 2% had a dog, cat, or other pet, and 1% had a double bed. Only 12.5% had a horizontal work or desk surface. Seventy-two percent of the residents lacked their own telephone, 40% had no television of their own, and 23% lacked even one chair for their own or a visitor's use. Thirteen residents lacked a single life-enriching item of those measured in their room environments.

The four-item Room Function-Enhancing Index describes how well the resident room environments support the needs of residents who use wheelchairs or walkers, or who experience mobility or dexterity problems. A minimum of 4 ft (1.2 m) on at least one side of the bed was attained in 76% of the rooms. Lever-type hardware was found on 48% of the entry

doors. Although 65% of the individuals used wheelchairs, only 7% of the closet rods were located 36 to 48 in. (91 to 122 cm) from the floor. In an eight-item Bathroom Function-Enhancing Features Index, the median number of index features was 4; 80% of the bathrooms had grab bars next to the toilet and wheelchair clearance under the sinks, and 66% had a toilet seat raised 17 in. (43 cm) or more from the floor, but the door and sink hardware rarely was lever style.

The 13-item Environmental Control Index includes items reflecting the amenability of the physical environment to resident control. Fifty-two percent of the resident room environments had adjustable heat, and 46% had adjustable air conditioning. The call button was located within 18 in. (46 cm) of the bed pillow for 96% of the resident room environments, and the on-off switch for task lighting was located within easy reach for 75%. Only 23% of the resident room environments provided the opportunity to control the intensity of the light with a dimmer switch. Only 3% allowed for control of the heat lamp or had light wall switches of the pressure or rocker type.

Room storage was reported by use of a seven-item index. Private closet-type storage (97%), drawer-type storage (93%), and a night stand (84%) were common to most resident room environments. Only 37% percent had storage space that could be locked. Less than half (41%) had counter space available around the bathroom sink. Only nine of resident bathroom environments exhibited sufficient storage space for incontinence products.

Unit Indices.—The Function-Enhancing Features Index incorporates seven items that facilitate ease of movement within and between units, primarily in the corridors. Almost all units (99%) had handrails on both sides of the corridor, but only 71% had a color contrast with the walls. Automatic door openers to exit the unit were found on only two units.

The 10-item Clutter Index measures the presence of nine specific types of clutter and a 10th category for “other.” Only 12 units (9%) had no clutter, whereas 3 units had all 10 types of clutter. Hoyer lifts, commodes, and other medical equipment were the most common type of corridor clutter, present in 58% of the units. Incontinence product disposal containers were found in 22%.

The Life-Enriching Features Index included 16 potentially enjoyable features in lounge or shared spaces available to all residents on the unit. The median number of unit life-enriching features was 10, with the most prevalent being a telephone (88%), a window with a view to the outdoors (82%), moveable seating (82%), television (76%), and living plants (65%). Large-print reading material was found in 50% of the units, a daily newspaper was available to residents in 32%, and a pet lived in 22%.

The Outdoor Amenities Index included 10 items related to outdoor spaces that could be accessed

readily from the unit. Fifty-six percent of the units had no outdoor access from the unit. Of the 58 units with outdoor access, 44% had direct access from the unit to the outdoor space, and most index items were present more than 50% of the time.

The Bathing-Shower Experience Index included 13 items. The majority of the bathing environments (92%) had a tub or shower room, and 38% had multiple tub and/or shower rooms. About two thirds (63.4%) had a sink and a toilet in the room, and 59% had adequate clearance below the sink with lever hardware on 56% of the sinks. The least common features in the unit bathing environments were toilets in separate enclosures (38%), showers or tubs in separate enclosures (28%), heat lamps in the shower room (15%), and sink mirrors for wheelchair use (12%).

The Dining Experience Index included nine items reflecting positive features of the dining spaces. Pictures on the wall (72%) and windows in the dining room (70%) were relatively common, but all other index characteristics occurred in less than half the units. Only 12% of unit dining environments were dedicated solely for dining purposes.

