Behavioral Mapping of Residents’ Activity in Five Residential Style Care Centers for Elderly Persons Diagnosed with Dementia: Small Differences in Sites Can Affect Behaviors

Doris L. Milke, Ph.D.,1 Researcher, CapitalCare Edmonton Area and Adjunct Associate Professor, Faculty of Rehabilitation Medicine, Faculty of Nursing, and Department of Psychology, University of Alberta, Edmonton AB
Charles H. M. Beck, Ph.D.,2 Professor Emeritus, Department of Psychology, University of Alberta, Edmonton AB
Stefani Danes, RA, AIA, LEED, AP, Perkins Eastman, Pittsburgh PA3
and
James Leask, B.A.,4 CapitalCare Edmonton Area. Edmonton, AB

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1 Senior Researcher, CapitalCare Edmonton Area, 9113-144 Ave., Edmonton, AB, Canada T5E 6K2; and Adjunct Associate Professor, Faculty of Rehabilitation Medicine, Rehabilitation Research Centre, 3-62 Corbett Hall, University of Alberta, Edmonton, AB T6G 2G4 dorismilke@capitalcare.net Tel: 1-780-496-2579; Fax 1-780-472-6699.
2 Department of Psychology, University of Alberta, Edmonton, AB T6G 2E9, cbeck@ualberta.ca; Tel: 1-780-437-2317.
3 Perkins Eastman, 1199 Liberty Ave, Pittsburgh, PA 15222 Danes@peapc.com
4 Research Associate, CapitalCare Edmonton Area, 9113-144 Ave., Edmonton, AB, Canada T5E 6K2; jamesleask@capitalcare.net; Tel: 1-780-496-2578; Fax 1-780-472-6699.
Abstract

The principal purpose of the study was to investigate the daylong patterns of activity of residents and staff in five similar care centres for persons with Alzheimer’s disease. The Therapeutic Environment Assessment Scale provided an architectural basis for assessing the significance of activity data gathered through behavior mapping. Slight architectural differences contributed to effects that were large and enduring, producing as much as a 50% differences between sites in the portion of residents involved. Taken together, the results suggest that resident status, use patterns, and architectural design details of a homelike residential setting have significant effects on the daily activities of residents.

Key words: dementia; physical environment; long-term care; residential care; assisted living; TESS-2+; direct observation; behavior mapping
Introduction

Residential care settings have become an accepted goal for many healthcare organizations. They satisfy the preferences of elderly clients for homelike surroundings in familiar residential neighborhoods and help make long-term care centers function like a home rather than a hospital (Imamoğlu, 2007; Verbeek, van Rossum, Zwakhalen, Kempen, & Hamers, 2009). They have become an integral part of the culture change movement as American healthcare seeks to improve residents’ quality of life. The physical environment is one of the three core domains of culture change, although a recent survey shows that very few care centers have altered their physical environment to support culture change (Doty, Koren, & Sturla, 2008). Thus, the design of such residential centers is apt to gain importance.

Little is known, however, about the daylong patterns of activity of residents and staff in these residential facilities and how the buildings shape them. Some interest in such observation has been shown recently (Calkins, Meehan, & Lipstreuer, 1999; Edelman, Fulton, Kuhn, & Chang, 2005; Gold, 1991; Kuhn, Kasayka, & Lechner, 2002; Margulis, 2003; Mathew and Sloane, 1991; Milke, 2003; Milke, Clark, & Bucknell, 2000; Schwarz, Chaudhury, & Tofle, 2004; Sloane et al., 2005; Zimmerman et al., 2005). Earlier research established that residents’ levels of activity are a concern in nursing homes. Gottesman and Bourestom (1974) observed activity in 40 nursing homes during peak daylight hours, finding residents were engaged in no or passive activity for 56% of the time observed. For 23% of the time they were involved in personal care, with television and socializing together consuming another 20% of their time. Over all observations, residents were in contact with another person for only 17% of the time. Ice reprised that study in 2002 by observing 27 nursing home residents. She also found residents spent 65% of their time doing little or nothing even though
the setting had a creative activities department. Only 12% of time was spent in social activities (Ice, 2002). Ice also gathered data on the activity level of healthy elders and found their time was spent quite differently: 17% in passive activities and 38% in social/expressive activities. Another study with healthy elders found they spent 40% in passive activities and 28% in social/expressive activities (Harper, 1998). These studies with healthy elders suggest that the inactive behavior observed in nursing homes residents does not match the pattern of healthy elders.

More critically, it is not known what exactly about the design of a residential care center makes it function like a home rather than a hospital. With new designs of residential care settings being presented regularly (e.g., www.HDC08.com; http://www.edra.org/), an underlying assumption appears to be that small variations in their architectural design will have little effect on resident and staff activity. This assumption and the dearth of literature with detailed information on the behavioral patterns of use of residential-style facilities resulted in a lack of any explicit hypotheses as to what we would find, and prompted us to undertake the present descriptive study. The principal purpose of the study was to investigate the daylong patterns of activity of residents and staff in five similar specially designed sites for the care of persons with Alzheimer’s disease. The most salient difference between the five sites was that two were designed with two 20-capacity housing units and three were designed with three 12-capacity units. Accordingly, much of the data presentation is focused on that feature. The Therapeutic Environment Assessment Scale provided an architectural basis for assessing the significance of activity data gathered through behavior mapping and provided a linkage with the findings of studies using this as a standardized instrument. We now present evidence that small design differences can have large effects on resident patterns of room occupancy and on their activities.
Methods

Participants

The five residential care sites considered in the present study were designed for the care of persons diagnosed with dementia and all were based on the pioneer site, the well-investigated and well-known architectural design of Woodside Place (WDS) in Oakmont, PA. (Deely, Klingensmith, & Silverman, 1995; DiMotta, Dubney, Hoglund, & Kershner, 1993; DiMotta & Hoglund, 2000; Hoglund & Ledewitz, 1999; McAllister & Silverman, 1999; Saxton, Silverman, Ricci, Keane, & Deely, 1998; Silverman et al., 1995). Of the four other sites, two were located in Edmonton, AB: McConnell Place North (MPN), and McConnell Place West (MPW), and one site in each of Cohoes, NY, Marjorie Doyle Rockwell Place (MDR), and Mt. Lebanon, PA, Asbury Place (ASB). Perkins Eastman Architects designed three sites. The WDS blueprints were purchased by CapitalCare to build Canadian sites and the architectural firm of Cohos Evamy adapted them, making adjustments to accommodate the weather and site-specific land features in Edmonton, AB. The five sites can be considered variations on a theme.

Generic data on residents, staff and volunteers were obtained from site administration records. A total of 184 elderly residents (35-40 per site), all but one of who had a primary diagnosis of dementia, were living in the facilities at the time of the study. The average Mini-Mental State Examination (MMSE) score (Folstein, Folstein, & McHugh, 1975) across sites was 13.2 ± 1.5 (M±SE), and specific within site means were 12.2 ASB, 15.3 MDR and MPN, 16.1 MPW, and 8.4 WDS. On average, the percent of males at the centres was 24.0 ± 6.6, range 11-31. Discharge criteria relating to mobility and sociability, common across the sites, included loss of mobility, requiring maximum assistance with activities of daily living, unable to participate in activities, unmanageable incontinence, and risk to self or others. The total staff employed at the five sites (22-43 per site) was 197. The number of direct care staff that residents were likely to encounter (full-time and full-time equivalents of part time care supervisors (LPNs) and caregivers) ranged from 19 to 28 across sites,
for a mean of 23.4±2.8. The reported daytime ratio of residents to care staff was 5:1 at WDS and MDR, and 6:1 at MPN, MPW, and ASB. This ratio continued most of the evening, dropping at night to 9:1 at WDS, 12:1 at MPN and MPW, and 13:1 at MDR and ASB.

