Journal of Housing For the Elderly

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Online publication date: 20 November 2009


To link to this Article DOI: 10.1080/02763890903327010

URL: http://dx.doi.org/10.1080/02763890903327010

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Post-Occupancy Evaluation of a Transformed Nursing Home: The First Four Green House® Settings

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To study how well the physical environments of four Green Houses® served the residents, staff, and visitors and to develop recommendations for similar small-house nursing home projects. Longitudinal post-occupancy evaluation of four houses using mixed-methods, including behavioral mapping, checklist ratings of individual bedrooms and bathrooms, place-centered time scans, environmental tracers, and questionnaires and interviews. The small residential environments achieved the desired functional results for residents and staff. Some components of the environment proved problematic, especially bathroom designs, lighting and fixtures, and storage spaces. Certain areas of the buildings were under utilized, particularly a den. Space was used differently in the two houses dedicated to residents with dementia compared to the other two houses. In the latter, residents tended to use their own rooms for a variety of activities, including visits, and often kept their doors closed, whereas in the former the central hearth area was used more frequently. The physical design of the Green Houses was associated with desired behavior and outcomes in residents and staff. Post-occupancy evaluation methods were useful to elicit detailed information about

The authors thank the Commonwealth Fund for sponsoring the evaluation of the Tupelo, Green Houses, and Mary Jane Koren, MD, the project officer for the fund. They also thank Steve McAllilly, CEO of Methodist Senior Services of Mississippi, the residents, family members, and staff connected with the first four Green Houses for their gracious support of research being conducted in their organization, and Richard McCarty, architect and CEO of the McCarty Company and his colleagues for their energy and commitment to developing Green House environments, their willingness to share their thoughts with researchers, and their interest in learning from post-occupancy evaluation.

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environmental performance and suggest modifications for the next iteration of Green Houses.

**KEYWORDS**  Green House nursing home, culture change, privacy, living environments

**INTRODUCTION**

This article presents a comprehensive longitudinal post-occupancy evaluation (POE) of a radically transformed model of nursing homes, the Green House. It concentrates on four houses physically removed from but licensed as part of a traditional nursing home during the first 2.5 years of their operation. We aimed to describe the physical settings and how they were used by residents, staff, and visitors and to develop recommendations for similar small-house nursing home projects.

**BACKGROUND**

Green Houses

Green Houses are trademarked small-house nursing homes first suggested by William Thomas, who also founded the Eden Alternative philosophy of person-centered care (Thomas, 1996) and later envisaged the Green House as a radical de-institutionalization of nursing homes (Thomas, 2004). A Green House is a self-contained, purpose-built residence for 10 or fewer residents needing a nursing-home level of care. One or more Green Houses may be licensed as a nursing home or part of nursing home; Green Houses that are thus linked administratively may be located on the campus of a long-term retirement community, contiguously in a residential neighborhood, or scattered throughout a neighborhood. Seeking a clear break with the institutions of the past, Thomas (2004) described a Green House as “an intentional community for people seeking the worth and meaning in late life” (p. 223) that “generates warmth through its commitment to small size, de-emphasis of hierarchy, and power of its belief in the genius of human longevity” (p. 224).

The Green House also transforms the organizational structure and the staff roles. Each Green House was to be staffed by a dedicated group of front line certified nursing assistant-level staff with additional training and broadened roles, including planning and cooking meals, doing light housekeeping and residents’ personal laundry, and fostering activity and quality of life. Professional staff members, including nurses and all the roles that are required under nursing home regulation, are organized into visiting clinical support teams who perform assessments and give care. The frontline staff
members are expected to support the work of all the professionals but report to an administrator rather than a nurse. As described in more detail by Rabig, Thomas, Kane, Cutler, and McAlilly (2006), the whole enterprise is guided by a “philosophy that emphasizes habilitation and a good quality of life for residents under normal rather than therapeutic circumstances” (p. 534).

As part of the model, the physical environments were expected to be homes with all their hallmarks and to blend into their neighborhoods. Conversely, institutional hallmarks such as long double-loaded corridors, nursing stations, public address systems, and medicine carts were to be eliminated. At the early stage of articulating the Green House concept, there was little design guidance beyond the general vision that they be homes and not be institutional—an early mantra was “if you would not have it in your own home, it does not belong in a Green House.” The exceptions were several required elements: a hearth area with a fireplace (which symbolized warmth and home); a dining table large enough to seat all residents plus frontline staff and several guests (which symbolized community); single rooms with en suite full bathrooms; and occupancy for no more than 10 residents. The vision also included widespread use of technology to improve resident functioning and communication and maximize the effectiveness of staff. The example given initially—and one that had implications for design—was the planned use of ceiling lifts to allow single-person transfer assists between the bed and chair or bathroom. In reaction to the constant blare of televisions in many nursing homes, the initial plan was that no televisions would be located in the hearth area.

