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Design of the physical environment is increasingly recognized as an important aid in caring for people with dementia. This article reviews the empirical research on design and dementia, including research concerning facility planning (relocation, respite and day care, special care units, group size), research on environmental attributes (noninstitutional character, sensory stimulation, lighting, safety), studies concerning building organization (orientation, outdoor space), and research on specific rooms and activity spaces (bathrooms, toilet rooms, dining rooms, kitchens, and resident rooms). The analysis reveals major themes in research and characterizes strengths and shortcomings in methodology, theoretical conceptualization, and applicability of findings.

Key Words: Architecture, AlzheimerÕs disease, Nursing homes, Assisted living

The Therapeutic Design of Environments for People With Dementia: A Review of the Empirical Research

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Design of the physical environment is increasingly recognized as an important aid in the care of people with AlzheimerÕs disease and other dementias. Facility administrators and designers now view the design of long-term care, assisted living, and other environments as more than simply decorative. Design is regarded as a therapeutic resource to promote well-being and functionality among people with dementia. This article reviews and analyzes findings from empirical research on the therapeutic impacts of design in dementia care settings.

Since the early 1980s, numerous Òdesign guidesÓÑbooks and articles offering planning, architectural, and interior design recommendationsÑhave been written to instruct architects and care providers on how to enhance safety, homelikeness, and so forth in dementia care facilities. At least four books of design guidance for dementia environments have been published to date (see Brawley, 1997; Calkins, 1988; Cohen & Day, 1993; Cohen & Weisman, 1991), along with numerous articles in scholarly and professional books and journals (see Appendix A, Note 1). Design recommendations for dementia environments are organized on a continuum by scale, as follows (after Cohen & Weisman, 1991): (a) planning principlesÑbroad decisions made when developing a dementia care facility (e.g., facility planning should accommodate a continuum of care); (b) general attributesÑdesired qualities of the overall environment of the facility (e.g., facility design should promote noninstitutional character); (c) building organizationÑdesired arrangement of spaces within the facility (e.g., building design should support residentsÕ sense of orientation); and (d) specific rooms and activity spacesÑthe design of particular rooms within the facility (e.g., design of bathrooms should preserve residentsÕ dignity and privacy).

Design guides typically offer ÒhypothesesÓ for how the spatial organization and appointment of the physical environment may promote well-being for people with dementia. For example, to minimize the sensory overstimulation that afflicts many people with dementia, design guides recommend modifications such as designation of quiet rooms with soft colors, elimination of unnecessary clutter, and removal of paging systems (cf. Brawley, 1997; Cohen & Weisman, 1991). Frequently, design guidance is based on the practical experience of designers or facility administrators; other times, design guidance is research based, applying findings from clinical research on dementia in the form of design ÒsolutionsÓ (Weisman, Calkins, & Sloane, 1994).

Not all design guidance requires empirical re-

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Other design guidance does demand verification through empirical research, however. Empirical research is needed to resolve situations in which conflicting design recommendations are offered. Research is also warranted when recommended design solutions are of unknown effectiveness or when design recommendations have major or controversial impacts for cost or quality of life. Research on design and dementia has been conducted in earnest since at least 1980, yet findings of many studies remain unknown among designers and facility administrators. In the following sections, we review and analyze existing studies of design and well-being for people with dementia to enhance the design of dementia facilities and to provide direction for future research.

Methods

Several strategies were used to identify potential studies for review. The first involved a key-word search of four major databases: Psych Abstracts, Medline, MAGS, and CAT (see Appendix A, Note 2). Potential studies were also identified by reviewing all issues (1980 or later) of several journals in gerontology and environment-design research (see Appendix A, Note 3). Finally, reference lists were inspected for all studies included in this review. In each case, articles, books, and chapters identified as potentially relevant (by title and by abstract if available) were collected and assessed for appropriateness.

Studies included in this review met the following criteria: a report of empirical research (see Appendix A, Note 4), published 1980 or later (see Appendix A, Note 5), written in English, with an emphasis on people with dementia or their families or staff caregivers, and with a substantial (though sometimes secondary) emphasis on the relationship between *the design of the physical environment* and the *well-being of people with dementia, their families, and/or staff.* For this review, the physical environment was loosely defined as the domain of relevance to architects, interior designers, facility managers, and/or administrators or caregivers undertaking environmental design or renovation. Thus, research on issues such as lighting, furnishings, and outdoor space was included. Research on microscale ÒproductÓ design (e.g., prosthetic devices to facilitate eating) or on the sensory or social environment outside the purview of designers (e.g., incorporation of music and pets) was excluded, as were studies that did not examine actual environments or actual impacts. Well-being was defined broadly, to include factors such as residentsÕ activities of daily living (ADL), physical well-being, cognitive function, and problem behaviors; family membersÕ well-being; and staff well-being and job performance. Seventy-one research reports were included in the review. Because of this selective search strategy, we may have overlooked some relevant material in the review.

