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The Therapeutic Environment Screening Survey for Nursing Homes (TESS-NH): An Observational Instrument for Assessing the Physical Environment of Institutional Settings for Persons With Dementia

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Objective. To develop an observational instrument that describes the ability of physical environments of institutional settings to address therapeutic goals for persons with dementia.

Methods. A National Institute on Aging workgroup identified and subsequently revised items that evaluated exit control, maintenance, cleanliness, safety, orientation/cueing, privacy, unit autonomy, outdoor access, lighting, noise, visual/tactile stimulation, space/seating, and familiarity/homelikeness. The final instrument contains 84 discrete items and one global rating. A summary scale, the Special Care Unit Environmental Quality Scale (SCUEQS), consists of 18 items. Lighting items were validated using portable light meters. Concurrent criterion validation compared SCUEQS scores with the Professional Environmental Assessment Protocol (PEAP).

Results. Interrater kappa statistics for 74% of items were above .60. For another 10% of items, kappas could not be calculated due to empty cells, but interrater agreement was above 80%. The SCUEQS demonstrated an interrater reliability of .93, a test–retest reliability of .88, and an internal consistency of .81–.83. Light meter ratings correlated significantly with the Therapeutic Environment Screening Survey for Nursing Homes (TESS-NH) lighting items ($r = .29–.38$, $p = .01–.04$), and the SCUEQS correlated significantly with global PEAP ratings ($r = .52$, $p < .01$).

Discussion. The TESS-NH efficiently assesses discrete elements of the physical environment and has strong reliability and validity. The SCUEQS provides a quantitative measure of environmental quality in institutional settings.

THE physical environment is emerging as an important determinant of psychosocial and health outcomes for older persons with Alzheimer's disease and related dementias. Among demented residents of long-term care facilities, environmental factors have been linked to agitation (Nelson, 1995; Sloane et al. 1998), intellectual deterioration (Annerstedt, 1994), orientation (Namazi & Johnson, 1991; Namazi, Rosner, & Rechlin, 1991), sleep patterns (Cruise, Schnelle, Alessi, Simmons, & Ouslander, 1998), and influenza A attack rates (Drinka et al., 1996). The increased sensitivity of persons with dementia to environmental conditions occurs because the illness reduces the individual's ability to understand the implications of sensory experiences. As a result, agitated behaviors, increased confusion, delusions, and other psychiatric disturbances are readily triggered by environmental stimuli (Lawton & Nahemow, 1973; Sloane et al., 1998).

Because long-term care settings are increasingly serving persons with dementia (Eppig & Poisal, 1997; U.S. Congress, 1987), objective assessment of the physical environment of these care settings has become increasingly important (Teresi, Lawton, Ory, & Holmes, 1994). This is heightened by the fact that physical environments are more accessible to change than many other factors that relate to outcomes among older persons with dementia, such as age, diagnosis, disease stage, and comorbid conditions (Carp, 1994). Little consensus is present, however, about what environmental parameters are most salient for persons with dementia (Grant, 1994), and no widely accepted measure yet exists for dementia care environments (Carp, 1994).

In 1991, a National Institute on Aging (NIA) cooperative agreement funded 10 investigative teams to study dementia special care units (SCUs). A number of work groups were formed to recommend common data collection instruments and procedures, one of which was to focus on the physical environment. This article describes the instrument that resulted from these efforts, the Therapeutic Environment Screening Survey for Nursing Homes (TESS-NH). This new instrument, a substantial revision of previous versions (Sloane & Mathew, 1990; Sloane, Mitchell, Long, & Lynn, 1995), was given the suffix NH in recognition that its development and psychometric evaluation were conducted in the nursing home setting. In contrast to the earlier instrument, the TESS-NH is a collection of descriptive items (hence the term *survey* rather than *scale*, which was used in the previous versions). Embedded within the TESS-NH is the Special Care Unit Environmental Quality Scale (SCUEQS), which is also described in this article. Finally, preliminary reports are provided to indicate that TESS-NH items and the SCUEQS are useful in the evaluation of units other than those specializing in the care of persons with dementia.

Methods

Instrument Development

The theoretical basis for the TESS-NH was an outgrowth of social ecological models, which conceptualized the environment in terms of interactions between a physical space and the persons within it (Moos, 1980). A poor fit between the environment and an individual's needs and desires was postulated to lead to adverse outcomes, such as negative behavior, decline in physical health, and depression (Kahana, 1982; Lawton & Nahemow, 1973). The physical setting was one dimension of such models; others were personal, interpersonal, and sociopolitical elements (Lawton, 1986). Although early social ecological assessments often viewed the environment globally, Weisman, Lawton, Sloane, Norris-Baker, and Calkins (1994) proposed that, due to marked disagreement about the critical elements for persons with dementia, the individual dimensions should be assessed separately. In the case of SCU research, Ohta and Ohta (1988) called for "a clear taxonomy of unit characteristics" and Grant (1994) called for assessment at the unit level, to avoid confounding by facility factors.

On the basis of the above studies and reports, the NIA SCU environment workgroup recommended developing an instrument that (a) contained a limited inventory of physical environmental features, (b) addressed consensus environmental goals (described below), and (c) built on the existing Therapeutic Environment Screening Scale, a 12-item instrument developed by Sloane and Mathew (1990). The workgroup recommended that the new instrument employ direct observation, using, as much as possible, discrete indicators of sensory/spatial properties and focusing on the unit (Lawton, Fulcomer, & Kleban, 1984; Weisman, 1981). On the basis of its review of existing instruments (Calkins, 1988; Cohen & Weisman, 1991; Lawton, 1980; Moos, 1980), the workgroup identified six consensus goals of the physical environment in long-term care that were to be evaluated by the instrument: provision of safety, security, and physical health; orientation; provision of privacy, control, and autonomy; stimulation (both positive and negative); enhancement of socialization (social milieu); and personalization/familiarity. (A seventh conceptual goal, competence/function/negotiability, was initially identified; however, its elements were subsumed under the other domains.)

With the help of an architectural/design consultant team, the workgroup reviewed existing literature on assessment of long-term care environments (Calkins, 1988; Cohen & Weisman, 1991; Grant, 1996; Lawton et al., 1984; Moos & Lemke, 1980, 1984; Nehrke et al., 1981; Sloane & Mathew, 1990) to identify items that addressed the above goals. These were grouped into domains, based on the work of Moos and Lemke (1984) and Weisman (1991), and were further modified based on review by workgroup members and by field testing. The resulting provisional instrument, the TESS-2+, was used to collect data in the NIA SCU studies. Although face-validated by numerous experts, the TESS-2+ was fielded with only modest pilot testing, without reliability studies, and without scale development. Consequently, a goal of the SCU studies was to revise the instrument and to create one or more scales for global evaluation of SCU quality.