Facility Indices.—We constructed a 10-item Facility Amenities Index to describe facility environment characteristics of comfort, convenience, or enjoyment for visitors, residents, and staff. Almost all facilities (98%) had a beauty or barber shop. Separate chapels or meditation rooms were found in 40%, 30% had a coffee or snack bar, and 15% had a café where light meals could be purchased.

The facility Outdoor Amenities Index included 10 items. One third of the facilities had the full complement of facility amenities. Approximately two thirds (65%) of the facility environments had a secured outdoor area, such as an interior courtyard or a fenced area.

We created a 15-item Facility Life-Enriching Features Index and a 13-item Facility Function-Enhancing Features Index. These indices parallel the respective unit indices. For example, corridor rails and way-finding devices were included in both the facility- and unit-level indices of function-enhancing features. Almost half of the facilities (48%) lacked lavatories at the front door that were accessible and permitted for resident use.

Table 1 presents descriptive statistics for each of 20 indices potentially related to quality of life. The median statistics illustrate that, except for the maintenance index at each level and the outdoor-amenities index at the facility level, many of the nursing facility environments fell short on these composite indices.

As we already noted, the environmental assessment had high interrater reliability at the item level. We also examined the interrater reliability at the index level for the 24 private rooms and 34 shared rooms in which multiple assessments were obtained.

Table 1. Characteristics of Composite Indices at Three Levels

Index (Theoretical Score)	No. of Items	Median	M	SD	Alpha Reliability
Room and bath (<i>n</i> = 1,988)					
Visual separation	5	3	2.72	1.86	0.85
Personalization	7	2	2.27	1.55	0.61
Room function-enhancing features	4	2	2.23	0.79	0.11
Bathroom function-enhancing features	8	4	4.06	1.42	0.41
Life-enriching features	15	5	4.82	2.15	0.60
Environmental controls	13	6	5.70	2.03	0.24
Storage	7	4	3.99	1.11	0.20
Maintenance	3	3	2.71	0.58	0.36
Unit (<i>n</i> = 131)					
Function-enhancing features	7	4	3.47	1.20	0.36
Life-enriching features	16	10	8.82	4.46	0.90
Clutter	10	3	3.54	2.53	0.75
Outdoor features	10	0	3.33	4.15	0.97
Bathing environment	13	8	7.22	3.47	0.86
Dining environment	9	4	3.40	2.44	0.78
Maintenance	6	6	5.3	1.19	0.29
Facility (<i>n</i> = 40)					
Function-enhancing features	13	8	8.35	2.27	0.55
Life-enriching features	15	7	7.68	2.72	0.68
Facility amenities and services	10	3	3.40	2.20	0.74
Outdoor amenities	10	9	8.20	1.87	0.69
Maintenance	5	5	4.83	0.45	0.20

Table 2 shows the results as pooled data and separately, using the intraclass correlation coefficient as a measure of reliability. The correlations ranged from .41 (maintenance) to .93 (visual separation). On four of the indices (personalization, life-enriching features, storage, and maintenance), reliability was higher in private rooms, whereas on three measures, reliability was higher in shared rooms (environmental controls, bathroom, and room function-enhancing features). The visual separation scale is inapplicable to private rooms, which automatically were awarded the best score for the index.