Research Design and Sample Size

Much research on design and dementia comprises small size samples. For example, more than 30% of the studies reviewed used samples of fewer than 30 participants; many included less than 10 participants. Sample sizes reflect the limited populations of residents at the single facility in which many studies were conducted, the high rates of resident mortality, and facilitiesÕ limited populations of residents in comparable stages of dementia. Although they raise concern for the validity and generalizability of findings, studies with small samples were included so as not to severely restrict the scope of this review. Research designs and samples are described in Table 1.

Results

The rate of research on design and dementia is increasing: from 6 research reports from 1981Ð1985, to 17 research reports from 1986Ð1990, to 26 research reports from 1991Ð1995, and to 21 research reports already published since 1996 (see Table 1). This section summarizes findings from the research reports reviewed, according to the organizational framework presented earlier (i.e., planning principles, general attributes of the environment, building organization, and specific rooms and activity spaces). The summary is followed by a discussion and analysis of existing research on design and dementia.

Planning Principles

These studies examine broad decisions regarding the development of dementia care settings. Studies examined impacts for well-being following relocation of people with dementia to new environments, use of respite and day care environments and of special care units (SCUs), and exposure to various group sizes of residents.

Relocation to New Environments.ÑFindings are mixed regarding the impacts of relocating people with dementia to new environments (Robertson, Warrington, & Eagles, 1993; Seltzer et al., 1988; see Appendix A, Note 6). When moved together as intact units of residents and staff, people with dementia appear to suffer few or no adverse impacts from relocation (Anthony, Procter, Silverman, & Murphy, 1987; McAuslane & Sperlinger, 1994; Robertson et al., 1993). The more pleasant environment of a new facility may partially explain the lack of negative impact for relocated residents (according to McAuslane & Sperlinger, 1994). In contrast, residents with dementia who are moved individually appear to suffer higher rates of depression and mortality following relocation (Anthony et al., 1987; Robertson et al., 1993). This effect holds when residents undergo orientation to ease relocation. Staff members also report decreased job satisfaction (attributed to anxiety) prior to moving, which returns to premove levels of satisfaction following relocation (McAuslane & Sperlinger, 1994).

Respite Environments.ÑRespite environments offer temporary care for people with dementia and provide relief to families. The impacts of respite environ-

Table 1. Summary of Key Information on the Studies Reviewed on Design and Dementia