Each of the NIA SCU study sites collected TESS-2+ data in the daytime, excluding meal times, during a 30–45-min structured walk through a unit. A training manual and a set of training slides were created and distributed to all study sites, and representatives at each site were trained by Margaret Calkins. Training involved approximately 4 hr of viewing slides with guided discussion on individual items and response categories and approximately 4 hr of onsite practice and discussion. The unit of observation was defined as a geographically distinct area of a long-term care facility or a whole facility, containing spaces for sleeping and public use. An SCU was defined as an area within a facility or an entire facility that represented itself to the public as primarily serving persons with dementia, contained a majority of persons with dementia, and was separated from the remainder of a facility by closed doors.

For these analyses, 7 NIA SCU sites contributed data on 204 SCUs and 59 non-SCU nursing home units in 10 states. Cooperating sites were the University of North Carolina at Chapel Hill (53 SCUs in Maine, Mississippi, Kansas, and South Dakota); University of California, Davis (12 SCUs and 5 non-SCUs in California); University of Kansas (48 SCUs and 33 non-SCUs in Michigan, North Carolina, and Washington); University of Minnesota (65 SCUs in Minnesota); Hebrew Home in Riverdale, New York (7 SCUs); Hebrew Rehabilitation Center (19 SCUs in Massachusetts); and the University of Maryland at Baltimore (21 non-SCU units). The 53 SCUs from the North Carolina site served as the developmental sample, and the remaining sites provided cross-validation data. The methods by which facilities were selected differed slightly across studies; however, each site attempted to achieve a random or proportional sample of nursing homes and SCUs within its study state(s).

On the basis of the distribution of responses in the data collected by the NIA SCU studies, a number of modifications were made in the instrument. Categorical items for which more than 85% of responses fell into a single response option were eliminated for lack of variability. Also, items with one or more options with fewer than 5% of responses were simplified, usually to dichotomous items. The resulting instrument was designated the TESS-NH.

Characteristics of the TESS-NH

To capture the six consensus goals of the NIA SCU workgroup, the TESS-NH contains 84 discrete items plus 1 global item that cover 13 domains. These domains include exit control, maintenance, cleanliness, safety, orientation/cueing, privacy, unit autonomy, outdoor access, lighting, noise, visual/tactile stimulation, space/seating, and familiarity/homelikeness. Good exit control provides for safer wandering (Day, Carreon, & Stump, 2000). Peeling paint, loose handrails, cracked tile, wheelchairs with missing parts, broken handles, and other maintenance problems are hypothesized to constitute both a hazard and an aesthetic liability. Lack of cleanliness is hypothesized to be associated with increased infection rates, poor resident care, and resident and family dissatisfaction. Safe environments reduce injury and mobility restriction (Day et al., 2000). Although there is controversy over what methods are most effective, proper cueing has been demonstrated to reduce confusion, undesired exiting, and incontinence among persons with dementia (Day et al., 2000; Namazi & Johnson, 1991; Namazi et al., 1991; Weisman, 1987). Privacy is hypothesized to reduce agitation (Morgan & Stewart, 1998) and increase family and resident satisfaction. Greater unit autonomy is hypothesized to enhance resident behavior, mood, and social function; reduce interruptions and noise; and facilitate staff function (Mace, 1991). Outdoor access is associated with increased vitamin D levels (Brawley, 1997) and reduced resident agitation (Mooney & Nicell, 1992). Bright, even, glare-free illumination has been associated with improved wayfinding (Netten, 1989) and reduced depression in persons with dementia (Hanger, Ancoli-Israel, Kripke, Jones, & Almendarez, 1992). Noise has been associated with poor sleep (Cruise et al., 1998; Schnelle et al., 1998), reduced ability to perform tasks (Elm, Warren, & Madill, 1998), and agitation (Sloane et al., 1998) in persons with dementia. Varied stimuli are characteristic of homelike, noninstitutional environments, although studies are mixed as to the optimal degree and type of stimulation in dementia (Cohen & Weisman, 1991; Hall, Kirschling, & Todd, 1986; Lawton et al., 1984). The absence of long corridors reduces agitation (Lawton et al., 1984; Morgan & Stewart, 1998), and appropriately configured seating enhances social opportunities (Day et al., 2000). Links to the familiar have been associated with increased satisfaction, reduced agitation and exit seeking, and improved functionality (Day et al., 2000; Reed, Payton, & Bond, 1998).

All of the observed items on the TESS-NH include a response format such that the higher number is hypothesized to represent a more favorable attribute of the physical environment. All items are categorical, except for the global measure of physical environment, which is in Likert format with responses ranging from 1 (low, distinctly unpleasant, negative, and nonfunctional) to 10 (high, quite pleasant, positive, and functional). The TESS-NH instrument and instructional manual are available at http://www.unc.edu/depts/tessnh.

Reliability Studies

Interrater reliability.—Two research assistants visited 12 SCUs concurrently and completed the items simultaneously and independently. Three of these facilities were in Maine, 4 in Mississippi, 4 in Kansas, and 1 in South Dakota. During each visit, the research assistants also conducted multiple observations on a subset of 17 TESS-NH items thought most likely to vary over the course of the day (e.g., lighting and cleanliness); each of these items was evaluated concurrently and independently on three occasions over the course of an 8-h data collection visit. Confirmatory interrater reliability data for binary TESS-NH items were gathered by two independent raters in 29 New York units.

Percentage of agreement and weighted kappa statistics were calculated to examine interrater reliability for categorical items; the Pearson correlation coefficient (equivalent to the intraclass correlation coefficient in the case of two raters and parallel measures) was used for continuous items.

Test–retest reliability.—Test–retest reliability was assessed in 21 non-SCU units in six nursing homes in Maryland. One evaluator conducted two observations on each unit, with the interobservation interval ranging from 103 to 150 days ($M = 129$ days).

Item test–retest reliability was evaluated using percentage of agreement, correlation coefficients (for continuous items), and weighted kappa statistics (for noncontinuous items). For the global rating and the SCUEQS (see below), scaled scores were compared and intraclass correlation coefficients were calculated using Kish's roh (Kish, 1965).

Evaluation of Scalability of Domains and Development of a Global Quality Scale

Evaluation of scalability of domains.—Items within each of the 13 domains were evaluated for scalability by computing Cronbach's alpha (Cronbach, 1951). To improve internal consistency, items that were negatively correlated or had a corrected item-to-total correlation of less than .20 were deleted, and the remaining items evaluated for scalability.