Federal and state regulatory requirements may challenge part of the Green House vision. For example, residents are expected to use the kitchens as they would in any home, yet established guidelines for food handling and separation of food from refuse make that difficult. CNAs with broadened roles are expected to cook and serve meals concurrently with providing resident care, necessitating particular attention to infection control. In a traditional NF many spaces are “off line” for residents (e.g., office spaces, industrial kitchens, and laundries). In the Green House, almost no space was to be off-line for residents.

In the Green House, the normalcy of the setting and the hallmarks of home were expected to foster meaningful activity and interactions. This is consistent with the ecological model (Lawton & Nahemow, 1973), which theorizes that competence is the result of the interaction of personal factors with their environment. Both behavior and emotions are the result of environments that produce the right levels of support and stimulation. Furthermore, physical environments fashioned like the Green Houses should reinforce Maslow’s 5-level hierarchy of needs (Maslow, 1970), namely: physiological; safety; social (love, acceptance, affiliation, and being needs); self-esteem (competence and recognition from others); and self-actualization. The Green Houses also embody cultural norms for
living spaces (Morris & Winter, 1991). For example, privacy is a strong cultural norm that has had great impact on design and ultimately on housing satisfaction. A focus group study showed that, regardless of income or ethnicity, seniors needing long-term care and their families strongly preferred not to share sleeping quarters with previously unknown individuals (Kane, Baker, Salmon, & Veazie, 1998). Based on specific environmental analyses, Calkins and Cassella (2007) showed additional health and management benefits to private occupancy as a norm. A large-scale study in nursing homes suggested environmental analogues to 11 domains of resident-reported quality of life: privacy; individuality; autonomy; spiritual well-being; sense of security and order; comfort; enjoyment; meaningful activity; reciprocal relationships; individual dignity; and functional competence (Kane et al., 2003); both of the environmental inputs and the resident outcomes can be measured at the individual resident level (Cutler, Kane, Degenholtz, Miller, & Grant, 2006). Finally, the design imperatives or principles of the Green House are consistent with the gradual consensus emerging over the past decade: that designs should consult resident’s needs for living space more than staff needs for work space; that residential scale, residential materials, and privacy are all desired; and that high lighting levels, navigation aids, and minimized walking distances are important to maximize functioning for elderly physically impaired or memory-impaired individuals (Brawley, 2005; Marsden, 2006; Regnier, Hamilton, & Yatabe, 1996).

Post-Occupancy Design

This study falls within the theoretical and methodological tradition of POE studies. Environmental scholars hold that a relationship must exist among design decisions, social and behavioral outcomes, and care goals. A POE permits measuring that relationship and providing feedback on how well the building or space performs after it is occupied. Definitions of a POE vary but all touch on systematic exploration of the extent to which the built environment met users' needs and engender satisfaction (Turpin-Brooks & Viccars, 2006; Zimmerman & Martin, 2001). The history of the POE can be traced to a policy of the Royal Institute of British Architects (1963) in its Plan of Work for Design Team Operation, which held that feedback in the form of a POE should become an accepted part of the project delivery and could improve the quality and sustainability of a building. Despite excellent building performance assessment work in the 1960s, the Royal Institute of British Architects withdrew this requirement in 1972, mainly because clients would seldom pay for a performance assessment.

In the United States, Carp (1966) conducted one of the first extensive POEs of project for seniors in a year-long analysis of Victoria Plaza, a senior congregate housing project. Worldwide enthusiasm is again mounting for
assessing building performance (Baird, Gray, Isaacs, Kernohan, & McIndoe 1995) with renewed attempts to make POEs routine, although with limited success. Most designers only become aware of issues in the use of their spaces when asked to investigate a problem (Bordass & Leaman, 2005).