Study	Concept of environment[a]; Focus of study	Research design	Sample information	Outcome measures of well-being	Physical environment features	Major finding(s) of environmental impacts on well-being
Annerstedt (1997)	Global; Environmental comparison	Quasi-experiment	28 residents[b] in group living; 29 residents in nursing homes; 293 residents in multiple environments	ResidentsÕ ADLs, social dependency, disorientation, confusion, aggressiveness, depression, anxiety, vocal disruptions	Group living units: small scale, private living/bedroom, shared living area and laundry	Group living had therapeutic impacts on people with dementia, especially in early stages.
Annerstedt (1994)	Global; Environmental comparison	Quasi-experiment	28 residents in group living; 29 residents in nursing homes	ResidentsÕ physical and social dependence; intellectual, emotional, and motor functions; confusion, irritability, anxiety, fear, mood, restlessness	Group living units: small scale, private living/bedroom, shared living area and laundry	Group living environments minimized dementia deficits.
Annerstedt (1993)	Global; Environmental comparison	Longitudinal study	28 residents in group living; 31 residents in nursing homes	ResidentsÕ brain damage; motor, intellectual, emotional ability; ADLs, dementia symptoms, physical activity, drug usage, cost of care	Group living units: small scale, private living/bedroom, shared living area and laundry	Group living units were associated with decreased deficits among residents, reduced emotional strain among relatives, and increased competence and satisfaction among staff.
			relatives[c]	RelativesÕ emotional strain, attitudes towards care		
			staff members[§]	Staff job satisfaction, attitudes towards care, knowledge of dementia		
Anthony, Procter, Silverman, & Murphy (1987)	Global; Environmental services & policies	Quasi-experiment	14 relocated residents; 39 nonrelocated residents in psychiatric hospitals	ResidentsÕ physical health, psychotropic and other drug usage, disruptive behavior (wandering, treatment compliance, depressed mood, activity level); psychogeriatric dependency (orientation, self-care, memory, sensory deficits, mobility, continence, feeding)	Relocation between hospitals	Relocation to a new unit was associated with depressive behavior and disorientation among residents.
			8 relatives of relocated residents	RelativesÕ satisfaction with unit and care		
Bellelli et al., (1998)	Global; Environmental comparison	Quasi-experiment	55 residents in 8 SCUs	ResidentsÕ cognition, function, behavior, somatic health, use of drugs, use of physical restraints	SCUs: magnetic locks, no environmental obstacles, neutral wall colors, sound-proofing, brightly colored room doors and handrails, separate activity area	Residents in SCU demonstrated reduced behavioral disturbances and decreased use of psychotropic drugs and physical restraints.
Benson, Cameron, Humbach, Servino, & Gambert (1987)	Global; Environmental comparison	One group pretest/ posttest	32 residents in SCU	ResidentsÕ mental and emotional status (including orientation, intellectual behavior, social behavior, social interaction), ADLs, nursing needs	SCU: orientation board, color coded rooms, names/photos on doors, alarm, double door knobs	Residents in SCU demonstrated prolonged increases in mental and emotional functioning and ADLs.
Bianchetti, Benvenuti, Ghisla, Frisoni, & Trabucchi (1997)	Global; Environmental comparison	One group pretest/ posttest	16 residents in SCU	ResidentsÕ cognitive status, ADLs, behavioral ratings, psychotropic drug use, physical restraint use	SCU: shared rooms, large wandering area, activity area, dining room, locked doors, wayfinding cues	Upon relocation to SCU, residents demonstrated significant declines in behavioral problems, without improvements in functional abilities or cognitive status.
Chafetz (1991)	Global; Environmental comparison	Quasi-experiment	12 residents in SCU; 8 residents in nonspecialized dementia unit	ResidentsÕ cognitive ability, behavioral appropriateness	SCU: outdoor patio, secure exit doors, secure closet and bureau drawers	SCU was associated with little impact on residentsÕ behavior and cognitive function.
Chafetz (1990)	Discrete; Design features	Quasi-experiment	30 residents in SCU	ResidentsÕ actual and attempted door openings	Tape strips in front of double, glass exit doors	Tape grid in front of glass door did not reduce exit attempts.
Cleary, Clamon, Price, & Shullaw (1988)	Global; Environmental comparison	Quasi-experiment	11 residents in SCU	ResidentsÕ functional behaviors, agitation, wandering, incontinence, food consumption, sleep, restraint use, medications, weight, perceptions of unit	SCU: shared rooms; tables for dining in resident rooms; neutral colors, decorations; no TVs, radios, or telephones	SCU was associated with improvements in residentsÕ functioning, including reductions in weight loss, agitation, restraint use, and wandering. Family and staff were satisfied with the SCU.
			11 relatives of residents	RelativesÕ satisfaction with the unit		
			32 staff members in SCU 37 general staff	Staff knowledge of dementia, satisfaction with work environment		
Cohen-Mansfield & Werner (1998)	Discrete; Problem behaviors	Quasi-experiment	27 residents in nursing home	ResidentsÕ location in the unit, body position, exit-seeking and trespassing, agitation, mood, pacing and wandering, confusion	Enhanced nursing home, incorporating visual, olfactory, and auditory stimuli to simulate home or nature environment	Enhanced nursing home environment was associated with positive impacts on the behavior and mood of residents who pace; staff and relatives also preferred enhanced environments.
			23 relatives of residents	Preferences for modified environments		
			29 staff members in nursing home			

(Table continues on next page)

Table 1. Summary of Key Information on the Studies Reviewed on Design and Dementia (*continued*)

Study	Concept of environment[a]; Focus of study	Research design	Sample information	Outcome measures of well-being	Physical environment features	Major finding(s) of environmental impacts on well-being
Cohen-Mansfield, Werner, & Marx (1990)	Discrete; Problem behaviors	Survey	24 residents in long-term care facility	ResidentsÕ agitation	Location in the unit	Agitation of residents was associated with residentsÕ location in the unit.
Dickinson, McLain-Kark, & Marshall-Baker (1995)	Discrete; Design features	One group pretest/ posttest	7 residents in SCU	ResidentsÕ exit attempts	Alarmed emergency exit doors with closed miniblinds over windows, cloth cover over panic bar	Visual barriers significantly reduced residentsÕ exit attempts.
ElmstŒhl, Annerstedt, & •hlund (1997)	Discrete; Design features	Quasi-experiment	105 residents in group living units	ResidentsÕ confusion, disorientation	Building layouts, amount of space, lighting, noise, size of hallways, homelike appearance and furnishings	Resident orientation was associated with group living unit design that facilitates perception without reducing Ócommunication area.Ó
Gštestam & Melin (1987)	Discrete: Design features	Experiment	21 residents in psychogeriatric ward (19 with dementia)	ResidentsÕ eating behavior, communication, activity levels	Noninstitutional dining arrangements (dining in coffee room at small tables with family	

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Table 1. Summary of Key Information on the Studies Reviewed on Design and Dementia (*Continued*)