Development of the SCUEQS.—One goal of the NIA studies was to construct a single standardized and operationalized measure of overall environmental quality that would be equivalent to a global rating by an expert. To construct the SCUEQS, we considered all TESS-NH items that had a correlation above .20 with global ratings of environmental quality, adequate interrater reliability, and adequate item variability. The scale was further refined by deleting items that reduced the overall alpha. The SCUEQS was developed using data from 53 SCUs in Kansas, Maine, Mississippi, and South Dakota; validation was conducted using data from 96 SCUs in California, Michigan, Minnesota, North Carolina, and Washington.

The SCUEQS is a summary scale consisting of 18 TESS-NH items; it is computed by adding the observed value for each item. Items reflect measures of maintenance, cleanliness, safety, lighting, physical appearance/homelikeness, orientation/cueing, and noise. SCUEQS items are footnoted *i* or *k* in Table 1. Possible scores range from 0 to 41. Use of various methods of weighting items, including *z* scores, did not significantly alter scale properties; thus, it is recommended that the SCUEQS be constructed by adding the items or by creating *z* scores.

The development of the SCUEQS was based on the criterion approach to scale development, as embodied in the work of the NIA workgroup and its design consultants. Because of the approach used and the small *N* (53) of the original sample, exploratory factor analysis was not used in SCUEQS development. However, an exploratory factor analysis was later conducted using a data set of 204 SCUs provided by the NIA coordinating center. A principal-components analysis was first conducted, followed by a scree test, in order to determine the dimensionality of the 18-item data set. Subsequently, a factor analysis using oblique rotation was conducted.

Validation

Concurrent criterion validity.—Validation was conducted using the Professional Environmental Assessment Protocol (PEAP), a standardized method of expert evaluation of the physical environment of dementia SCUs (Lawton et al., 2000; Norris-Baker, Weisman, Lawton, Sloane, & Kaup, 1999; Weisman et al., 1994). The PEAP involves a several-hour site visit by an expert in environmental design and aging, during which eight dimensions are rated: safety and security, awareness and orientation, support of functional abilities, facilitation of social contact, privacy, opportunities for personal control, regulation and quality of stimulation, and encouragement for continuity of self. For the validation, 44 nursing home SCUs were jointly site-visited by an expert in environmental design, who completed the PEAP, and a trained research assistant, who completed the TESS-NH.

Because the PEAP involves global evaluations of the physical environment, PEAP results were compared with SCUEQS scores for the units studied. The relationship between scores on the two instruments was assessed using Pearson's product–moment correlations. In addition, the SCUEQS items and the global rating of the overall physical environment were compared with independent PEAP dimensions.

Concurrent criterion validity of lighting items was evaluated in 52 SCUs by using a portable light meter. On the same day that TESS-NH evaluations were conducted, light meter readings were taken at four locations in activity areas. Intensity was measured in foot-candles, and evenness was computed by dividing the reading in the darkest area of a room by the reading in the brightest area. The Spearman correlation was used to examine the association between estimates of light intensity using the TESS-NH and those obtained using the light meter.

Concurrent outcome validity.—The ability of the SCUEQS to explain cross-sectional nursing home resident outcomes was evaluated in a study of factors associated with resident agitation during 3,723 observations of residents in 53 SCUs (Sloane et al., 1998). Analyses evaluated associations between TESS-NH variables and the outcomes of interest.

Use of the TESS-NH in Non-SCU Settings

As part of the NIA collaborative studies, several projects successfully used a preliminary version of the TESS-NH to assess non-SCU settings. The only logistical problem reported with data collection in nondementia units was in defining the boundaries of a unit, as non-SCU areas of nursing homes frequently have common areas that serve more than one nursing unit. To evaluate the applicability of the TESS-NH to non-SCU settings, Cronbach's alpha was computed for the SCUEQS using data from 80 dementia-care areas that did not meet the NIA criteria for a dementia unit (generally clusters within large wards) and 45 nondementia units.

Results

Interrater Reliability

Interrater reliability of TESS-NH items is presented in Table 1. The average percentage of agreement between two raters was 86.7 (range 41.7% to 100%). Pearson correlation coefficients for continuous variables ranged from .33 to 1.0; kappas ranged from .13 to 1.0; only 7 items had kappas less than .40, and the majority (two thirds) were greater than .70. The interrater reliability of the SCUEQS was .93.

A separate study of interrater reliability of selected TESS-NH items, conducted at the New York site of the NIA studies, using two raters and 29 units, yielded kappas ranging from .75 to 1.0 for 17 out of 24 items examined. Two additional items had kappas that could not be computed due to empty cells; however, agreement was perfect. Only 2 items had low kappas: .43 for light evenness in activity areas and .45 for status of television in public areas.

Test–Retest Reliability

Item analysis indicated that environmental factors that are the most fixed, such as the nature of the floor surface, demonstrated high levels of test–retest reliability (agreement above .8). Those that reflect resident or staff behavior, such as adequacy/evenness of lighting, the amount of dirt/litter, the level of maintenance, and the presence of odors, demonstrated moderate to substantial agreement. The global subjective rating item demonstrated an intraclass correlation coefficient of .81; the test–retest reliability (intraclass correlation coefficient) of the SCUEQS was .88.

Scalability of Items Within TESS-NH Domains

When items within each of the 13 TESS-NH domains were evaluated for scalability, the following domains could not be scaled (reasons are given in parentheses): unit autonomy (dispersion problems in Item 3, inadequate number of observations of Items 3 and 4 due to item revision), exit control (items mutually exclusive), space/seating (only 2 items; inadequate observations of Item 15 due to revision; Item 16 not ordered), access to outdoors (only 2 items; inadequate observations of Item 27 due to revision), orientation/cueing (inadequate number of observations due to item revision), and privacy (only 1 item). The means, standard deviations, and Cronbach's alphas for the other domains were as follows: for maintenance (4 items), the mean was 6.6 (*SD* = 1.6.) and the alpha was .83; for cleanliness (6 items), the

Table 1. Distribution and Interrater Reliability of the Therapeutic Environment Screening Survey for Nursing Homes Items