Few POEs have been conducted in nursing homes and residential care facilities and most have been focused on dementia programs. A 3-year study of the Woodside Place (Hoglund & Ledewitz, 1999), a 36-person setting for people with Alzheimer’s arranged in three 12-person interconnected houses, illustrates a comprehensive longitudinal approach to a POE process. The evaluation was designed to examine the interrelationship between the organizational, programmatic, and environmental factors on resident health and social experience, staff performance, and family caregiver satisfaction (Silverman et al., 1996). Nine design concepts were studied: acknowledging privacy and community; flexible rhythms and patterns; small-group size; caregiver and family relationships; engaged wandering; alternative way-finding systems; independence with security; and focused and appropriate stimulation and residential qualities. Key findings included that the rooms designated for a single purpose, such as the music room or activity room, were underutilized as were lounges at the end of the corridor; residents spent less than 10% of their time in their rooms, suggesting to the authors that a smaller room size was acceptable if more square footage were to be given to shared spaces; and color cueing and way-finding techniques were observed to be unsuccessful. In a smaller scale example, a POE was conducted for the bathrooms in a dementia-specific setting, relying on a survey of 17 resident assistants to determine whether design objectives had been met (Noreika, Kujoth, & Torgrude, 2002). Altering the floor construction to improve safety and for ease of cleaning was the most frequent suggestion for improvement.

In a review of 23 POEs in senior settings in the community and institutions in the United States and Scandinavia, Anderzhon, Fraley, and Green (2007) fielded 5-member evaluation teams that visited each project for 2 days to evaluate them on creating a community; making a home; regional/cultural design; environmental therapy; outdoor environment; and quality of workplace and the physical plant. The study, which used the self-reported description of the projects by the architects as the basis for the evaluations, did not extend to evaluate the actual behavior of residents or staff in the spaces. Generally, the authors concluded that much experiential data is available on senior housing environments but it is not well documented for use across projects. One case study is dedicated to the Green Houses at Traceway (Chapter 18, 212–221); the evaluators judged that the design largely served the goal of giving residents “the amenities of any suburban home” and that all elements of the design “allows it to fade into and become a part of the landscape of 21st century America” (p. 218).

Preiser (2001) defined three levels of effort in the POE process. First, an indicative review gives a quick snapshot of a project utilizing a few
interviews combined with a walk-through and possibly a short questionnaire with the aim of highlighting major strengths and weaknesses of a building; an investigative review is an in-depth study of the building’s performance and uses more rigorous research techniques with staff being given questionnaires backed up by focus groups and interviews; and a diagnostic review is a thorough analysis that links physical performance data to occupant responses and an analysis of the building’s systems including lighting and lighting levels, energy use, heating, temperature, and acoustic performance. In the study reported here, we used the techniques of both an investigative and diagnostic review with the luxury of being able to make detailed observations of the use of space over time.

Specific Setting for the Study

This study was conducted in the first Green Houses to be operated. They were located on a retirement campus in Tupelo, Mississippi, which included independent-living duplexes and apartments, low-income apartment housing, assisted living, and a 140-bed nursing home. The sponsor was in the midst of planning for rebuilding and modernizing its nursing home when it switched course and decided to build four Green Houses in an undeveloped area of the campus where independent housing is located (McAlilly, 2004). The architect, Richard McCarty, and the sponsor worked closely with William Thomas, the conceptual founder of the Green House, to ensure that the designs were compatible with the Green House vision. As part of the development, an architecture student visited the homes of older people in the geographic area and photographed the way they organized space and furnishings. According to Thomas, ideally a Green House is fitted to a particular time and place and thus “its specific dimensions and layouts can only be derived from the way elders live in a particular locale” (Thomas, 2004, p. 224). Accounts of the design process emphasize the efforts to create a home and clarify that it should be done within a cost that would allow for the homes to operate under Mississippi Medicaid reimbursement rates (Mabry, 2006; Wallace, 2006).

Small-house living for elderly people with disabilities is not completely unknown prior to Green House; one whole stream of assisted living is the small-house or foster-home variety (which itself takes lessons from group homes for younger adults) and the other is the self-contained apartment. The design ideas of these Green Houses have analogues in small group homes, many of which were developed for adults with developmental disabilities. Some of these are literally homes in the community that are used for people with disabilities; others are purpose-built with residential kitchens and living spaces resembling the Green House. However, the innovation and, thus, the challenge of the Green House models, including the challenge...
for design, is to create such settings as nursing homes where all the residents are at the nursing home-level (not just a few, as typically occurs in assisted living), where there is no higher level beyond the hospital to which they can be referred, and where there is a need for all of the paraphernalia and trappings of heavy care in places that are trying to function as homes.

The first two houses, Laney and Page (each house took the name of the oldest resident at the time of move-in), were occupied by the 20 residents previously in the nursing home’s locked dementia care unit (the dementia care unit was out-of-date and initial funds for rebuilding had been donated for an Alzheimer’s program). The other two houses, Franks and Martin, were occupied by residents who requested to move in who were chosen in order of their length of residency in the retirement community. Move in was staggered at one house per week and was accomplished in May and June 2003. Given a plan to gradually phase out the traditional nursing home, during the next 2.5 years all admissions to Green House were from the retirement community (typically the nursing home but occasionally the assisted-living setting) ordinarily using the same priority system. Given the initial mix, vacancies at Laney and Page House were filled only by those with substantial dementia who often had behavioral issues, although individuals with dementia were found in all the houses.