Study	Concept of environment[a]; Focus of study	Research design	Sample information	Outcome measures of well-being	Physical environment features	Major finding(s) of environmental impacts on well-being
Kihlgren, Brœne, Karlsson, Kuremyr, Leissner, & Norberg (1992)	Global; Environmental comparison	Quasi-experiment	5 residents in collective living home 5 residents of nursing home relatives[c] staff[d]	ResidentsÕ mental and somatic health: orientation, motor functions, vision, hearing, speech, ADLs, behavioral disturbance, work load, psychiatric symptoms Perceptions of residents, residentsÕ living	Collective living home: separate apartments with own furniture, rooms for common activities	Residents in collective living demonstrated better social abilities, more alertness, reduced depression, and more disturbances, than did residents in a nursing home. Staff were more accepting of residentsÕ behavior in collective living than in nursing home.
Koss & Gilmore (1998)	Discrete; Design features	Quasi-experiment	13 residents in dementia unit	ResidentsÕ amount of food intake, amount of help needed eating, agitation	Increased light intensity, high contrast tablecloth, place mats, dishes, and so forth for dining	Heightened contrast and increased light were associated with increased food eaten and reduced agitation among residents.
Kovach & Meyer-Arnold (1996)	Discrete; Problem behaviors	Cross-sectional survey	18 residents in SCU 15 clients in day care program	ResidentsÕ behavior (especially agitation) during bathing, caregiver behavior during bathing	Physical features in and outside the bathroom that impact bathing, tubs versus showers	Environmental (and other) features are associated with increased agitation during bathing.
Lawton, Liebowitz, & Charon (1970)	Global; Environmental comparison	Quasi-experiment	9 original residents in long-term care, 6 new residents (including one original) in SCU	ResidentsÕ mental status, number of personnel present, staff-to-resident interaction, resident-to-resident interaction, self-maintaining behavior, active interest, location of resident, excursions off unit	SCU: private rooms, noninstitutional design (bright colors, pattern, bird noises, planter, space for personal belongings), defined social space	SCU was associated with decreased personal interactions, decreased self-maintaining behavior, increased mobility, and increased range of behavior among residents.
Lawton, Fulcomer, & Kleban (1984)	Global & discrete; Environmental comparison	Post-occupancy evaluation	56 residents in SCU 134 relatives of long-term care residents 86 relatives of SCU residents 80 staff members in long-term care unit 60 staff members in SCU	ResidentsÕ location and social behavior RelativesÕ assessment of old and new building Staff assessment of old and new building	SCU: bright room decor, color coding, graphics, large orienting stimuli, large central area	SCU design was associated with increased therapeutic impact, decreased pathological behaviors, and decreased self-maintenance behaviors among residents. SCU design was associated with increased visits from relatives.
Lovell, Ancoli-Israel, & Gevirtz (1995)	Discrete; Design features	Quasi-experiment	6 residents in skilled nursing facility	ResidentsÕ agitation	Exposure to bright light	Exposure to bright light reduced resident agitation, with greatest impacts on residents in mid- to late-stage dementia.
Lyman (1989)	Global; Environmental comparison	Quasi-experiment	staff at day care center for dementia and nondementia clients[c]	Staff stress and quality of caregiving	Relocation of day care center to enhanced facility (safety and surveillance features, enclosed garden, therapy rooms)	Relocation of day care center to enhanced facility was associated with positive and negative changes in the nature of staff stress and quality of care.
Mayer & Darby (1991)	Discrete; Design features	Quasi-experiment	9 residents in psychogeriatric ward	ResidentsÕ exit attempts	Placement of mirror, reverse mirror in front of exit door	Mirror in front of exit door reduced residentsÕ exit attempts.
McAllister & Silverman (1999)	Global; Environmental comparisons	Ethnographic study	Population of personal care home of 59 residents, 8 residents in personal care home 8 residents in nursing home	ResidentsÕ experience of community, participation in		

Table 1. Summary of Key Information on the Studies Reviewed on Design and Dementia (*continued*)