**Procedures**

**Environmental Survey**

The Therapeutic Environment Screening Scale–2+ Revised was used to assess general design features (subsequently referred to as TESS-2+). The scale is an observational checklist that is used to describe the ability of the physical environment of a long-term care institutional setting to address the therapeutic goals of nursing home and residential care residents with dementia (Lawton, Weisman, Sloane, & Calkins, 1997). A number of versions were in circulation. The TESS-2+ was used in the National Institute on Aging (NIA) (1993) special care unit collaborative studies. Current formats are for nursing homes (TESS-NH; Sloane et al., 2005; [http://psychsoc.gerontologyjournals.org/cgi/content/abstract/57/2/S69](http://psychsoc.gerontologyjournals.org/cgi/content/abstract/57/2/S69)) and residential care settings (TESS-NH/RC; [http://www.unc.edu/depts/tessnh/pdf_files/Tess%20NHRC%20Revised%201_14_02.pdf](http://www.unc.edu/depts/tessnh/pdf_files/Tess%20NHRC%20Revised%201_14_02.pdf)). The 37-item TESS-2+ checklist consists of discrete items measuring a range of environmental domains, such as exit control, maintenance, and safety (listed in the first column of Table 2), as well as three global evaluative ratings: staff interaction, resident involvement in activities, and physical environmental atmosphere. Psychometric properties include interrater reliability for TESS-2+ items ranging from 67% to 100% agreement (Sloane et al., 1998). The items on the TESS-2+ can be considered to point out areas where a site meets best practice standards for dementia design. The TESS-2+ data were expected to provide an assessment of the physical differences in the five sites and thus a potentially useful set of measures for understanding differences in the use of the five facilities.
Data Collection and Analysis

We collected information on principal characteristics relating to physical features, staff, volunteers, residents, and care programming, retrospectively from site records of April and May of 1998. The assessment of physical features included a review of floor plans and records of maintenance requests. On-site observation was done to complete the TESS-2+. The interrater reliability of TESS-2+ ratings was assured by prior tests of the agreement between observers. Although an observer typically uses the scale to assess a dementia unit in a nursing home, in this study the assessment was of the five small purpose-designed settings (the third author completed the TESS for ASB, MDR, and WDS, the first and second authors did MPN and MPW). During the NIA studies the scale was used not only for special care units, but also some entire sites (Sloane et al., 2002), and Slaughter, Calkins, Eliasziw, and Reimer (2006) found this version of the TESS useful to distinguish between purpose-built dementia care facilities and traditional care facilities.

The Special Care Unit Environmental Quality Scale (SCUEQS) was used to score the TESS-2+ using a method previously described (Sloane et al. 2002; Lawton et al., 2000). The 18-item SCUEQS subscale derived from the TESS-2+ was determined to be a robust measure of overall environmental quality during the NIA studies. Scores can range between 0 and 41, with 41 being a better environment for persons with dementia. Internal consistency of this scale was measured using Cronbach coefficient alpha (α 50.82) (Sloane et al., 1998). In addition, using a method developed by Slaughter et al. (2006), a composite score, the Composite Above Average Quality Score (CAAQS), was calculated using all items from the TESS-2+. A value of 1 was assigned if the rating for the center was above the middle of the range for the item (i.e., midpoints are shown in column four of Table 2) and if equal to or below the midpoint, the assigned score was 0. For each cluster of centres (the 20 capacity houses of ASB and MRD and the 12 capacity houses of MPN, MPW, and WDS), the resulting binary scores representing each of the 14 domains in the TESS-2+ were summed and a percentage of 14 was calculated to facilitate comparison with the data of Slaughter et al., (2006). This
number represents the percentage of domains that were above average in quality for the site. Group means were then used to compare results on the SCUEQS and the CAAQS for the 20-capacity and the 12-capacity sites.

**Behavior Mapping**

The principal method of behavioral mapping used place-centered instantaneous scans, which provides systematic samples of behaviors. This is one of the least intrusive methods for direct observation (Lehrner, 1979). During behavioral mapping, the observer, at set intervals, quickly notes the activity of people within an area and moves on to other areas. These scans are much less invasive than continuous observation and with momentary scans interobserver reliability is inherently better. Often observation is considered the gold standard for collecting behavioral data, but there is a concern that the presence of an observer influences the behavior (typically to more socially acceptable behavior). During scans, the observer quickly passes through the spaces of interest, allowing very little time for those present to adjust their activity.

The data were collected by on-site staff familiar with facility routines, following instructions in a procedure manual written by the first author. Thus the collection of data across sites followed a standardized methodology, including the use of common behavioral categories, common floor-plan notation, preprinted checklist sheets, trained paid observers, and time-locked sampling. Approval for direct observation, as described, was obtained appropriate to each jurisdiction. Observers learned mutually exclusive and comprehensive definitions, a standard procedure for ethogramatic checklists, for nine categories of behaviors. On each of two days at each site, they directly observed activities of persons in public areas following a systematic protocol. Every hour over 14 hours, they toured public spaces noting the subject’s group (resident, staff, family, others) and the type, time, and location of the activity (Martin & Bateson, 1987; Sommer and Sommer, 1986). Information was written upon copies of site floor plans. The identity of individuals was not recorded. General activity categories included just sitting (inactively), activities of daily living (ADLs, e.g., self-care, grooming, washing,
eating, taking medications), light housekeeping, leisure, disruptive behavior, walking, watching, and miscellaneous behaviors. Communication was indicated as an independent action because it could occur concurrently with any of the activity categories.

Information about activities at each of the five sites included a description and schedule of daily and special occasion events for residents, average attendance of residents at programmed events of each type, the procedures for intervening when problem behaviors arose, definition of problem behaviors, and the average weekly incidence of problem behaviors (not presented). The interpretation of data from Behavior Mapping benefited from this information.

**Sampling and Data Analysis**

Behavioral mapping included all care staff, volunteers, family members, residents and others over a two-weekday period in early June at each site, except at MDR where data collection was on two sunny days in September that were comparable to June weather. Observations were made each hour between 0730 and 2130 hours, for a total of 15 scans per day. They were conducted in all public spaces at each site, excluding rooms bathing rooms, toilets, and bedrooms as well as areas used exclusively by staff. Two observers were trained at each site to collect the data, to a criterion of at least 85% agreement on location, person, and behavioral categories. Behavior observations were collated by site by activity and time-of-day format.

**Results**

**Floor Plan Comparisons**

Building orientation varied across sites as did the views of outdoor gardens (floor plans in Fig 1-5). Table 1 lists some of the most salient similarities and differences between the sites.

Each building had residential wings, referred to as houses, with residentially scaled rooms, linked by a common area shared by all houses (Figures 1-5). The common areas in all sites included
a great room, a fireplace seating area, at least one activity or craft room, a family or private dining room, and a beauty salon.