Therapeutic Goal, Domain, and Item No.[a]	Item Description	Scoring Range	Distribution in a sample of 53 nursing home SCUs		Reliability[b]		
			M	*SD*	% Agreement	τ[c]	κ[d]
Privacy/control/autonomy							
Unit autonomy							
1	Unit nursing station presence/type	0–2	1.62	0.49	100	N/A[f]	1.00
2a	Nursing station for paperwork	0–1	0.71	0.46	91.7	0.88	0.91
2b	Desk for paperwork	0–1	0.15	0.36	100	1.00	1.00
2c	Combined work area for paperwork	0–1	0.04	0.19	100	N/A[g]	1.00
2d	Enclosed workroom, not a nursing station	0–1	0.13	0.34	100	1.00	1.00
3	Unit use as pathway between other units[e]	0–1	0.33	0.49	100	1.00	1.00
4a	Residents eat on/off unit[e]	0–3	2.88	0.31	91.7	0.67	0.62
4b	Formal activities on/off unit[e]	0–3	2.33	0.44	83.3	0.63	0.63
4c	Residents bathe on/off unit[e]	0–3	2.92	0.29	91.7	N/A[g]	N/A[g]
Outdoor access							
26	Enclosed courtyard	0–3	2.45	0.84	91.7	0.88	0.91
27a	Attractiveness of courtyard[d]	0–3	2.08	1.16	58.3	0.59	N/A[g]
27b	Courtyard is functional[d]	0–3	1.88	1.05	50.0	0.49	0.33
Privacy							
29a	Privacy curtain provides only separation between beds in semiprivate rooms	0–1	0.96	0.20	83.3	N/A[g]	N/A[g]
Safety/security/health							
Exit control							
5a	Doors to rest of facility disguised	0–2	0.04	0.19	100	N/A[g]	1.00
5b	Doors to outside disguised	0–2	0.04	0.02	100	1.00	1.00
6a	Number of exits off of the unit[e]	N/A	3.79	1.83	41.7	0.85	N/A[h]
6b	Number of elevators off of the unit[e]	N/A	1.00	1.04	91.7	0.84	N/A[h]
6c	Doors are locked[e]	0–1	0.77	0.42	100	1.00	1.00
6d	Locking device triggered by approach	0–1	0.06	0.23	91.7	N/A[g]	N/A[g]
6e	Lock disengaged by keypad/switch[e]	0–1	0.71	0.46	58.3	0.53	0.44
6f	Locked at night/during bad weather[e]	0–1	0.04	0.14	91.7	0.62	0.62
6g	Doors are alarmed[e]	0–1	0.75	0.44	100	1.00	1.00
6h	Alarm triggered by device worn by resident	0–1	0.09	0.30	100	1.00	1.00
6i	Alarm disengaged using keypad, card, or switch	0–1	0.46	0.33	41.7	0	0
6j	Alarm sounds with all entries/exits	0–1	0.17	0.38	83.3	0.63	0.52
Maintenance							
7a	Maintenance of social spaces[i]	0–2	1.66	0.52	75.0	0.53	0.44
7b	Maintenance of halls[i]	0–2	1.55	0.57	66.7	0.33	0.33
7c	Maintenance of resident rooms[i]	0–2	1.68	0.47	100	1.00	1.00
7d	Maintenance of resident bathrooms[i]	0–2	1.72	0.46	91.7	0.82	0.80
Cleanliness							
8a	Cleanliness of social spaces[i]	0–2	1.40	0.69	91.7	0.94	0.93
8b	Cleanliness of halls[i]	0–2	1.72	0.46	91.7	0.84	0.82
8c	Cleanliness of resident rooms	0–2	1.76	0.43	75.0	0.43	0.31
8d	Cleanliness of resident bathrooms	0–2	1.79	0.41	91.7	0.67	0.62
9a	Bodily excretion odor in public areas[i]	0–2	1.68	0.58	97.2	0.90	0.89
9b	Bodily excretion odor in resident rooms[i]	0–2	1.55	0.57	83.3	0.87	0.86
Safety							
10a	Floor surface in social spaces	0–2	0.72	0.66	100	1.00	1.00
10b	Floor surface in halls[i]	0–2	0.77	0.87	83.3	0.70	0.79
10c	Floor surface in resident rooms	0–2	0.64	0.59	75.0	0.43	0.31
10d	Floor surface in resident bathrooms	0–2	1.30	0.75	83.3	0.83	0.79
11a	Handrails in hallways	0–2	1.92	0.27	91.7	N/A[g]	N/A[g]
11b	Handrails in bathrooms[e]	0–2	1.38	0.57	83.3	0.57	N/A[g]
Stimulation							
Lighting							
12a	Light intensity in hallways	0–3	0.70	0.72	83.3	0.87	0.85
12b	Light intensity in activity areas[i]	0–3	1.15	0.69	94.4	0.97	0.97
12c	Light intensity in resident rooms[i]	0–3	0.58	0.66	74.3	0.84	0.77
13a	Glare in hallways[e]	0–2	1.00	0.80	66.7	0.87	0.54[j]
13b	Glare in activity areas[e]	0–2	1.00	0.67	66.7	0.70	0.48[j]
13c	Glare in resident rooms[e]	0–2	1.12	0.64	41.7	0.48	0.17[j]
14a	Lighting evenness in hallways	0–2	0.38	0.49	88.9	0.78	0.77
14b	Lighting evenness in activity areas	0–2	0.66	0.48	86.1	0.75	0.73
14c	Lighting evenness in resident rooms	0–2	0.17	0.38	94.3	0.85	0.84

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Table 1. Distribution and Interrater Reliability of the Therapeutic Environment Screening Survey for Nursing Homes Items (*Continued*)

Therapeutic Goal, Domain, and Item No.[a]	Item Description	Scoring Range	Distribution in a sample of 53 nursing home SCUs		Reliability[b]		
			M	*SD*	% Agreement	τ[c]	κ[d]
Visual/tactile stimulation							
24a	Bedrooms with view of courtyard	0–3	5.24	1.37	83.3	1.00	0.78
24b	Public areas with view of courtyard	0–3	2.66	0.85	91.7	1.00	0.91
25a	Tactile stimulation opportunities	0–3	1.30	0.77	97.2	0.96	0.98
25b	Visual stimulation opportunities[i]	0–3	1.83	1.00	91.7	0.97	0.96
Noise							
30	Status of television in main activity area	0–6	1.57	0.82	94.4	0.93	0.87
31a	Resident screaming/calling out	0–2	2.62	0.54	91.7	0.84	0.88
31b	Staff screaming/calling out	0–2	2.49	0.58	88.9	0.67	0.70
31c	TV/radio noise	0–2	1.85	1.33	86.1	0.86	0.78
31d	Loud speaker/intercom noise[i]	0–2	2.66	0.55	94.4	0.89	0.84
31e	Alarm/call bell noise	0–2	2.51	0.68	100	1.00	1.00
31f	Other machine noise	0–2	2.69	0.61	100	1.00	1.00
Socialization							
Space/seating							
15	% of rooms with a chair per person[e]	0–3	2.62	0.57	58.3	0.61	0.13
16a	Public room inventory	N/A	N/A	N/A	94.4	0.79	0.77
17a	Path leads to dead ends	0–1	0.13	0.34	100	1.00	1.00
17b	Path with places to sit	0–1	0.45	0.50	91.7	0.84	0.82
18	Configuration of rooms on unit	0–2	0.21	0.50	100	1.00	1.00
Personalization/familiarity							
Familiarity/homelikeness							
19	Public areas homelike[i]	0–3	1.43	0.98	58.3	0.71	0.70
20	Kitchen on the unit[i]	0–2	0.89	0.78	83.3	0.84	0.84
21	Pictures/mementos in resident rooms[i]	0–3	1.94	1.01	91.7	0.94	0.95
22	Noninstitutional furniture in resident rooms	0–3	1.36	1.11	66.7	0.82	0.79
23	Resident appearance[i]	0–2	1.30	0.61	74.3	0.62	0.53
Orientation							
Orientation/cueing							
28a1	Doors left open[e]	0–1	0.79	0.40	91.7	0.78	0.75
28b1	Resident's name on/near door	0–1	0.24	0.43	100	1.00	1.00
28c1	Current picture of resident[k,i]	0–1	0.21	0.41	100	1.00	1.00
28d1	Old picture of resident[k,i]	0–1	0.019	0.14	83.3	N/A[g]	N/A[g]
28e1	Objects of personal significance	0–1	0.00	0.00	100	N/A[g]	1.00
28f1	Room numbers	0–1	0.64	0.48	100	1.00	1.00
28g1	Color coding	0–1	0.00	0.00	100	N/A[g]	1.00
28a2	Bathroom door left open; toilet visible from bed[e]	0–1	0.00	0.00	100	N/A[g]	N/A[g]
28b2	Bathroom door open; toilet not visible from bed[e]	0–1	0.29	0.45	91.7	0.82	0.80
28c2	Bathroom door closed; picture or graphic[e]	0–1	0.17	0.39	100	1.00	1.00
28a3	Activity area visible from 50% of resident rooms[e]	0–1	0.42	0.47	83.3	0.66	0.66
28b3	Visual indicator of activity area visible from 50% of resident rooms[e]	0–1	0.25	0.26	100	1.00	1.00
28c3	Direction, identification sign visible from 50% of resident rooms[e]	0–1	0.00	0.00	100	1.00	1.00
Global rating							
32	Subjective rating of overall environment	1–10	5.75	1.70	44.4–80.0[l]	0.67	0.55