Discussion

We developed and applied environmental checklists to assess tangible physical environments at the room, unit, and facility levels, achieving good interrater reliability for the individual items in the checklists. Our goal was to develop a procedure to assess the presence or absence of discrete environmental features linked to quality of life such that repeat administrations and multiple observers would provide the same results. An additional goal was to develop an environmental database that could

Table 2. Interrater Reliability of the Room and Bath Indices

Variable	Pooled Sample (<i>n</i> = 58 Pairs)	Shared Rooms (<i>n</i> = 34 Pairs)	Private Rooms (<i>n</i> = 24 Pairs)
Personalization	.872	.767	.899
Life enriching	.855	.751	.839
Visual separation	.930	.858	NA
Environmental controls	.630	.659	.585
Storage	.679	.536	.776
Maintenance	.409	.196	.659
Bathroom function enhancing	.722	.751	.669
Room function enhancing	.648	.695	.568

describe an individual resident's specific physical environment with considerable precision. To date, generally positive evidence of the reliability of the environmental checklists based on interrater reliability of the room and bath items has been produced. Interrater reliability was adequate to high for the room indices, with the exception of the maintenance index at each level, which relied on subjective judgments (e.g., "well maintained"). The much poorer interrater reliability of the maintenance index in shared rooms relative to private rooms may reflect some ambiguity between assessors in apportioning poor maintenance to the sampled resident rather than the roommate.

Further, we grouped information into composite indices to characterize the environment on conceptually linked items that theoretically relate to quality of life. The more abstract composite indices include those measuring function-enhancing features and life-enriching features at all three environmental levels for personalization, visual privacy, and environmental control at the room and bath level. The examination of these indices helped the researchers organize a vast amount of information and suggested further research, as subsequently described. Although the indices were not designed to be internally reliable scales, we did compute alpha reliability and found that many indices had alpha reliabilities too low to permit their use as scales in any analysis.

The descriptive findings reflect extraordinary variation at each of the three levels for both items and indices. Despite the variation and the coexistence of exemplary features, especially in the public common spaces at the facility level, the individual room environments and many of the units were often spare and far from function enhancing. The enormous range found in most of the items measured for even this small sample suggests the importance of generating some empirical data on the effects of environmental features on resident well-being. The identified problems included lack of lounge space; overcrowding in bathrooms shared by up to 20 res-

idents; the long distances between individual room environments and some of the bathrooms and other spaces; corridor clutter; noise; and the general absence of life-enhancing features. The problems noted in room-level toilet rooms and unit tub and shower rooms (such as inadequate ventilation, low light levels, poor switches and controls, and improper use as storage areas) are particularly relevant to quality-of-life outcomes such as dignity, privacy, comfort, security, and functional competence. Bathing often occasions resident agitation, discomfort, or humiliation, which reduces quality of life (Hoeffler, Rader, McKenzie, & Stewart, 1997; Rader, Lavelle, Hoeffler, & McKenzie, 1996). Those facilities with the most private rooms also tended to have the most shared lounge spaces where residents could achieve privacy.

Limitations

Further research is needed to establish the interrater reliability of the specific items in the unit- and facility-level checklists, which in this study were applied by a single rater. The maintenance items require work because of their unacceptable interrater reliability and lack of variation. Residents perceive cleanliness as important to their comfort and general quality of life (Kane, 2003), but if the lack of variation found in this study pertained to a larger sample, the maintenance indices would be of little use.

Our selection of quality-of-life-related environmental checklist items was based on the literature and a rating exercise undertaken by a group of experts. Another rating group might have suggested different or additional items, and consumers might have yet a different perspective. Similarly, the constructs selected for the creation of composite indices was limited by the imagination of the researchers, and the items used in each index were necessarily limited to those collected in the original checklists. A self-correcting process is built into this procedure; for example, the very act of assessing multiple physical environments reveals possibilities for personalization or control that might not have been considered feasible for a nursing home.

It has already been noted that the 20 indices constructed by summing the count of conceptually linked items cannot be used as scales, let alone as linear additive scales—thus, we do not argue that the presence of two function-enhancing features is twice as good as having only one such feature in a residents' room. The strength of these indices devolves from the reliability of the underlying items, rather than the alpha coefficient, which is a measure of the intercorrelation of the items. The indices are presented as a useful heuristic to enable a very large number of environmental attributes to be parsed into meaningful groups. In many cases the alpha coefficients were inadequate to use as scales. This was particularly true of the function-enhancing feature

indices, all of which had alphas less than 0.55. In contrast, none of the life-enriching feature indices had alphas less than 0.60; this suggests that, in this sample, life-enriching features were more likely to be jointly implemented, whereas different function-enhancing features did not commonly appear together. Researchers and providers interested in applying these environmental checklists should have license to modify and expand the lists.