Overall, the floor plans of ASB and MDR were very similar, as were the plans of the other three centers, MPN, MPW, and WDS. In the latter three centres, the houses were equivalent to the three parallel wings, flanked by courtyards, that is, outdoor spaces with natural green elements and a view to the sky. Each wing was self-contained; each had a kitchen, living/dining room and laundry, and a room for bathing or showering. Each wing had a central hallway with bedrooms running its length on either side accommodating 12 residents. ASB and MDR floor plans had two perpendicular housing areas comprised of two parallel wings. The architects viewed this design as four houses each accommodating 10 residents. Each bedroom hallway and one living area was considered a house and a pair of houses was viewed as sharing a kitchen. The kitchen was planned as a hub for staff assigned to the two bedroom hallways and a place to locate a staff-buddy for a task (DiMotta & Hoglund, 2000). However, at ASB, for example, the arrangement of furniture, with glider-rocking chairs arranged primarily in one dining-living space and tables placed in the dining-living area on the other side of the kitchen, suggested that more than the kitchen was being shared, and that these common rooms were being used as a continuous space for all 20 residents to share. In gathering data from management and staff, there was no evidence that staff and residents were treating a particular dining-living room as being the domain of just one hallway of residents. Moreover, ASB staff said residents housed in bedrooms along one hall were frequently found in the other bedroom hall. Mealtime seating varied for breakfast, lunch, and dinner, but the variation was not related to
residents’ home hallway. Consequently, each U-shaped housing area in ASB and MDR was considered a house for the purposes of this study.

House kitchens differed across sites. At ASB and MPW, these were large country kitchens, but at other sites the kitchens were small. At WDS, kitchens were designated as “serveries”. Some sites had activity areas or rooms in the common areas. In the fireplace seating area adjacent to WDS’s country kitchen (but not within the country kitchen) were a large dining table and matching chairs. An open wall above a bar-type counter allowed items to be passed from the country kitchen. This made the space more flexible, because it was not viewed as a special events venue like the enclosed private dining rooms in the other four centers. It also encouraged various activities to be conducted on this dining table that were not scheduled for the common areas in the other centers. Table 1 supplements this descriptive comparison.

The common features included floor plans designed for small group living (houses of 12 or 20), in self-contained houses with spaces for cooking, eating, bathing, and gatherings, bedroom hallways that are short by facility standards (yet long for family dwellings), a variety of common spaces, and informal staff workspaces, but no formal nursing stations (Table 1). Differences in general design between sites were also in quantitative measures; for example, the number of beds ranged from 36 to 40, the number of public rooms ranged from 11 to 17 (Table 1), and most striking, the seating capacity in public rooms varied from 165 to 232 (Table 1), with ASB and MDR having somewhat less capacity than MPN and MPW. Inspection of floor plans showing chair location (data not shown) revealed that the differences in numbers of seats between sites were principally in the houses’ kitchen and living/dining areas, implying that the site differences in these floor plan areas were relevant.
Therapeutic Environment Screening Scale

Environmental characteristics were described using the 38-item Therapeutic Environment Screening Scale (TESS-2+). Designees at each site filled out the form after training by one of the authors of the study who was experienced in using the scale. Interrater agreement was assured by comparing interpretations and ratings; consensus was reached on any issues related to scoring. Interrater reliability for TESS-2+ items had ranged from 67% to 100% agreement (Sloane et al., 1998). There were no significant differences in the mean domain scores between the sites that had 12-capacity houses and those with 20-capacity houses (Table 2). The findings are presented by grouping the items into two types of goals and domains, those associated with the general site design that may be more architecturally based and those more aligned with interior design, site operations, and providing care.

General Design. The scores related to the therapeutic goals and domains for building design were similar across sites, reflecting the implementation of the basic Woodside building model (Table 2: Exit control, Orientation and cuing, Privacy, and Functional ability, Physical attractiveness). All sites in this study had strategies for exit control (Table 2: 2a–2h). WDS had both alarms and keypad-locks on external exits, while the other sites had keypad-locks. MPN and MPW had a reception desk at the front entrance as a clerk-observation post. At ASB and MPW, the external exits were partially disguised; at the other sites they were not (Table 2: 3a, 3b).
Orientation and cuing is related to residents’ personal safety and self-awareness, thus the photos and names beside the bedrooms doorways, which all sites used, are important (Table 2: 27, 28, 29); as in the “tip of the tongue phenomenon” they need a cue to retrieve the memory (Zeisel, 1998). An open interior plan that allows residents to see into public rooms is an optimal way finding strategy for persons with dementia; all sites employed this. The strategic location of cues and personal items can also aid way finding. Although institutional-style directional signage is eschewed, on restroom doors, for example, both graphics and labels are advised. Open floor plans often require few signs. MDR had the most signs and MPW used the fewest graphics and signs, with other sites having intermediate numbers (Table 2: 19, 20). Large windows that provide natural exterior views (Table 2: 4) are not only attractive, they are another tactic that serves way finding and also provides seasonal orientation in the latitudes of these five sites. The entrances of residents’ bedrooms were personalized at all sites (Table 2: 27, 28, 29). Redundancy is recommended and a greater variety of items were used at ASB, MDR, WDS, and MPN than at MPW for this purpose.

All five sites scored well on supporting functional ability (Table 2: 16, 17, 18), that is, either slowing decline or stimulating improvement, which is something for which sites designed for dementia have been associated (Benson, Cameron, Humback, Servino, & Gambert, 1987; Greene Asp, & Crane, 1985; Innes & Surr, 2001; McCracken & Fitzwater, 1989; Rabig, Thomas, Kane, Cutler, & McAlilly, 2006; Rule, Milke, Dobbs, 1992; Silverman et al., 1995; Skea & Lindesay, 1996; Warren, 1998).

**Interior Design and Approach to Care.** The first goal of this type is safety, security, and health, with domains (besides exit control, discussed above) of Maintenance, Cleanliness, Lack of odors, and Safety (of floors). A second goal is Stimulation and a third is Socialization. Slaughter et al. (2006) viewed these as basic requirements and found no significant differences in these goals when comparing the 6 special care facilities (bungalows) with the 45 units in traditional institutional facilities, so it is not surprising that the same was true for these highly similar sites.
Stimulation domains include Lighting, Tactile and Visual stimulation, as well as Quietness. Both sensory deprivation and over-stimulation are viewed as problems (Brawley, 1997; Day, Carreon, & Stump, 2000; Cronin-Golumb, 1995). According to Zeisel, Hyde & Levkoff, (1994), appropriate levels of stimulation results from having a site with a high sensory comprehension ranking, so not necessarily the overall calmest setting, but rather one with a moderate amount of sensory input that residents can understand. Ambient lighting was considered good in all sites with minimal glare from a number of reflecting surfaces such as picture windows and French doors (Table 2: 21). Lighting was evenly distributed and levels were considered ample (Table 2: 22, 23), with the exception of MPN. Ambient auditory noise was not deemed a problem whether considering type or level of noise (Table 2: 24, 25). The general availability of things to touch in common areas, such as those that invite handling or folding, was somewhat less at ASB and MDR than at other sites.

Overall ratings of home likeness and the individuality of residents’ appearance were consistently good, but the general atmosphere, influenced by residents’ lower overall levels of participation in activities and a less positive rating for staff interactions with residents, resulted in MDR scoring lower that other sites (Table 2: 15, 31, 32, 36). WDS scored in the mid-range on residents’ involvement, but as indicated above its residents had much lower MMSE scores. At all sites, personal pictures or mementos were in most residents’ bedrooms. However, such items were not present in common rooms at MDR.