Study	Concept of environment[a]; Focus of study	Research design	Sample information	Outcome measures of well-being	Physical environment features	Major finding(s) of environmental impacts on well-being
McAuslane & Sperlinger (1994)	Global; Environmental services & policies	Quasi-experiment	15 residents relocated to community nursing home 12 residents remaining in psychogeriatric ward 16 relocated staff 19 staff not relocated	ResidentsÕ behavioral dependence, problem behaviors Staff job satisfaction	Relocation from a psychogeriatric ward to a community nursing home	Relocated residents showed no evidence of changes in behavioral dependency or in the number of problem behaviors. Staff initially reported increased job dissatisfaction prior to relocation.
McCracken & Fitzwater (1989)	Global; Environmental comparison	One group pretest/ posttest	11 residents in SCU	ResidentsÕ behavior (language, social interaction, attention, orientation, motor coordination, incontinence, eating, dressing, and grooming)	Open versus closed dementia unit	Closed SCU was associated with improved functioning among residents.
Melin & Gštestam (1981)	Discrete; Design features	Experiment	21 residents in psychogeriatric ward (19 with dementia)	ResidentsÕ eating behavior, communication	Noninstitutional dining arrangements	Noninstitutional dining arrangements improved eating behavior and communication among residents.
Mishima, Okawa, Hishikawa, Hozumi, Hori, & Takahashi (1994)	Discrete; Design features	Experiment	14 residents in psychogeriatric ward 10 residents without dementia in psychiatric hospital	ResidentsÕ sleep time, behavior disorders, melatonin secretion levels	Exposure to morning bright light therapy	Exposure to bright light increased residentsÕ total and night sleep time, reduced day sleep time, and reduced behavior disorders.
Moony & Nicell (1992)	Discrete; Design features	Longitudinal study	Residents in five SCUs (each with 25Ð31 residents)	ResidentsÕ incidents (falls, injuries, aggression, missing, other), time spent outdoors	Therapeutic and traditional outdoor environments	Use of outdoor environments reduced incidents and aggressive behavior among residents.
Moore (1999)	Global; Implied environmental comparison (though one case only)	Ethnography	22 residents in SCU Staff in SCU	ResidentsÕ experience of dining, social interaction, homelikeness, interactions with staff Staff behavior and attitudes towards residents	SCU: small group size; clustered dining and living rooms, kitchen; wandering area, views to outdoors, day light, religious corner, common areas	SCU was associated with enhanced social interaction and friendship formation among residents, but organizational and physical factors in SCU limit therapeutic potential.
Morgan & Stewart (1999)	Discrete; Design features	Cross-sectional survey	9 relatives of residents relocated from high to low density SCU 9 relocated staff members	RelativesÕ assessment of buildings, perceptions of density and of private rooms Staff assessment of buildings, perceptions of density and of private rooms	Low density SCU: small group size, overall facility size, private rooms and bathrooms	Small group size, small facility size, and private residents rooms of SCU were evaluated as positive features.
Morgan & Stewart (1998)	Discrete; Design features	Quasi-experiment	39 residents relocated from one high density long-term care unit to another 14 residents relocated from high density long-term care to low density SCUs 11 residents remaining in high density unit	ResidentsÕ disruptive and nondisruptive behavior	Group size, overall facility size, private rooms and bathrooms	Residents relocated to low density SCU displayed improvements in disruptive and nondisruptive behavior.
Namazi & Johnson (1996)	Discrete; Problem behaviors	Longitudinal study	22 residents in SCU 12 primary care staff in SCU	ResidentsÕ bathing habits; bathing safety; bathing problem behavior, especially aggression and agitation Staff perceptions of bathing and bathing problems	Bathing environment and equipment	Institutional tub was associated with

Table 1. Summary of Key Information on the Studies Reviewed on Design and Dementia (*continued*)

Study	Concept of environment[a]; Focus of study	Research design	Sample information	Outcome measures of well-being	Physical environment features	Major finding(s) of environmental impacts on well-being
Satlin, Volicer, Ross, Herz, & Campbell (1992)	Discrete; Design features	Quasi-experiment	10 residents in veterans hospital	ResidentsÕ agitation, sleep patterns, restraint usage, medication usage	Exposure to bright light	Exposure to bright light was associated with improved sleep patterns among residents, but not with reduced agitation or reduced use of restraints.
Saxton, Silverman, Ricci, Keane, & Deeley (1998)	Global; Environmental comparison	Longitudinal study	26 residents in SCU 19 residents in nursing home	ResidentsÕ ADLs (self-care, toileting, social/cognitive function, mobility), cognitive impairment, problem behaviors, depression, falls	SCU: cluster design, small groups, wandering path	SCUs were associated with preserved mobility among residents, but not with reduced functional decline.
Scandura (1995)	Discrete; Problem	8 m6pdepresce.ai11.7809 2.285retD (Concept of)Tj -0.6499j 9 0 339ued				

a major survey of 53 SCUs in four states (Sloane et al., 1998). According to this study and others, larger unit sizes are associated with higher resident agitation levels and with increased intellectual deterioration and emotional disturbances (Annerstedt, 1994; Sloane et al., 1998). Further, residents in larger units exhibit more frequent territorial conflicts, space invasions, and aggressiveness toward other residents (Morgan & Stewart, 1998). In contrast, people with dementia residing in smaller units experience less anxiety and depression and more mobility (Annerstedt, 1997; Skea & Lindesay, 1996). Small group sizes are also positively associated with increased supervision and interaction between staff and residents (McCracken & Fitzwater, 1989) and with social interaction and friendship formation among residents (McAllister & Silverman, 1999; Moore, 1999; Netten, 1993). No consistent numbers are offered for what constitutes a ÒlargeÓ or a ÒsmallÓ unit.