Note: SCU = special care unit.

[a]Item numbers have been revised from the unpublished forms used in the National Institute on Aging (NIA) studies.

[b]Twelve simultaneous facility visits by trained raters from the University of North Carolina at Chapel Hill.

[c]Pearson's correlation coefficient for items with >3 response options; otherwise Spearman's.

[d]Kappa.

[e]Items revised or added after the NIA collaborative studies. Reliability for these items was based on 12 simultaneous facility visits by trained raters from the University of Maryland at Baltimore.

[f]Nominal item; correlations are not appropriate.

[g]Unable to compute statistic because at least one rater had no variation in response.

[h]Continuous item; kappa not appropriate.

[i]Indicates items contained in the Special Care Unit Environmental Quality Scale (SCUEQS).

[j]Reliability of glare items can be improved with rater training space (e.g., consistently opening window treatments and turning on lights); a previous reliability study of a composite glare item achieved a correlation of .88 and a kappa of .86.

[k]The two items noted are combined as a single item in the SCUEQS.

[l]Agreement 44.4%; 80% near agreement (within 1 point on a 10-point scale).

mean was 6.7 (SD = 1.4) and the alpha was .72; for safety (5 items), the mean was 6.6 (SD = 2.3) and the alpha was .71; for lighting (6 items), the mean was 7.5 (SD = 2.3) and the alpha was .62; for familiarity/homelikeness (5 items), the mean was 6.9 (SD = 2.9) and the alpha was .63; for visual/tactile stimulation (4 items), the mean was 8.4 (SD = 2.2) and the alpha was .54; and for noises (8 items), the mean was 9.2 (SD = 2.4) and the alpha was .33

Psychometric Properties of the SCUEQS

The mean SCUEQS in the development data set was 26.3 (SD = 5.6), and the range was between 13 and 38. Corrected item-to-total correlations for the SCUEQS ranged between .25 and .67. The Cronbach's alpha in the development data set was .81; in the validation data set, the Cronbach's alpha was .83. As noted above, SCUEQS scores demonstrated an intraclass correlation coefficient of .88 on test–retest data and .93 on interrater data. Table 2 summarizes the item composition and psychometric properties of the SCUEQS.

Principal-components analysis of the 18 SCUEQS items, followed by a test of scree, revealed two components with eigenvalues of 4.66 and 2.21, accounting for 25.9% and 12.3% of the total variance, respectively. The first component accounted for 68% of the variance explained by the first two components. The pattern matrix coefficients from the principal-components analysis (not shown) ranged from .22 to .70 for the first component, with about two thirds of the items exhibiting correlations of .40 and above. Following this, a factor analysis using oblique rotation was conducted; the results are shown in Table 3. The eigenvalues for the factors were 3.48 and 2.75. The correlation between the factors was .271.

Table 3 shows both the pattern matrix of loadings (standardized regression coefficients) and the correlations of the items with the factor contained in the structure matrix. The latter coefficients reflect the correlation inherent in the factors and are typically used for interpretation (see, e.g., Harmon, 1976). Adequacy of the factor pattern was examined through inspection of the residuals (difference between the observed and reproduced correlations from the pattern matrix), which showed that most were less than .05; eight were greater than .12. The overall root mean square off-diagonal residual was .07, indicating adequate fit; however, there were some items that fit less well, most notably the two items related to odors. As shown in Table 3, there is evidence of a possible second factor consisting of items related to lighting, noise, and visual and other stimulation. A number of the items loading on the second factor were not well explained by the factors extracted, a not-unexpected result given that the methodology for scale development was criterion referenced rather than attempting to define a latent attribute (Seraphine, 2000).

Table 2. Item Composition and Psychometric Properties of the Special Care Unit Environmental Quality Scale

Item No.	Item	Corrected Item-to-Total Correlations: Developmental Data Set (n = 53 SCUs)	Validation Data Set (n = 96 SCUs)
7a	Maintenance of shared space	.54	.52
7b	Maintenance of halls	.46	.39
7c	Maintenance of bedrooms	.44	.55
7d	Maintenance of bathrooms	.67	.47
8a1	Cleanliness of shared spaces	.37	.68
8b1	Cleanliness of halls	.44	.52
8b3	Floor surface of halls	.32	.36
9a	Bodily excretion odors in public areas	.25	.29
9b	Bodily excretion odors in residents' rooms	.32	.29
12b	Light intensity in activity areas	.36	.46
12c	Light intensity in residents' rooms	.34	.34
19	Public areas have homelike appearance	.48	.63
20	Kitchen on the unit	.61	.37
21	Pictures/mementos in residents' rooms	.31	.41
23	Resident appearance	.59	.32
25b	Visual stimulation opportunities	.32	.50
28c or 28d	Current or old picture at entrance to resident's room	.25	.31
31d	Loud speaker/intercom noise	.32	.41
Psychometric properties			
Internal consistency		.81	.83
Interrater reliability (n = 12)		.93	NA
Test–retest reliability (n = 21)		.88	

Note: SCU = special care unit.