The mean SCUEQS scores (Table 2), which summarized a subset of the TESS-2+ items, were not significantly different between the sites that had 12-capacity houses and those with 20-capacity houses. The SCUEQS had been derived for the NIA studies of special care units and was considered by experts to measure important aspect of the physical environment and serve as a reliable measure for differentiating better nursing units and assessing the overall environmental quality (Sloane et al., 2002). The results appear to justify the architects’ design decisions that resulted in two hallways of 10 residents sharing the large kitchen and the living-dining rooms. Slaughter et al.
(2006) devised another composite score, the Composite Above Average Quality Score (CAAQS), which they found to be more sensitive than the SCUEQS. The CAAQS represents the percentage of domains that were above average in quality. It revealed a difference between the sites with 12-capacity houses (85.7%) and those with 20-capacity houses (78.6%) that was not shown by the SCUEQS, but the difference was not significant.

**Behavioral Mapping**

**Reliability.** The number and category (staff, family, or resident) of persons observed at each location was recorded on floor plans in successive behavior scans, one hour apart, over the course of two days. Interobserver reliability of the scans was assessed at each site. Cohen’s kappa, a measure of agreement between observers, has a range from 0, no agreement, to 1.00, total agreement. Fleiss (1981) characterized a kappa of .4 to .6 as fair, .6 to .75 as good, and over .75 as excellent. There was good agreement on average between two independent observers on the identification of behaviors observed, Kappa mean (SD), 0.851 (0.4), and excellent agreement on identification of people being scanned as residents, staff, family or others, kappa mean (SD), 0.732 (0.7).

**Observations.** Fifteen observation periods, or scans, per day were conducted, one per hour during the two days of observation. Examination of the within-site data revealed that the only differences were day differences in specific scans related to the occurrence of special events, e.g., barbecues. Consequently, the data were collapsed across days. A scan of about 10 minutes in duration was required to count people in all public areas. Observers minimized the possibility of counting the same person in more than one room during a scan by following a preplanned path through the building and working quickly. Counts of sightings of staff, family and volunteers, and residents by hour in each
area of each site were summed over the two-day period of observation. To assist the description of
the findings, resident data were subsequently adjusted to show the mean percent of residents at a site
who were observed per scan per day, and to show the percent of scans in which residents were
involved in a particular activity or seen in a particular room or area.

**Staff and Family.** Observations of staff and family are presented without data as these were
ancillary to the principal focus on residents. Staff were seen most often in the house kitchens or
dining/living rooms across all sites, except WDS. At WDS, staff were seen in the kitchens, but
seldom in the dining/living rooms. In all three sites with 12-capacity houses, the central house was a
hub of staff activity with nearly twice as many staff seen in that kitchen (or an adjacent room, which
was the dining room in MPN and MPW, but was a hallway in WDS) as in the kitchens of the houses
on either side. WDS staff were also seen in the seating area outside the great room nearly as much as
in the house kitchens. Residents were seldom engaged in an activity when staff were not around, e.g.,
see Figure 6 for MPN. This is not surprising, because persons with Alzheimer disease lose their
ability to initiate activities (Colling, 1999; Lee et al., 2006). Others have shown that appropriate
environments are not sufficient; residents with this disease need activities, and all five sites employed
activity coordinators (Grant, 1998; Van Haitsma, Lawton & Kleban, 2000; Voelkl, 2006).

Family members were at some sites as early as 8:30 a.m. and as late as 9:30 p.m., although at
MPN all visits, except one, were in the afternoon. ASB had a family meeting, increasing the number
of sightings of family members to 42 (19 were associated with the meeting). The numbers of sightings of family members over the two days of observation at other sites were: WDS – 27, MPN – 23, and MDR and MPN – 12 each.

Resident Locations. Direct observation revealed a pattern of use that was unexpected and not evident in TESS results. Overall, resident sightings were at least 25% higher at WDS than at the other four sites (Table 3). The number of sightings in the common areas of WDS was over 60% greater than those at any other site (Table 3). Residents were most frequently seen in the area just outside the great room (Table 4). By contrast, at all other sites residents spent more time (60% of sightings) in their houses (Table 4). ASB, where residents spent 80% of their time in their houses, represented the extreme in this regard with the other sites being intermediate between ASB and WDS (Table 4). Differences did not appear to align with whether the houses were of 20- or 12-capacity. At all sites, residents were seen most frequently in the common areas outside of the houses, with the common hallways, the great room, and fireplace seating area accounting for decreasing numbers of residents, in that order (Table 4); however, a stylist in the ASB beauty salon drew a crowd, showing how an occasional event can change behavior patterns. At the sites with 12-capacity houses and television rooms, those rooms were popular and drew as many residents as the fireplace area.

The large percent (39.6) of residents seen in common areas at WDS was attributable to sightings in the common hallway and fireplace seating area next to the School House (Figure 5, Table 4). All residents could be gathered in the area, which was slightly larger than the great room;
observers noted a continuous round of activities involving groups of varying sizes. No other site used this area as intensely. At WDS, a day program brought in 8 additional residents and several staff who ran activities that attracted some residents (discussions, newspaper reading, crafts). Observers were asked not to count persons associated with the day program in their tally, but the heavy use of the central space and the day program activities presented there had some influence. ASB and MDR also had day programs that used separate spaces for that purpose, so program participants were not seen. Chairs lining the walls in this area of WDS, augmenting seating arrangements in front of and on either side of the fireplace, as well as oversized displays of small snapshots on several walls, resulted in an institutional appearance. Local lore attributes the lineup of chairs to residents who initiated it shortly after move-in. Staff moved chairs back where the interior designers located them, but residents would pull them back across the corridor in a line, until staff gave up.

Site differences in the use of the great room were noteworthy. ASB appeared to use it only for church services on a regular basis, with “audience-seating” left in place from day-to-day. Possibly, this was because this great room was relatively distant from the houses (Figure 1). In WDS, MPN, and MPW, great room seating was rearranged throughout the day to accommodate numerous events. MPN and MPW used the great room like a town hall, holding events such as afternoon teas, dances, and musical entertainment. At MDR, small numbers of residents were in the great room throughout the day, but no large gatherings were seen.

Within sites, the sightings of residents in the houses were distributed fairly evenly across the houses (Figures 1-5, Table 3). Residents were most often seen in the living-dining rooms and, as noted above staff were most often seen in the adjacent kitchens. The exception was WDS, where the house design did not provide a good line of sight for staff between the kitchens and the living-dining rooms (Figures 4 & 5). Staff at all other sites could work in kitchens and keep an eye on residents. WDS staff actively encouraged residents to leave dining rooms after a meal and join activities in the central area, likely for two reasons: because activities were not planned for the houses and because
staff working in the houses could not easily monitor a resident who remained in the house living-dining room. WDS staff were rarely seen in the houses’ living-dining rooms. The School House, the centre house, accounted for the majority of residents observed across all houses. This kitchen, adjacent to the highly used area just outside the Great Room, provided a relatively good monitoring station for the house and activities in the common areas. At WDS mealtimes, two common areas were used; residents who needed substantial assistance with meals were often fed in the craft room and a high-functioning group ate at the dining table alongside the fireplace seating.

In the houses at other sites, most sightings of residents were in the dining/living room areas. Fewer were in the kitchen and fewer still in the house hallways (Table 3). At MDR, only one area adjacent to the kitchen was devoted to dining and almost no residents were seen in kitchens. The same was not true at ASB, where approximately the same proportions of residents were seen in the shared kitchens as in each of the living-dining rooms on either side (Table 3 sums all four living-dining rooms). However, at ASB the numbers were likely from residents moving between the two dining/living rooms and passing through the kitchens (Figure 1) because residents were rarely engaged in the type of tasks encouraged at MPN and MPW (i.e., handling dishes, setting tables, etc., to encourage maintenance of their functional abilities, Figure 7). Interestingly, the highly similar sites found different ways to use their spaces and different approaches to activities.