Smaller facilities offer additional benefits for residents and staff. In a comparison of 28 residents of group living facilities (see Appendix A, Note 9) and 31 residents of traditional nursing homes, residents of group living displayed higher motor functions and slightly improved or maintained ADLs and required less usage of antibiotics and psychotropic drugs (Annerstedt, 1993; see Appendix A, Note 10). In the same study, relatives with family members in group living units reported lower levels of strain and better attitudes toward dementia care than relatives of residents in nursing homes. Staff members also experienced benefits associated with group living facilities. Staff in group living units reported greater competence, more knowledge in dealing with dementia, and greater job satisfaction than did their counterparts in nursing homes (Annerstedt, 1993).

General Attributes of the Environment

These studies investigate desired qualities of the overall facility environment. Studies have examined effects on well-being associated with noninstitutional character, levels of sensory stimulation, lighting levels, and design modifications for safety.

*Noninstitutional Character.ÑDesign guides frequently endorse the use of noninstitutional design features, such as homelike furnishings and personalization, to promote well-being among residents. This endorsement is supported by research findings, though studies often compare facilities in which many features vary (e.g., staff training, activity programming), in addition to environmental design. Noninstitutional environments characterized as having homelike or ÒenhancedÓ ambiance (personalized rooms, domestic furnishings, natural elements, etc.) are associated with improved intellectual and emotional well-being, enhanced social interaction, reduced agitation, reduced trespassing and exit seeking, greater preference and pleasure, and improved functionality of older adults with dementia and other mental illnesses (Annerstedt, 1994; Cohen-Mansfield & Werner, 1998; Kihlgren et al., 1992; McAllister & Silverman, 1999; Sloane et al., 1998). Compared with those in traditional nursing homes and hospitals, residents in noninstitutional settings are less aggressive, preserve better motor functions, require lower usage of tranquilizing drugs, and have less anxiety. Relatives reported greater satisfaction and less burden associated with noninstitutional facilities (Annerstedt, 1997; Cohen-Mansfield & Werner, 1998; Kihlgren et al., 1992). Staff also prefer less institutional, enhanced environments (Cohen-Mansfield & Werner, 1998).

Noninstitutional environments are not entirely beneficial, however. A higher degree of homelikeness is associated with greater restlessness, more disturbances (tied to greater assertion of independence), and increased disorientation and deterioration of diet (ElmstŒhl, Annerstedt, & •hlund, 1997; Kihlgren et al., 1992; Wimo, Nelvig, Adolfsson, Mattsson, & Sandman, 1993). Studies also show that mortality and decline rates for residents do not significantly improve in noninstitutional units when compared with traditional settings (Annerstedt, 1994; Phillips, Sloane, Howes, & Koch, 1997; Wimo et al., 1993). Further, noninstitutional design requires supportive caregiving to be effective. In an ethnographic study of one facility, ÒinstitutionalÓ caregiving practices (characterized as inflexible and formal) were described as undermining the therapeutic potential of the homelike environment (Moore, 1999).

*Sensory Stimulation.ÑResidents face difficulties with sensory overstimulation, which may increase the distraction, agitation, and confusion associated with dementia. Sensory overstimulation may be exacerbated by the normal hearing loss that accompanies aging and the further hearing loss associated with dementia, both of which may increase confusion and reduce social interaction and self-esteem (Brawley, 1997; see Appendix A, Note 11). (Visual deficits, discussed later, further increase overstimulation.) At the same time, sensory deprivation has been identified as a potential problem in many dementia care environments (Cohen & Weisman, 1991). Design guides call for appropriate levels of sensory stimulation, striking a careful balance between environmental overstimulation and deprivation. Recommendations include removing unnecessary clutter, providing tactile stimulation in surfaces and wall hangings, and eliminating overstimulation from televisions, alarms, and so forth (cf. Evans, 1989; Hall, Kirschling, & Todd, 1986).

Researchers have identified characteristics and locations linked with high levels of sensory stimulation in environments for people with dementia. In an ethnographic study of one skilled nursing facility, overstimulation is associated with loud noises (loud talking, singing and clapping, etc.), with crowding and disruptive behavior from other residents, and with frightening experiences (e.g., scary movies, costumes; Nelson, 1995). High stimulationÑas measured by agitation levelsÑwas found to occur in elevators, corridors, nursing stations, bathing rooms, and other

residentsÕ rooms, whereas low stimulation has been observed in activity and dining rooms (Cohen-Mansfield, Werner, & Marx, 1990; Negley & Manley, 1990). Detailed descriptions of these spaces were not provided by researchers.