The goal of linking the environment to particular individuals was not fully met with reference to dining and bathing environments. We failed to anticipate the great variety of eating and bathing arrangements that we found, and the reality that individual residents did not necessarily bathe or dine regularly in the bathing or dining areas most proximate to their rooms. Future researchers using this approach will need to build in specific information about where each resident eats or dines to confidently apply information from those indices to nested analyses. Because this study showed this information cannot be inferred by knowing the resident's room number or by observing that there is a shower in the resident's private bathroom, we recommend collecting information about which bathing and dining areas are used by the residents in the study. On a related issue, some parsimonious data collection is needed so that researchers are sure the various features that enhance resident control (including heating and cooling controls and locks) are in working order.

The checklist approach may mask extreme variation in positive or negative directions. For example, a nursing facility with a modest selection of books in a single reading room and a facility located in a large continuing care retirement community that had a full-time librarian and three libraries (one for large-print books, one for regular books, and a separate video and book cassette library) are both credited with "having a library or reading room" on the facility-amenity index.

Potentially, the indices could inappropriately make larger facilities seem to be better environments for quality of life than smaller ones. A large facility may have a wide variety of features and amenities even if they are spread out such that a specific resident may only be able to access a limited subset. At present, the checklist approach does not adjust for size of units or facilities, though it should be noted this is less of a problem at the unit level, because units tend to be about the same size (e.g., 40 to 50 residents). In small facilities composed of, for example, two units, the unit amenities and the facility amenities would tend to be almost identical.

Finally, the descriptive results that we present here are based on a relatively small sample of nursing facilities from a small number of geographic regions. Though the sample is suggestive of poor environments despite an oversampling of facilities with high privacy and inclusion of nominated exemplars, it

cannot be generalized to the nation or the participating states. Furthermore, the environmental norms may have changed since 1999–2000 when the data were collected, and such changes are likely moving towards higher expectations and more private, normalized environments.

Research Implications

As indicated, the assessment-checklist approach can be streamlined somewhat, and further short questionnaires will have to be developed and tested to capture additional information about environments used by each individual to ensure the ability to link the individual to the setting. More items could be generated for the checklists and for particular composite indices. The groupings for indices appeared to have face validity, but they are not comprehensive or timeless lists of relevant attributes of the environment. As technology improves and as expectations and standards rise, environmental features considered rare or luxurious today may seem commonplace, whereas new possibilities to enhance resident control, function, and life enrichment may start appearing. Checklists such as those developed here will evolve dynamically, informed by further research with experts on design and technology, and also by the views of residents on the environmental features that enhance their own functioning, control, and well-being. Future validation research could also explore the weightings that might be placed on various items based on the utilities of residents and families, and magnitude estimation approaches might be used to identify whether residents' preferences change as a result of disability or cultural background.

For the environmental checklists described here, we were guided by an emphasis on quality-of-life outcomes. Those researchers wishing to emphasize how individual-level physical environments affect quality of care or health status might select additional items and create additional composite indices.

Further research is needed on the connection between the different features measured in the environment and resident outcomes. Data such as these permit researchers to study the amount of variation within facilities, and the factors associated with that variation. We have undertaken a cluster analysis to determine whether facilities can be classified by their environments at the room, unit, and facility level (Degenholtz, Miller, Kane, Cutler, & Kane, in press). The procedures also permit researchers to study how various environmental and policy or programmatic features are correlated. Further, hierarchical analysis tools can be used to take into account the nested features of the environment (rooms in units in facilities) on residents with various characteristics. Small nursing facilities with few units will use facility-level spaces in lieu of unit spaces, but presently little is known about the trade-offs that architects make

among room-and-bathroom features, unit features, and overall facility features and how residents are affected by such trade-offs. Hierarchical analysis will be ideal for testing hypotheses related to the effects of private rooms on domains of resident quality of life. It is possible that smaller, more individually tailored and arranged spaces are consistent with how older people with disabilities establish their priorities by using principles of selective optimization with compensation (Baltes & Baltes, 1990). Also helpful would be studies of the costs of making environmental improvements in new construction and in renovations.