ASB, MPW, and WDS held barbecues during the days of observation (Table 3). This meant the residents’ presence in the kitchen and dining areas was reduced at those meals. Accordingly, for comparison across sites, dining area sightings were adjusted by adding mealtime sightings in the courtyards. The peak periods for resident sightings were during the midday lunch (11:30-13:30) and evening meals (16:30-18:30) (Table 5). Even so, sightings of residents at mealtimes were only 66-80% of occupancy, indicating eight to ten residents were not seen at mealtimes in public areas at most sites (Table 5). The exception was WDS, where sightings indicated nearly all residents were observed in public areas at mealtimes (Table 5), although WDS residents did not gather in the house
dining areas for the noon meal. With most activities occurring in the core of the building, WDS was flexible about meal arrangements, serving meals where residents were located, such as the area outside the great room on an activity room. Residents were not required to return to their own houses to eat. They could join day program residents and eat in the common area, or join residents in another house. One group of women was known for asking to eat together, on their own, in the common area.

WDS also led other sites in the number of residents observed at other times of the day (Table 5). The differences were especially marked in the afternoon between meals (13:30-16:30) and the period after the evening meal (18:30-21:30). This suggests that WDS staff may have been viewing the central areas like they would the central areas of a unit in a nursing home; on dementia units, staff often prefer that residents stay in view and not return to their rooms.

**Resident Activity.** The observed activity patterns were surprising, considering high levels of resident inactivity reported for nursing home residents (Gottesman & Bourestom, 1974; Ice, 2002). Gottesman and Bourestom’s (1974) observations in 40 nursing homes revealed that residents spent 56% of their time during peak daylight hours engaged in no activity or passive activity. In that study, residents were involved in personal care, television, and socializing for 43% of the time. Ice (2002) reprised the Gottesman and Bourestom study and found residents spent 65% of their time doing little or nothing with only 12% in social activities (Ice, 2002). In the present study, observations of Just Sitting and Watching were expected to measure levels of passive behaviors. Residents in the five sites appeared to be engaged in ADLs and Leisure for greater amounts of time than in Just Sitting, and Watching (although small amounts of napping, as passive behavior, were coded as Miscellaneous), but this was not significant (Figure 7). Chi-square analysis using phi coefficients found that residents at WDS engaged significantly less in ADLs than residents in other centres (p<0.0001); residents at ASB, MPN, & WDS were engaged less in leisure (p<0.05 each); ASB
residents were engaged less in Just Sitting (p<0.0005); and residents were observed Watching less at MDR, MPN, & MPW (p<0.0005 each). Leisure was the most frequently observed activity for MDR, MPN, and MPW, the second most frequent at ASB, and the third at WDS. Recreational activities, both planned and informal activities, were considered to be Leisure, thus watching TV or waiting to be served at a coffee party were both coded as being Leisure (persons who were within the group and actively attending to events, but not actively engaged at the moment, were coded as Leisure too and this was distinguished from Watching, which was defined as “attending to activities or interactions of others from a distance, such as from a doorway watching a street”).

The ADLs were the second most frequently seen activity for MDR, MPN, and MPW and the third for ASB, but were seen much less at WDS. The majority of ADLs across sites occurred at meal times, indicating they involved dining (ASB 57.0%, MDR 59.0%, MPN 75.8%, MPW 73.6%, but WDS 42.2%). The low percent of time spent by WDS residents on ADLs during the evening meal time (4.2%) agrees with the low number of sightings in the dining area at that time (38.5% of max). It appears that WDS residents sat, watched, and walked but did not spend much time eating (Figure 7). In contrast, previous research at MPN and MPW has found mealtimes to be the longest duration behavior. Scans needed to be one hour apart to avoid seeing meals on two consecutive scans and oversampling the behavior (Milke et al., 2000).

Work, that is, tasks such as housekeeping and cooking, were not seen at either of the sites with 20-capacity houses, but this is the only difference evident when compared with the 12-capacity
houses. Compared to other sites, MPN and MPW residents engaged in moderate proportions of all behaviors (Figure 7). Residents at WDS spent proportionately less time on ADLs, light housekeeping, and Leisure, and more time at Walking, Watching, and Just Sitting. Chi-square analysis using phi coefficients showed that residents were observed Walking significantly less at MDR (p< 0.05), residents at ASB and MDR engaged significantly less in Work, and there were no significant differences between sites in Miscellaneous activities (Figure 7).

**Observers’ Notes**

Some large differences were found in the care programs across sites. Observers’ notes indicated that at MPN and MPW residents were encouraged to be involved in the daily routine of the facility and direct care staff ate meals with residents. This strategy was said to stimulate conversation and provide residents with a model for appropriate behavior. Staff played the role of “mother,” rising to find an item in the kitchen and keeping an eye on food consumption. Managers at MPN and MPW considered this role an essential component of care. At ASB, MDR, and WDS there was no evidence of such a role.

Most cooking was done in facility kitchens away from areas that residents could access. This tended to result in the house kitchens being treated more like institutional serveries. Fridges mainly contained large juice jugs and prepared snacks. However, at MPW and MPN, when a resident opened the fridge door, the door was full of condiments and casseroles; it looked just like home because of an effort to keep institutional sized packages to a minimum. These two sites used their kitchens quite differently than the other three sites. At MPN and MPW, all breakfasts and snacks were prepared in the houses each day by direct care staff. On four weekdays, lunches also were prepared. Residents were invited to participate in some of the chopping, slicing, and mixing, which was considered an essential component of the care program. When meals were delivered from nearby facility kitchens, staff decanted items into family-size serving bowls. They added condiments and poured drinks,
serving the meals much like those prepared in-house. Although residents helping with meal preparation appeared to be limited to MPN and MPW, staff records indicated additional forms of daily and special occasion activities occurred at all sites. Daily activities included easy tasks, e.g., folding laundry and exercises at all five sites, discussion groups at MDR and WDS, religious activities at ASB, MPN, and MPW, music/singing at ASB, MPW, and WDS, movies at ASB, and grooming at all sites except WDS.

Outdoor courtyards were accessible to residents on the observation days at all sites. The barbecue meal at MPW drew the highest number of residents outside, but from mid-morning until early evening residents were seen on the patios or walkways. This was true at every site except MDR, where few ventured outside (data not presented).

Disruptive behaviors were seen only at ASB, where at 7:30 a.m., 2:30 p.m., and 4:30 p.m., a single resident was disruptive. Whether this was the same or different resident is not known; the identity of persons was not recorded. This accounted for only 0.3% of all behaviors seen at ASB (and was not shown on Figure 7).

**Discussion**

The TESS-2+scale results clearly indicated that the pioneering WDS site, and the four sites modeled on it, met best practice standards in many areas. These include the ratings for global site assessment, overall configuration of self-contained living arrangements with adjacent common spaces, informal workspaces for staff, and accessible, outdoor green spaces, walking paths, and maintenance. More pertinent to the present study, there were no significant differences between the sites that had 12-capacity houses and those with 20-capacity houses on any TESS items, the NIA subscale of overall environmental quality (SCUEQS), or CAAQS, the composite score devised by
Slaughter et al. (2006). Sites with 20-capacity houses did not look substantially different from sites with 12-capacity houses, according to the scale.