Table 3. Factor Pattern and Factor Structure Coefficients of the Special Care Unit Environmental Quality Scale After Oblique Rotation Using Direct Oblimin (N = 204)

Variable	M	SD	Factor Pattern (Standardized Regression Coefficients): Factor 1	Factor Pattern: Factor 2	Factor Structure (Item-to-Factor Correlations): Factor 1	Factor Structure: Factor 2
Cleanliness—shared social spaces	1.51	0.58	.362	.453	.485	.551
Cleanliness—halls	1.64	0.51	.476	.280	.552	.409
Maintenance—shared social spaces	1.67	0.49	.800	−.004	.800	.212
Maintenance—halls	1.62	0.52	.776	.030	.784	.240
Maintenance—bedrooms	1.64	0.48	.852	−.119	.820	.112
Maintenance—baths	1.70	0.48	.807	−.036	.800	.182
Floor surface—halls	1.49	0.74	−.069	.554	.081	.535
Odors—public areas	1.65	0.56	.430	−.060	.414	.057
Odors—resident bedrooms	1.55	0.55	.553	−.030	.544	.120
Public area homelike	1.32	1.06	.320	.529	.463	.615
Kitchen on unit for residents	0.62	0.79	.306	.281	.382	.364
Light level in activity areas	2.35	0.62	.204	.392	.311	.447
Light level in resident rooms	1.83	0.80	.020	.486	.151	.492
Intercom noise	2.61	0.56	.056	.371	.157	.386
Current or old photo cue	0.25	0.44	−.057	.395	.051	.380
Picture/mementos in rooms	2.17	1.06	−.046	.545	.101	.533
Visual stimulation	2.03	0.93	−.172	.737	.028	.675
Appearance of residents	1.62	0.54	−.060	.692	.128	.380

Concurrent Validity

When SCUEQS scores were compared with independently conducted expert assessments using the PEAP in 44 SCUs (Norris-Baker et al., 1999), the correlation between the global PEAP assessment (a 5-point scale) and the SCUEQS was moderately strong ($r = .52, p < .01$). In addition, the correlation between the global PEAP scores and the TESS-NH global rating item was very strong ($r = .68, p < .01$).

Light meter levels at four locations in 53 SCU activity areas correlated significantly with TESS-NH ratings of light intensity (rs = .29–.38; ps = .01–.04). Similarly, TESS-NH ratings of light evenness of activity rooms in the same units correlated significantly with the ratio of light meter readings in midroom divided by readings at the darkest area of the room ($r = .33, p < .05$).

Concurrent Outcome Validity

In a study of 53 SCUs in four states, a correlation of −.34 ($p < .01$) was identified between unit SCUEQS scores and the prevalence of resident agitation, averaged over multiple direct daytime observations. Individual items demonstrating significant negative correlations ($p < .05$) with agitation included hall cleanliness, maintenance in public areas, maintenance of bedrooms, urine/stool odor in public areas, availability of kitchen for resident use, and resident grooming. In multivariate analyses involving 35 measures of facility, unit structure, staffing, and treatment procedures, the SCUEQS emerged as the strongest independent predictor of the level of observed resident agitation (Sloane et al., 1998).

Use of the TESS-NH in Non-SCU Settings

In the combined NIA SCU data set, the mean global ratings across settings were 6.46 for 204 SCUs, 5.31 for 80 non-SCU dementia units (e.g., clusters without closed doors), and 6.93 for 45 nondementia units (Sloane et al., 1995). Cronbach's alpha for the SCUEQS was .78 in the non-SCU dementia units and .63 for the non-SCU units.

Discussion

The most established environmental assessment instrument for long-term care settings, the Multiphasic Environmental Assessment Procedure (MEAP), has several drawbacks as an instrument for the study of dementia care environments. It does not address some of the environmental issues that are considered to be important in dementia care; its very detailed assessment is often not suitable for multisite studies or for use by nonresearchers; its scoring is biased toward larger, more institutional settings; and it is compiled at the facility level rather than at the unit level (Moos & Lemke, 1984). During the 1990s, two additional instruments were developed that evaluated the environment of institutional settings for persons with dementia: the PEAP (Lawton et al., 2000; Norris-Baker et al., 1999; Weisman et al., 1994) and the Nursing Unit Rating Scale (NURS) (Grant, 1996). The PEAP is limited, however, by its global nature and the fact that its ratings must be performed by an expert in environmental design (Carp, 1994); the NURS deals primarily with policy and program features rather than physical environmental attributes (Lawton, Weisman, Sloane, & Calkins, 1997). Thus, an objective, dementia-focused environmental assessment tool is needed.

This article describes the development, components, and characteristics of a new instrument, the TESS-NH. It can be completed in a 30–45 min walk through a unit by someone with a relatively modest level of training and experience in person–environment concepts (Lawton et al., 1997). It contains a summary scale, the SCUEQS, that appears to have strong reliability and validity and that consists of discrete, standardized, easily understood components, thereby better identifying sources of differences and, potentially, targets for interventions. Originally developed for the evaluation of nursing home SCUs, the TESS-NH has been successfully used in nonspecialized nursing home units.

The most basic use of the TESS-NH is in the description of individual elements of the physical environment of institutional settings that are considered by experts to be of potential importance in the provision of quality care for persons with Alzheimer's disease and related dementias. A further potential use may be for self-evaluation by administrative and clinical staff of nursing homes and other long-term care facilities. In addition, the SCUEQS provides a single measure of overall environmental quality that may be useful in comparative outcome studies of long-term care settings, thereby distilling environmental quality into one variable that can, for example, be entered into regression analyses. Similarly, the SCUEQS, or a modification of it, might be useful to families or others interested in making a quick assessment of the overall quality of an SCU.

The results of an exploratory factor analysis of the SCUEQS indicate that the item set may not be unidimensional in that a second (albeit minor) factor emerged; however, inspection of the pattern and structure matrices (Table 2) shows that several of the items load on both factors and that the loadings for numerous items are not especially high. Although definitive interpretation must await cross validation, this result is not unexpected because the scale was developed using a procedure that does not necessarily produce an item set that is highly intercorrelated or that has high correlations with a specific underlying factor. Because of the exploratory nature of the analyses, it is not possible to define the exact dimensionality of the scale; nonetheless, the results provide preliminary data for future investigation.