Overstimulation may impair residentsÕ ability to concentrate. Limited stimulation activity areasÑ made by hanging cloth partitions to eliminate views to ongoing activityÑreduce distractions among residents by up to two-thirds (Namazi & Johnson, 1992b). Use of partitions increased the ability to focus on a task among residents in all stages of dementia by eliminating some visual and especially auditory distractions (e.g., noise, talking).

Findings on the effects of low stimulation units are mixed. Use of a neutral design and color scheme, elimination of stimulation, and consistent daily routines have been shown to reduce behavioral disturbances, curtail use of physical and chemical restraints, and encourage weight gain (Bianchetti, Benvenuti, Ghisla, Frisoni, & Trabucchi, 1997; Cleary, Clamon, Price, & Shullaw, 1988). Similarly, in one quasi-experiment, 13 residents of an SCU that incorporated structured resident routines and reduced stimulation displayed fewer catastrophic reactions and more positive interactions, compared with nine residents in long-term care (Swanson et al., 1993). Reduced stimulation units have had little effect in regulating sleep patterns, decreasing urinary incontinence, or discouraging wandering, however (Bianchetti et al., 1997; Cleary et al., 1988; Swanson et al., 1993; see Appendix A, Note 12).

Design guidance argues that certain levels of sensory stimulation may be required to promote engagement in activities and interaction and to minimize withdrawal among people with dementia (cf. Calkins, 1988). The positive impacts of sensory stimulation have received limited research. The experimental Weiss Institute of the Philadelphia Geriatric Center was designed to maximize positive sensory stimulation; this facility featured resident rooms opening directly to a central open space. The spatial configuration was intended to enhance residentsÕ orientation and engagement in activities (Lawton, Fulcomer, & Kleban, 1984). Indeed, in a postoccupancy evaluation of the Weiss Institute, residents were found to spend less time in their rooms and were more attentive to activity following relocation to this facility (Lawton et al., 1984). In a related study, a high stimulation environment (including orientation aids, recreational materials, and extensive reality orientation programs) was associated with increased morale among 16 staff members in one unit, compared with morale among 13 staff members in a traditional dementia unit (Jones, 1988). The focus on increasing structure and resident orientation in the high stimulation unit suggests other possible explanations for enhanced staff morale in this unit.

*Lighting and Visual Contrast.*ÑPeople with dementia face particular visual deficits, including difficulty with color discrimination, depth perception, and sensitivity to contrast (Cronin-Golumb, 1995). These deficits exacerbate normal changes in vision that accompany aging, such as irritation from glare and changes in color perception (Brawley, 1997). Design guides for dementia environments recommend strategies to reduce glare, increase contrast where appropriate, and minimize confusion concerning depth perception. Design guides also recommend increasing overall light levels and exposure to bright light (cf. Brawley, 1997).

Compared with other older adults, people with dementia are exposed to inadequate levels of bright light (described as light exceeding 2,000 lux; Campbell, Kripke, Gillin, & Hrubovcak, 1988). In findings from two studies involving 24 and 10 residents, respectively, bright light treatment consistently regulated circadian rhythms and improved sleep patterns among people with dementia (Mishima et al., 1994; Satlin, Volicer, Ross, Herz, & Campbell, 1992; see Appendix A, Note 13). Results are mixed concerning the impact of bright light on agitation (Lovell, Ancoli-Israel, & Gevirtz, 1995; Mishima et al., 1994; Satlin et al., 1992).

Most often, research on the effects of bright light is conducted under laboratory conditions, requiring special equipment and the restraint of residents. The effects of bright light as a regular environmental feature have received limited attention. One quasi-experimental study was identified in which researchers examined the effect of ceiling-mounted light fixtures that provided high intensity illumination (790Ð2,190 lux; Van Someren, Kessler, Mirmiran, & Swaab, 1997). Bright light administered in this fashion fostered behavioral improvements and increased circadian restÐ activity rhythms among 22 people with severe dementia. Residents in facilities with low overall light Slb, 1997h researchers;n t0& SwaacOh of iTw (Brsidents in f

fect. Impacts were attributed to residentsÕ loss of memory of personal identities; accordingly, residents may have been distracted from exiting when engaged or frightened by the image of an approaching ÒstrangerÓ

resident rooms and doors (Lawton et al., 1984). In studies with eight residents, large signs improved resident orientation, when incorporated with orientation training (Hanley, 1981); signs alone had minimal effect on residentsÕ orientation, however.

The type of orientation device may make a difference, though research on this question is limited to one experiment involving 10 SCU residents. When displayed in cases outside resident rooms, personally significant memorabilia were somewhat more likely to help residents find their rooms than were displays without personal significance (Namazi, Rosner, & Rechlin, 1991). Personally significant memorabilia were most useful for those with moderate dementia; higher functioning residents were able to orient with nonsignificant memorabilia as well, and lower functioning residents were aided by neither.