**Behavioral Mapping**

A principal finding from behavioral mapping was the amount of time residents were found engaged in leisure activity at all five sites. Leisure was the most frequently observed activity for MDR, MPN, and MPW, the second most frequent at ASB, and the third at WDS. The level of participation in meaningful activities is considered an important measure of residents’ quality of life (Gonzalez-Salvador et al., 2000; Zimmerman et al., 2005). Although the extent of engagement is typically measured in more focused and intensive ways, the fact that observers saw residents who were alert and watching an activity is meaningful, because observers were asked to distinguish whether the resident was “just sitting” or “watching”, if that was the extent of the involvement. When percentages of time spent in Leisure are combined with Activities of Daily Living, following the lead of Gottesman and Bourestom (1974), who combined personal care, television and socializing, the results in this study are ASB 46.8%, MDR 70.1%, MPN 47.1%, and MPW 48.3%. All percentages total are better than the 1974 study’s 43%. Only WDS, with 26.1%, was substantially worse and that was largely because so little time was devoted to the evening meal. Ice (2002), studying one site, had found only 12% of time spent in social activities; however, little time was spent Just Sitting or Watching. For the five sites in this study, total percentages of these inactive behaviors are ASB 31.6%, MDR 17.1%, MPN 22.9%, MPW 17.6%, and WDS 40.2%, which are all substantially different than Gottesman and Bourestom’s finding of 56% of time engaged in no activity or passive activity, or the 65% seen by (Ice, 2002).

Surprisingly, the five sites differed in the percent of maximum possible number of sightings of residents observed in public areas per scan per day, ranging from 49% at MDR to 80% at WDS. This range of 38% difference between the lowest and highest sites is considerable. The traditional concern of staff is that residents who stay in their rooms miss out on socialization and planned
activities (Grade, 1976; Hogden, 1985). The public areas most frequented by WDS residents were the fireplace area and the common hallway area. At most sites, if the residents were not observed in the common areas, it would be likely that they were in the house areas. This was confirmed in the other principal finding that the percent of maximum possible sightings in the house areas was lowest for WDS at 25% and highest at ASB at 50%. At ASB, residents spent 80% of their time in their two houses. At WDS they were encouraged to spend their time in the common areas, and they did. The houses were used very differently at the two sites and this may have been because the architects, who were very involved in both sites, made it evident that they were intended to be used differently. However, the use of communal spaces often has little to do with the intended purpose. Lawton (1970) reports that in 10 observational rounds of a facility, a total of 13 people were observed in the nine social rooms on the nine floors, while 79 were counted in the main floor social room, where arrivals and departures could be observed. Similarly, areas around nursing stations and elevators frequently draw residents (Lawton, 1970; Lawton, 1977; Snyder, 1980).

A number of factors can be ruled out in the search for unique characteristics of WDS that could have contributed to the above findings. The first factor is the reliability of the observers. It is unlikely that the differences were due to variability in the observational skills/procedures of the observers because of the high level of agreement in the assessment of interobserver reliability and because all observers followed the same protocol in collecting the data. The observers’ reliability was also attested to by the similarity of the data within sites across the two days of data collection. The second factor is the general floor plan. WDS shared the same basic floor plan with MPN and MPW, a building footprint like the capital letter E. So, it is unlikely that the gross outer shape of the floor plan was relevant. The third, more general factor is related to the inter-site comparability of the TESS-2+ data. These data indicate that the five sites were remarkably similar in general and internal design features. WDS has ratings on all measures that were comparable to one or more of the other sites,
including potentially relevant measures such as the presence of homelike features, the degree of interaction with staff, and residents’ involvement in activities.

There are, however, a number of other factors that may be relevant to understanding the WDS data. WDS was the only site in which meals were served in the common areas as well as in the house dining rooms. Congruently, as already noted, the highest number of resident sightings at WDS was in the common areas (fireplace and common hallway) and most of these common area sightings were in the common areas of WDS adjacent to the central area of the three houses. Importantly, these were the only common areas with a direct line of sight to the central hall and kitchen of the central house (School House). Staff notes indicated that the number of meal servings from the central house kitchen was twice as high as that of the kitchens of the other two houses at WDS. Again there is congruence; resident sightings in the central house dining room, although low relative to central common areas, were twice as high as in the dining rooms of the other two houses at WDS. It is also relevant that staff used all parts of the central common area for activity programming. Thus, it seems probable that several factors, including the internal floor plan, meal service, and activity programming, made the central common areas of WDS a multiuse area, which resulted in high number of resident sightings though out the day with peaks at meal times. It is worth asking whether WDS staff would have used the central common area so intensely if the house kitchens had been aligned with the dining rooms, providing staff with oversight, as in MPN and MPW.

These observations could also explain another WDS anomaly, that is, the low number of residents seen to be engaged in ADL activities at meal times compared to other sites. If the lower-functioning residents at WDS engaged in other activities in the central common areas, perhaps abandoning a meal to walk or sit elsewhere, that could result in fewer observations of eating during the mealtime. Conversely, it could mean that it would be more likely that
other activities (i.e., watching, walking, sitting, and leisure activities) would be seen during meal times, which was the case in WDS.

Finally, the unique features of the WDS resident sighting data may have been related to the greater degree of dementia (lower than average MMSE scores) of WDS residents. The average MMSE scores at other sites were 50 to 100% higher, indicating less severe symptoms than the average WDS score. Congruently, WDS had relatively high levels of sightings of sitting, watching, and walking behavior, and the highest number of pacing incidents. Thus, it is possible that the differences in degree of dementia between sites and the related differences in levels of ambulation made it more likely that WDS residents would leave their rooms and therefore WDS residents would be sighted most frequently in the common areas of the WDS facility.

It is important to note that no substantial differences were found between the 20-capacity and 12-capacity houses, that is, in the mean domain scores of the TESS, which was used to describe environmental characteristics. Scores were much the same across the five sites. The TESS has goals and domains aligned with the general site design, which are more architecturally based, and those best aligned with interior design, site operations, and providing care.

The architects might have thought their design at ASB and MDR would result in a small care group of 10, and that residents along each bedroom hall would form a household, but this did not happen. The residents in the 20-capacity houses did not form a 20-resident cluster either; instead they formed small groups for eating and activities. Therefore, other factors, such as early or late rising, or naturally-formed friendships, may be a greater influence than bedroom proximity. The addition of eight more residents per house might be anticipated to lead to crowding in the houses’ living-dining areas or some other notable difference. However, crowding was not evident in the 20-capacity houses. In fact, WDS gatherings in the common areas were more apt to be viewed as crowds.
Observations indicated there that Disruptive Behavior, often attributed to crowding, was rare. It occurred in only one site, and therefore could not be associated with a particular design.