The results of the exploratory factor analysis should be considered in the context of different goals of scale development. One goal is to best measure a theoretical underlying latent attribute; a second is to reduce parsimoniously the number of variables in an analysis; a third is to maximize the relationship of a measure with a criterion. Exploratory factor analyses have frequently been used as a first step in pursuing the first goal (to ensure a highly intercorrelated item set that is reflective of the underlying factors). The SCUEQS was developed to address the third goal, and this method of scale development will not necessarily produce the most satisfactory factor analytic result. Nonetheless these results suggest that (a) the SCUEQS, although developed using a different philosophy, does appear to reflect a theoretical construct, (b) it can be treated as a relatively homogeneous measure of such a construct, and (c) there is some evidence suggesting that the SCUEQS may reflect more than one underlying dimension. Thus, although investigators using the SCUEQS are encouraged to conduct factor analyses to determine the dimensionality of the SCUEQS in other data sets, the current recommendation would be to use the SCUEQS as a single scale.

Estimates of the interrater and test–retest reliability of the TESS-NH were generally high. However, caution must be taken because few raters were involved. The typical study of test–retest reliability examines only a subset of cases rated by two or more raters, with the remaining cases rated by only one rater. When only one rater rates cases, the interrater reliability may be overestimated. Moreover, examining interrater reliability when only two raters are involved limits decomposition of the variance due to raters and may therefore not adequately represent the variability in ratings (Fan & Chen, 2000). Furthermore, because the item base rate influences reliability coefficients, interpretations of the magnitude of coefficients must be made cautiously. Landis and Koch (1977) and Fleiss (1981) presented widely cited, although somewhat controversial, guidelines for interpreting coefficient kappa (see, e.g., Dunn, 1989; Roberts & McNamee, 1998). Landis and Koch considered .40 as moderate agreement and .60–.80 as substantial.

Not all items in the final TESS-NH meet the criteria for moderate or substantial agreement. Additional items were retained for one or more of the following reasons: (a) Items 7a, 7b, 13c, 15, and 28a2 were revised after primary data collection, with expectation for greater reliability with increased rater training and experience; (b) skewed distributions reduced or invalidated the kappa of Items 4c, 5a, 11a, 11b, 28d1, 28e1, 28g1, and 29a; (c) rater bias was noted during reliability testing of Items 8a, 8b, 8c, 9a, and 9b, thereby lowering the percentage of agreement; and (d) Items 6e, 6i, 10c, 27a, and 27b were believed to be the best available measure of an important environmental domain. Regardless of reported reliabilities, investigators using the TESS-NH are encouraged to conduct reliability studies on all items in their own settings.

Several additional caveats are noted. Because few principles of environmental quality are backed by controlled trials, both the TESS-NH and the SCUEQS rest largely on untested empirical grounds. Also, some resident-specific goals of physical design are difficult to evaluate on a unit level, and therefore are poorly represented by the TESS-NH. The most noteworthy example is the capacity of the environment to maximize resident function, in that environmental interventions may require evaluation at the resident level rather that at the unit level (Lawton et al., 1997; Namazi & Johnson, 1992; Norris-Baker et al., 1999). Furthermore, because the development of the TESS-NH favored retention of items that had some dispersion across the nursing home SCUs in the NIA data set, rare design elements or innovations from other sectors (e.g., assisted living) would not be detected by this instrument. Thus, the TESS-NH provides estimates that are rooted in the current state of the field of environmental design and health. Future work will better establish the role of the TESS-NH and its variables in evaluating quality and will identify areas where additional or different measures are appropriate.

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This is dedicated to the memory of Powell Lawton, our colleague and mentor.

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References

Annerstedt, L. (1994). An attempt to determine the impact of group living care in comparison to traditional long-term care on demented elderly patients. *Aging Clinical Experimental Research, 6*, 372–380.

Brawley, E. C. (1997). *Designing for Alzheimer's disease.* New York: Wiley.

Calkins, M. P. (1988). *Design for dementia: Planning environments for the elderly and the confused.* Owings Mills, MD: National Health.

Carp, F. (1994). Assessing the environment. *Annual Review of Gerontology and Geriatrics, 14*, 302–314.

Cohen, U., & Weisman, G. (1991). *Holding on to home.* Baltimore: Johns Hopkins University Press.

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika, 16*, 297–334.

Cruise, P. A., Schnelle, J. F., Alessi, C. A., Simmons, S. F., & Ouslander, J. G. (1998). The nighttime environment and incontinence care practices in nursing home residents. *Journal of the American Geriatrics Society, 46*, 181–186.

Day, K., Carreon, D., & Stump, C. (2000). The therapeutic design of environments for people with dementia: A review of empirical research. *The Gerontologist, 40*, 397–416.

Drinka, P. J., Krause, P., Schilling, M., Miller, B. A., Shult, P., & Gravenstein, S. (1996). Report of an outbreak: Nursing home architecture and influenza-A attack rates. *Journal of the American Geriatrics Society, 44*, 910–913.

Dunn, G. (1989). *Design and analysis of reliability studies.* New York: Oxford University Press.

Elm, D., Warren, S., & Madill, H. (1998). The effects of auditory stimuli on functional performance among cognitively impaired elderly. *Canadian Journal of Occupational Therapy, 65*, 30–36.

Eppig, F. J., & Poisal, J. A. (1997). Mental health of Medicare beneficiaries: 1995. *Health Care Financing Review, 15*, 207–210.

Fan, X., & Chen, M. (2000). Published studies of interrater reliability often overestimate reliability: Computing the correct coefficient. *Educational and Psychological Statistics, 60*, 532–542.

Fleiss, J. L. (1981). *Statistical methods for rates and proportions* (2nd ed.). New York: Wiley.

Grant, L. A. (1994). Conceptualizing and measuring social and physical environments in special care units. *Alzheimer Disease and Associated Disorders, 8*, S321–S327.

Grant, L. A. (1996). Assessing environments in Alzheimer's special care units: Nursing Unit Rating Scale. *Research on Aging, 18*, 275–291.

Hall, G., Kirschling, M. V., & Todd, S. (1986). Sheltered freedom—an Alzheimer's unit in an ICF. *Geriatric Nursing, May/June*, 132–137.

Hanger, M. A., Ancoli-Israel, S., Kripke, D. F., Jones, D. W., & Almendarez, L. (1992). Effect of phototherapy on depression in nursing home residents. *Sleep Research, 21*, 88.

Harmon, H. H. (1976). *Modern factor analysis.* Chicago: University of Chicago Press.

Kahana, E. (1982). A congruence model of person environment interaction. In M. P. Lawton, P. G. Windley, & T. O. Byerts (Eds.), *Aging and the environment: Theoretical approaches.* New York: Springer.

Kish, L. (1965). *Survey sampling.* New York: Wiley.

Landis, J. R., & Koch, G. G. (1977). Agreement measures for categorical data. *Biometrics, 33*, 159–174.