Orientation is further impacted by building configuration. Simple building configuration is associated with resident orientation, when residents are also provided with explicit environmental information

ing. One quasi-experiment involving 44 residents in two SCUs compared residentsÕ responses to various forms of directional signage for toilet rooms, including the word Òrest-room,Ó Òtoilet,Ó or a graphic of a familiar household toilet (Namazi & Johnson, 1991b). Early and moderate stage dementia residents were most likely to locate and use public toilets in response to primary color signage affixed to the floor (responding to residentsÕ typically downcast gaze) comprising a series of arrows and the word ÒtoiletÓ (Namazi & Johnson, 1991b). Further, frequency of toilet use increased dramatically when toilets were visibly accessible to residents (Namazi & Johnson, 1991a), though this experiment included only 14 residents. ResidentsÕ use of toilets increased by over 800% when curtains surrounding toilets (in lieu of doors) were left open, making public and private toilets clearly visible when not in use (Namazi & Johnson, 1991a). In particular, visibility increased toilet use among residents with more advanced dementia.

Dining Rooms and Kitchens.ÑDesign guides offer many recommendations regarding dining and kitchen areas (cf. Calkins, 1988; Cohen & Weisman, 1991). Suggestions emphasize the importance of a familiar and normal dining experience, the need to locate dining and kitchen activity areas within each dementia unit or Òhousehold,Ó and the value of reducing sensory stimulation to encourage eating. Research findings from an experiment with 22 residents support noninstitutional dining arrangements. Noninstitutional diningÑin which residents dined Òfamily styleÓ at small dining tables in a coffee room, instead of from trays while seated in chairs in the corridorÑ was linked to increased social interaction and communication during dining and to improved eating behavior among residents (Gštestam & Melin, 1987; Melin & Gštestam, 1981). Institutional staff practices (e.g., assigned seating, institutional food service) provoked disruption and agitation in dining rooms with homelike design features (Moore, 1999).

In an impact not anticipated by design guidance, relocating dining to the dementia unit of an SCUÑ from a remote, centralized dining roomÑsignificantly decreased residentsÕ aggression (Negley & Manley, 1990). Assaults were reduced by over 40% when residents were no longer crowded into elevators to reach the centralized dining room (Negley & Manley, 1990). (Elevators had been sites of frequent violations of personal space, which caused altercations.) In this instance, assaults may have been further reduced by designating two dining areas on the dementia unit, thus separating higher functioning residents, more likely to be assailants, from lower functioning residents, more likely to be assault victims. In the same quasi-experiment, staff reported less anxiety and more time for assisting residents after moving dining to the dementia unit.

In a study on the design of environments to encourage independent snacking, installation in kitch-

decisions and policies for dementia care environments (e.g., impacts of relocating residents to new environments). Studies of *problem behaviors* investigate resident conduct that creates difficulties in caregiving (e.g., stressful aspects of bathing). One study (Nalon, 1993) fit more than one type (see Table 2). Of these types, studies of design features (26 studies) and of environmental comparisons (24 studies) predominate (compared with 15 studies of problem behaviors and 7 studies of environmental services and policies). Studies should be evaluated according to the type of research they represent. For example, findings from studies of environmental comparisons should indicate which type of environment is preferred and why.

The following sections analyze findings from existing studies with respect to their implications for application and future research.

Recommendations to Enhance Applicability of Findings

The focus of this article on design application demands some recommendations (though tentative) concerning the therapeutic design of environments for people with dementia. On the basis of existing research findings, dementia care environments should consider the suggestions presented in Appendix B among others.

Application of findings is often impeded by studiesÕ research design and/or methods. Confidence in findings is impaired by the frequent use of small samples and the absence of comparison groups. Additionally, many studies use nonequivalent comparison

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Appendix B

Recommendations for the Therapeutic Design and Planning of Dementia Environments

- ¥ Incorporate small size units.
- ¥ Separate noncognitively impaired residents from people with dementia.
- ¥ Offer respite care as a complement to home care.
- ¥ Relocate residents, when necessary, in intact units rather than individually.
- ¥ Incorporate noninstutional design throughout the facility and in dining rooms in particular.
- ¥ Moderate levels of environmental stimulation.
- ¥ Incorporate higher light levels, in general, and exposure to bright light, in particular.
- ¥ Use covers over panic bars and door knobs to reduce unwanted exiting.
- ¥ Incorporate outdoor areas with therapeutic design features.
- ¥ Consider making toilets more visible to potentially reduce incontinence.
- ¥ Eliminate environmental factors that increase stress in bathing.