These observational results, combined with the TESS results, have broad implications for future studies. The first implication is methodological and the second is empirical. Methodologically, the combination of architectural and behavioral measures in studies of facilities for the elderly, highlights the advantages over methodologies that employ only behavioral measures, e.g., Dementia Care Mapping (Brooker, 2005; Fulton, Edelman, & Kuhn, 2006; Sloane, Brooker, Cohen, et al., 2007) and over studies that rely on client interviews (Kane, 2003). Empirically, 20 residents in a house is approaching the size of dementia units in some nursing homes. The present study revealed that the main difference seen in the operation of the 12-resident house and the 20-resident house design was that the latter appeared to hold more activities within the house, raising questions about the value and need for those common spaces, whereas the former made more use of the common spaces for activities. In this way, behavior was affected by the house design and by the way that staff chose to organize activities.
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### Table 1

**Comparison of Architectural Features Across Five Sites**

<table>
<thead>
<tr>
<th>Feature</th>
<th>ASB</th>
<th>MDR</th>
<th>MPN</th>
<th>MPW</th>
<th>WDS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total facility square footage</strong></td>
<td>23,040 sq. ft.</td>
<td>27,308 sq. ft.</td>
<td>24,750 sq. ft.</td>
<td>23,864 sq. ft.</td>
<td>21,540 sq. ft.</td>
</tr>
<tr>
<td>Size of administration area (offices, conference, reception, etc. but not service or employee spaces)</td>
<td>960 sq. ft. (No entry hall)</td>
<td>1,584 sq. ft. day program offices and program space</td>
<td>1,675 sq. ft</td>
<td>1,629 sq. ft.</td>
<td>972 sq. ft. (No entry hall)</td>
</tr>
<tr>
<td>Staff (lunch) room</td>
<td>16' x 18'</td>
<td>6'11&quot; x 6'2&quot;</td>
<td>15.8' x 16'</td>
<td>13.8' x 16'</td>
<td>9.5' x 30' (plus) b</td>
</tr>
<tr>
<td>Treatment or examination room</td>
<td>No.</td>
<td>Yes. in daycare area</td>
<td>No.</td>
<td>No.</td>
<td>Yes. In central area c</td>
</tr>
<tr>
<td>Medications storage</td>
<td>Central medication cart</td>
<td>Medication room.</td>
<td>Medication room per house</td>
<td>Medication room per house</td>
<td>Central medication cart</td>
</tr>
<tr>
<td>Location of meal preparation</td>
<td>Facility kitchen in administration area</td>
<td>Facility kitchen in administration area</td>
<td>Adjacent nursing home (see house kitchen)</td>
<td>Adjacent nursing home (see house kitchen)</td>
<td>Facility kitchen in administration area</td>
</tr>
<tr>
<td>Use of house kitchen</td>
<td>Servery, snacks</td>
<td>Servery, snacks</td>
<td>Meal preparation for all breakfasts and some lunches, servery</td>
<td>Meal preparation for all breakfasts and some lunches, servery</td>
<td>Servery, snacks</td>
</tr>
<tr>
<td>Family dining room or central country kitchen usage</td>
<td>Small group activities; family functions by reservation</td>
<td>Small group activities; family functions by reservation</td>
<td>Small group meetings; Great Room party food preparation; family functions by reservation</td>
<td>Small group meetings; Great Room party food preparation; family functions by reservation</td>
<td>Small group activities; family functions by reservation</td>
</tr>
<tr>
<td>Houses and capacity</td>
<td>2, 20</td>
<td>2, 20</td>
<td>3, 12</td>
<td>3, 12</td>
<td>3, 12</td>
</tr>
<tr>
<td>Private tubroom</td>
<td>Two off the central hallway</td>
<td>Two off the central hallway</td>
<td>One located in each house</td>
<td>One located in each house</td>
<td>None</td>
</tr>
<tr>
<td>Private shower areas</td>
<td>One per 10 residents located in each wing of each house</td>
<td>One per 10 residents located in each wing of each house</td>
<td>One per resident located in each resident room with the one shared bedroom having a shared shower</td>
<td>One per resident located in each resident room with the one shared bedroom having a shared shower</td>
<td>One per 12 residents located in each house</td>
</tr>
<tr>
<td>Resident room doors</td>
<td>Split door</td>
<td>Split door</td>
<td>Split door</td>
<td>Regular</td>
<td>Split door</td>
</tr>
<tr>
<td>Inventory of public rooms and seating capacity (includes all alcoves that can be used for seating and seating areas near exits)</td>
<td>15 / 165</td>
<td>17 / 176</td>
<td>15 / 232</td>
<td>13 / 219</td>
<td>14 / 182</td>
</tr>
<tr>
<td>Variety and appearance of outdoor Area</td>
<td>2 small (little greenery); 1 medium (mixed hard/green surfaces) and a large courtyard—very appealing</td>
<td>2 small (much greenery); 1 medium (mixed hard/green surfaces); 2 large courtyards (1 mixed hard/green surfaces, 1 green) — very appealing</td>
<td>3 small (much greenery); 1 large (mostly green courtyard) — very appealing</td>
<td>3 small (much greenery) and 1 large (mostly green courtyard) — very appealing</td>
<td>1 small (much greenery), 1 medium (mostly green) and 1 large (mostly green) courtyard. — very appealing</td>
</tr>
</tbody>
</table>

a Does not include research/teaching wing. Total for entire floor space is 40,382 sq. ft.

b Room at WDS was not intended as a lounge, i.e., a retreat from work; to professionalize the care staff role it was to serve as a place to read and discuss work. At other sites the lunch room also served as a lounge.

c Room was intended as a multi-purpose room.
Table 2
Therapeutic Environment Screening Scale Items for Goal and Domain, Possible Range, Midpoint, and Mean in Each Group

<table>
<thead>
<tr>
<th>Therapeutic Goal and Domain</th>
<th>Item Numbers</th>
<th>Range</th>
<th>Mid-point</th>
<th>ASB &amp; MDR 20-Capacity Houses</th>
<th>MPN, MPW &amp; WDS 12-Capacity Houses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>ASB Site Scores</td>
<td>Mean</td>
<td>MPN, MPW, WDS Site Scores</td>
</tr>
<tr>
<td>Safety/security/health</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exit control</td>
<td>2a, 2b, 2c, 2d, 2e, 2g, 2h, 3a, 3b</td>
<td>0-11</td>
<td>5.5</td>
<td>2, 1</td>
<td>1.5</td>
</tr>
<tr>
<td>Maintenance</td>
<td>7b1, ‡ 7b2, ‡ 7b3, ‡ 7b4 ‡</td>
<td>0-8</td>
<td>4.0</td>
<td>8, 8</td>
<td>8.0</td>
</tr>
<tr>
<td>Cleanliness</td>
<td>7a1, ‡ 7a2, ‡ 7a3, 7a4</td>
<td>0-8</td>
<td>4.0</td>
<td>8, 8</td>
<td>8.0</td>
</tr>
<tr>
<td>Lack of odors‡</td>
<td>9a, ‡ 9b, ‡</td>
<td>0-4</td>
<td>2.0</td>
<td>4, 3</td>
<td>3.5</td>
</tr>
<tr>
<td>Safety‡</td>
<td>7c1, 7c2, ‡ 7c3, 7c4, 8</td>
<td>0-10</td>
<td>6.0</td>
<td>10, 10</td>
<td>10.0</td>
</tr>
<tr>
<td>Orientation/cuing</td>
<td>19, 20*, 27a, 27b/c, ‡ 27d, 27e, 27f, 28, 29</td>
<td>0-17</td>
<td>8.5</td>
<td>12, 12</td>
<td>12.0</td>
</tr>
<tr>
<td>Privacy/control</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Privacy</td>
<td>30a, 30b, 30c, 30d</td>
<td>0-4</td>
<td>2.0</td>
<td>0, 0</td>
<td>0</td>
</tr>
<tr>
<td>Functional ability</td>
<td>16, 17a, 17b, 18‡</td>
<td>0-7</td>
<td>3.5</td>
<td>7, 7</td>
<td>7.0</td>
</tr>
<tr>
<td>Stimulation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lighting</td>
<td>21, 22a, 22b, ‡ 22c, ‡ 23a, 23b, 23c</td>
<td>0-14</td>
<td>7.0</td>
<td>13, 13</td>
<td>13.0</td>
</tr>
<tr>
<td>Tactile/visual stimulation</td>
<td>34, 35, ‡ 37b</td>
<td>0-16</td>
<td>8.0</td>
<td>10, 6</td>
<td>8.0</td>
</tr>
<tr>
<td>Quietness</td>
<td>24a, 24b, 24c, 24d, 24e, ‡ 24f, 24g, 25, 26</td>
<td>0-25</td>
<td>12.5</td>
<td>21, 21</td>
<td>21.0</td>
</tr>
<tr>
<td>Physical attractiveness</td>
<td>4a1, 4a2, 4b1, 4b2, 4c1, 4c2, 4d1, 4d2, 37c</td>
<td>0-34</td>
<td>14.0</td>
<td>16, 15</td>
<td>15.5</td>
</tr>
<tr>
<td>Socialization</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Homelike environment</td>
<td>15, ‡ 31, ‡ 32</td>
<td>0-9</td>
<td>4.5</td>
<td>9, 9</td>
<td>9.0</td>
</tr>
<tr>
<td>Resident appearance</td>
<td>36‡</td>
<td>0-2</td>
<td>1.0</td>
<td>2, 2</td>
<td>2.0</td>
</tr>
<tr>
<td>SCUEQS</td>
<td></td>
<td></td>
<td>0-41</td>
<td>-</td>
<td>41, 39</td>
</tr>
<tr>
<td>CAAQS, %†</td>
<td></td>
<td></td>
<td>0-100</td>
<td>-</td>
<td>78.6%</td>
</tr>
</tbody>
</table>