Lawton, M. P. (1980). Residential quality and residential satisfaction among the elderly. *Research on Aging, 2*, 309–328.
Lawton, M. P. (1986). *Environment and aging.* Albany, NY: Center for the Study of Aging.
Lawton, M. P., Fulcomer, M., & Kleban, M. (1984). Architecture for the mentally impaired elderly. *Environment and Behavior, 16*, 730–757.
Lawton, M. P., & Nahemow, L. (1973). Ecology and the aging process. In C. Eisdorfer & M. P. Lawton (Eds.), *The psychology of adult development and aging.* Washington, DC: American Psychological Association.
Lawton, M. P., Weisman, G. D., Sloane, P., & Calkins, M. (1997). Assessing environments for older people with chronic illness. In J. A. Teresi, M. P. Lawton, D. Holmes, & M. Ory (Eds.), *Measurement in elderly chronic care populations.* New York: Springer.
Lawton, M. P., Weisman, G. D., Sloane, P., Norris-Baker, C., Calkins, M., & Zimmerman, S. I. (2000). Professional Environmental Assessment Procedure for special care units for elders with dementing illness. *Alzheimer's Disease and Associated Disorders, 14*, 28–38.
Mace, N. (1991). Dementia care units in nursing homes. In D. H. Coons (Ed.), *Specialized dementia care units.* Baltimore: Johns Hopkins University Press.
Mooney, P., & Nicell, P. L. (1992). The importance of exterior environment for Alzheimer residents: Effective care and risk management. *Healthcare Management Forum, 5*, 23–29.
Moos, R. H. (1980). Specialized living environments for older people: A conceptual framework. *Journal of Social Issues, 36*, 75–94.
Moos, R. H., & Lemke, S. (1980). Assessing the physical and architectural features of sheltered care settings. *Journal of Gerontology, 35*, 571–583.
Moos, R. H., & Lemke, S. (1984). *Multiphasic Environmental Assessment Procedure (MEAP): Manual.* Palo Alto, CA: Social Ecology Laboratory, Veterans Administration, and Stanford University Medical Center.
Morgan, D. G., & Stewart, N. J. (1998). High versus low density special care units: Impact on the behavior of elderly residents with dementia. *Canadian Journal on Aging, 17*, 143–165.
Namazi, K. H., & Johnson, B. D. (1991). Physical environmental cues to reduce the problems of incontinence in Alzheimer's disease units. *American Journal of Alzheimer's Care and Related Disorders and Research, 6*(6), 16–21.
Namazi, K. H., & Johnson, B. D. (1992). Dressing independently: A closet modification model for Alzheimer's disease patients. *American Journal of Alzheimer's Care and Related Disorders and Research, 7*(1), 22–28.
Namazi, K. H., Rosner, T. T., & Rechlin, L. (1991). Long-term memory cuing to reduce visuo-spatial disorientation in Alzheimer's disease patients in a special care unit. *American Journal of Alzheimer's Care and Related Disorders and Research, 6*(6), 10–15.
Nehrke, M. F., Turner, R. R., Cohen, S. H., Whitbourne, S. K., Morganti, J. B., & Hulicka, I. M. (1981). Toward a model of person-environment congruence: Development of the EPPIS. *Experimental Aging Research, 7*, 363–379.
Nelson, J. (1995). The influence of environmental factors in incidents of disruptive behavior. *Journal of Gerontological Nursing, 21*(5), 19–24.
Netten, A. (1989). The effect of design of residential homes in creating dependency among confused elderly residents: A study of elderly demented residents and their ability to find their way around homes for the elderly. *International Journal of Geriatric Psychiatry, 4*, 143–153.
Norris-Baker, C., Weisman, G., Lawton, M. P., Sloane, P., & Kaup, M. (1999). Assessing special care units for dementia: The Professional Environmental Assessment Protocol. In E. Steinfeld & G. S. Danford (Eds.), *Enabling environments: Measuring the impact of environment on disability and rehabilitation.* New York: Kluwer Academic/Plenum.
Ohta, R. J., & Ohta, B. M. (1988). Special units for Alzheimer's disease patients: A critical look. *The Gerontologist, 28*, 803–808.
Reed, J., Payton, V. R., & Bond, S. (1998). The importance of place for older people moving into care homes. *Social Science and Medicine, 46*, 859–867.
Roberts, C., & McNamee, R. (1998). A matrix of kappa-type coefficients to assess the reliability of nominal scales. *Statistics in Medicine, 17*, 471–488.
Schnelle, J. F., Cruise, P. A., Alessi, C. A., Ludlow, K., Al-Samarrai, N. R., & Ouslander, J. G. (1998). Sleep hygiene in physically dependent nursing home residents: Behavioral and environmental intervention implications. *Sleep, 21*, 515–523.
Seraphine, A. E. (2000). The performance of DIMTEST when latent trait and item difficulty distributions differ. *Applied Psychological Measurement, 24*, 82–94.
Sloane, P. D., & Mathew, L. J. (1990). The Therapeutic Environment Screening Scale. *American Journal of Alzheimer's Care, 5*(6), 22–26.
Sloane, P. D., Mitchell, C. M., Long, K., & Lynn, M. (1995). *TESS 2+ Instrument B: Unit observation checklist—physical environment: A report on the psychometric properties of individual items, and initial recommendations on scaling*. Chapel Hill: University of North Carolina.
Sloane, P. D., Mitchell, C. M., Preisser, J. S., Phillips, P., Commander, C., & Burker, E. (1998). Environmental correlates of resident agitation in Alzheimer's disease special care units. *Journal of the American Geriatrics Society, 46*, 1–8.
Teresi, J., Lawton, M. P., Ory, M., & Holmes, D. (1994). Measurement issues in chronic care populations: Dementia special care. *Alzheimer Disease and Associated Disorders, 8* (Suppl. 1), S144–S183.
U.S. Congress, Office of Technology Assessment. (1987). *Losing a million minds: Confronting the tragedy of Alzheimer's disease and other dementias* (OTA-BA-323). Washington, DC: U.S. Government Printing Office.
Weisman, G. D. (1981). Modeling environment-behavior systems: A brief note. *Journal of Man-Environment Relations, 1*, 82–87.
Weisman, G. D. (1987). Improving way-finding and architectural legibility in housing for the elderly. In V. Regnier & J. Pynoos (Eds.), *Housing and the aged: Design directives and policy considerations.* New York: Elsevier.
Weisman, G. D. (1991). Environments for older persons with cognitive impairments: Toward an integration of research and practice. In G. Moore & R. Marans (Eds.), *Advances in environment, behavior and design* (Vol. 4). New York: Plenum Press.
Weisman, G. D., Lawton, M. P., Sloane, P. D., Norris-Baker, C., & Calkins, M. (1994). *The Professional Environmental Assessment Protocol (PEAP).* Milwaukee: University of Wisconsin—Milwaukee School of Architecture.

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