We plan to examine how resident characteristics interact with environmental characteristics to generate resident outcomes. For example, some residents may depend more than others on their immediate environment, and some may be able to glean little benefit from improved environments. Perhaps some residents with severe functional impairment do not benefit at all from the environmental control features in a room environment. Along similar lines, research can show whether resident characteristics such as income, Medicaid status, gender, and family structure affect the personalization of rooms, which may depend more on resident and family initiative than facility staff. Indirect effects of environment on quality of life can be explored as mediated by staff activities—for example, the lack of storage space for supplies in a resident's room and bathroom may result in less staff time for care and interaction with the residents.

Practice Implications

Careful description of physical environments suggests remedies for the problems observed. For example, the first step to mitigate noise or clutter is to identify their various types and sources. Notably, some changes are no more expensive than increasing the wattage of light bulbs, or investing in low-cost fixtures, switches, and hardware. The results suggest that personalization requires attention, through permissive policies and active efforts to increase the likelihood that individual resident expression occurs in residents' rooms. Some improvements could be made with modest resources. We argue that individual nursing facilities will gain insights through the undertaking of self-assessments using these tools. At the aggregate level, the findings add to the growing evidence about the importance of single-occupancy rooms, which requires philosophical shifts at times of major renovations or construction.

At first blush, assessing the environment attributed to each individual may seem unrealistic for either practice or research. On the practice side, we suggest there is value in directly examining the actual person's environment. Caregiving staff can be trained to be reliable in the way they apply the checklists, and each staff member is unlikely to be assigned many assessments in an operational program. There is no substitute for direct observation, and it is not possible

or appropriate to assume that observations of one resident's rooms can suffice to characterize the experience of others, even on the same nursing unit. A later applied project, wherein staff completed self-assessments of the physical environments in old nursing homes with the goal of improving quality of life, showed that the greatest barriers to accurate assessment occur for two reasons: (1) because staff members become accustomed to substandard living environments rather than seeing them with the eyes of a stranger, and (2) because staff inaccurately assess environmental deficits if there appears to be a good reason for the problem (Cutler & Kane, 2004). Thus, a nurse might fail to note clutter in the corridors or obstructed handrails because "the carts *need* to be in the hall," or fail to record a smell of feces because "one of the residents is being changed." Training and practice can overcome such myopia and permit problem identification, which is the first step toward problem solving. On a more ambitious level, those nursing homes that are considering renovation, rebuilding, or additions would benefit by applying these assessment approaches to their existing environments, and to being able to draw on detailed information about other nursing home environments in their market area of the type that could be generated by this assessment procedure. A pervasive sense of discouragement about what can be accomplished within regulations and Medicaid levels of reimbursement may often create unnecessary obstacles to action.

Conclusions

When it is used along with existing approaches to assess environments, we view the resident-level approach described here as useful to address specific research questions with more precision and to consider the actual environment of particular residents. The items and indices used in research of this type will evolve along with improved knowledge of how environments affect outcomes. This capability of bringing the inquiry on physical environments to the specific resident is consistent with the contemporary attention to individualization and person-centered approaches that have been advocated for nursing homes in the 21st century (Weiner & Ronch, 2003). The enhanced scrutiny on the details of the environment as available to each individual and as experienced by that individual is bound to be a salutary corrective against the tendency to forget that nursing homes should first be human dwelling places rather than clinical workplaces.

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