* Large means represent better physical environment.
‡ Items used to compute the 18-item Special Care Environmental Quality Scale (SCUEQS); 27b and 27c were treated as a single item and item 15 was misnumbered in the TESS-2+ Revised version (as item 13).
† Item 20 is the percentage of common rooms with signs/graphics; floor plans in all sites allowed a view into common rooms (scored as zero).
§ An item was unintentionally omitted from the TESS-2+ scoring form (10 in Odors and 11 in Safety).
§ Composite Above Average Quality Score (CAAQS) represents the percentage of TESS-2+ domains that were above average in quality.
### Table 3

Percent of Resident Population Who Were Observed During Behavior Scans at Each Site in Particular Areas

<table>
<thead>
<tr>
<th>Area/Site</th>
<th>20-Capacity Houses</th>
<th></th>
<th></th>
<th>12-Capacity Houses</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ASB</td>
<td>MDR</td>
<td>MPN</td>
<td>MPW</td>
<td>WDS</td>
</tr>
<tr>
<td>Total Areas</td>
<td>60.8</td>
<td>49.3</td>
<td>51.1</td>
<td>56.4</td>
<td>80.3</td>
</tr>
<tr>
<td>Total Common Areas</td>
<td>6.2</td>
<td>15.8</td>
<td>16.9</td>
<td>20.0</td>
<td>51.1</td>
</tr>
<tr>
<td>Total Outdoor Areas</td>
<td>4.6</td>
<td>0.2</td>
<td>1.1</td>
<td>5.6</td>
<td>3.8</td>
</tr>
<tr>
<td>Total House Areas</td>
<td>50.0</td>
<td>33.3</td>
<td>33.1</td>
<td>31.1</td>
<td>25.4</td>
</tr>
<tr>
<td>House #1</td>
<td>25.9</td>
<td>16.8</td>
<td>11.5</td>
<td>6.9</td>
<td>6.2</td>
</tr>
<tr>
<td>House #2</td>
<td>24.1</td>
<td>16.5</td>
<td>10.8</td>
<td>12.8</td>
<td>12.3</td>
</tr>
<tr>
<td>House #3</td>
<td></td>
<td></td>
<td>10.8</td>
<td>11.4</td>
<td>6.9</td>
</tr>
<tr>
<td>House Kitchen</td>
<td>14.9</td>
<td>0.8</td>
<td>7.5</td>
<td>5.3</td>
<td>4.9</td>
</tr>
<tr>
<td>House Living/Dining Room</td>
<td>32.4</td>
<td>27.8</td>
<td>23.6</td>
<td>23.2</td>
<td>20.0</td>
</tr>
</tbody>
</table>

*Resident data were adjusted to show the mean percent of residents at a site who were observed per scan per day.

Note: Total Areas is the sum of the following: Total Common, Total Outdoor and Total House. Total House Areas is the sum of Houses #1, House #2, and House #3. House Kitchen and Living/Dining Rooms are summed across houses. Blank cells indicate that the question was not applicable.
### Table 4
Percent of Resident Population Who Were Observed During Behavior Scans at Each Site in Particular Common Areas

<table>
<thead>
<tr>
<th>Location</th>
<th>20-Capacity Houses</th>
<th>12-Capacity Houses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ASB</td>
<td>MDR</td>
</tr>
<tr>
<td>Great Room</td>
<td>0.7</td>
<td>7.5</td>
</tr>
<tr>
<td>Fireplace Seating Area</td>
<td>2.2</td>
<td>6.9</td>
</tr>
<tr>
<td>Activity/Craft Room</td>
<td>0.4</td>
<td>4.7</td>
</tr>
<tr>
<td>TV Room</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Other TV Area</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Common Area Hallway Seating</td>
<td>3.7</td>
<td>10.8</td>
</tr>
<tr>
<td>Music Room</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Garden Room</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Beauty Salon</td>
<td>3.9</td>
<td>1.2</td>
</tr>
<tr>
<td>Family Dining Room/Country Kitchen</td>
<td>0.0</td>
<td>0.9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>10.9</td>
<td>32.0</td>
</tr>
</tbody>
</table>

*Resident data were adjusted to show the mean percent of residents at a site who were observed per scan per day.

Note: Dashes indicate that residents were not observed in these areas.
<table>
<thead>
<tr>
<th>Time of Day</th>
<th>20-Capacity Houses</th>
<th>12-Capacity Houses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ASB</td>
<td>MDR</td>
</tr>
<tr>
<td>Before Lunch</td>
<td>54.1</td>
<td>36.0</td>
</tr>
<tr>
<td>Lunch</td>
<td>80.5</td>
<td>66.3</td>
</tr>
<tr>
<td>Between Meals</td>
<td>65.7</td>
<td>53.0</td>
</tr>
<tr>
<td>Supper</td>
<td>76.5</td>
<td>73.8</td>
</tr>
<tr>
<td>After Supper</td>
<td>5.0</td>
<td>39.0</td>
</tr>
</tbody>
</table>

* Resident data were adjusted to show the mean percent of residents at a site who were observed per scan per day.

Note: Before Lunch (4 scans-7:30-10:30), Lunch (2 scans-11:30 & 12:30), Between Meals (3 scans-13:30 to 15:30), Supper (2 scans-16:30 & 17:30), After Supper (4 scans-18:30 to 21:30).
Figure 1
Floor plan of Asbury Place, Mt. Lebanon, PA
Figure 2
Floor plan of Marjorie Doyle Rockwell Center, Cohoes, NY
Figure 3
Floor plan of McConnell Place North, Edmonton, AB
Figure 4
Floor plan of McConnell Place West, Edmonton, AB
Figure 5
Floor plan of Woodside Place, Oakmont, PA

Woodside Place
Oakmont, PA

Admin & Services
Activity/Craft Room
Beauty Salon
Dining/Living Room
Family Dining Room
Fireplace Seating Area
Great Room
Hallway
Kitchen
Laundry Room
TV Room
Shower Room
McConnell Place North* Residents' Activities When Alone and in the Presence of Staff

The average MMSE score was 15.3 at MPN, higher than the average across sites 13.2 ± 1.5 (M±SE); MPN residents appeared not to initiate activities when alone.
Figure 7
Percent of Scans in Which Residents at Each Site Engaged in Particular Behaviors