**METHOD**

**POE Framework**

For this study, environment was defined to include the building and its surrounding outdoor space, its fixtures, furnishings, equipment, and décor, and how it was all used. We used multiple sources of data to complete a performance evaluation, including technical elements, functional elements, and behavioral elements, following a model suggested by Preiser, Rabinowitz, and White (1988).

This POE was part of a 2.5 year multi-method longitudinal quasi-experimental study comparing the Mississippi Green Houses to two comparison sites using data collected at baseline and three 6-month follow-up intervals. The main evaluation compared outcomes of the Green House residents, their family members, and the CNA-level resident assistants to those of residents, family, and CNA’s at the sponsoring nursing home and a retirement campus owned by the same firm approximately 80 miles away; positive results for resident quality of life, satisfaction, and functioning and for family well-being are published elsewhere (Kane, Cutler, Lum, Degenholtz, & Yu, 2007; Lum, Kane, Cutler, & Yu, 2008). This POE deals only with the Green Houses, not the comparison settings.
Research Questions
Listed below are the general research questions guiding the POE:

- How have the private Green House spaces informed the nursing home experience for residents and other users (family and other visitors and staff)?
- How have the shared Green House spaces informed the nursing home experience for residents and other users?
- How well does the environment achieve its aim of being a home?
- How well does the environment function as a workspace for staff?
- Were cross-Green House differences found in the use of the environments initially or over time?
- How does the environment support specific care tasks and life functions (e.g., bathing, meals, interactions with other residents and those outside Green House, and outdoor activity)?
- What environmental changes are recommended for the next generation of Green House’s on the Tupelo campus or elsewhere?

Data Collection

FLOOR AND SITE PLAN ANALYSIS
A richly detailed description of the actual physical setting is a component of any POE. We undertook a systematic study of floor and site plans, detailing each room by size, configuration, furnishings, and design features. We also described the furniture, equipment, and decor.

ADMINISTRATIVE DATA ANALYSIS
We developed cost-calculation worksheets to capture the costs of construction and operations during start-up and when a steady state was achieved. Data for the construction costs were gathered from The McCarty Company, the architectural firm that designed and constructed the Green Houses.

ENVIRONMENTAL CHECKLISTS
Data on the rooms and bathrooms were gathered using a 112-item checklist for assessing resident room and bath areas that is part of the Environmental Quality Assessment for Living (EQUAL) checklists (Cutler et al., 2006). The first author completed the checklist assessments for each of the 40 residents at the beginning of the study and for each new resident who had moved in during subsequent data collection intervals.
BEHAVIORAL MAPPING

An observational behavioral mapping schedule was developed to systematically chart the location and movement of residents, staff, and visitors during specific time periods organized to map much the same time period for the same length of time in each Green House during morning, afternoon, and evening hours. For example, lunch was served at sometime between 11:00 a.m. and 1:00 p.m. in each house. For four subsequent days, that time period was observed in each house, giving information about whether residents were sitting at the table prior to the meal and how long they lingered afterward. During the observation period, notes were made about who was in each space and what they did there. For each follow-up period, mapping included a minimum of 6 hours per house for each of the four houses. Alternating between houses, the mapping was done in 2-hour sessions throughout the day, including weekends.

INTERVIEWS WITH USERS

During observation periods throughout the study, the first author conducted unstructured interviews with elders, staff, and family and compiled field notes for the interviews after each visit. These interviews dealt with what informants liked or disliked about the specific spaces and their perceptions of difference from previous nursing home experiences. Also, as part of the overall evaluation, data collectors interviewed each Green House resident, family member, and CNA-level staff member. At each of four time intervals 6 months apart, the interviews included ratings of satisfaction with the physical environment and open-ended questions seeking reactions to the private and shared space from residents and family and the working environment from staff with 100% response rates from the Green House sample. We incorporated these qualitative responses from Green House users into the POE.

PLACE-CENTERED TIME SCAN

During each wave of data collection, a systematic observational scan was conducted in each house within a 30-minute timeframe by swiftly moving between houses and documenting how the shared spaces were being used in each house during those 30 minutes. Time scans were conducted four times throughout the day for a minimum of two scans per time slot per Green House during each data collection wave, using beginning times of 9:30 a.m., 12:30 p.m., 3:00 p.m., and 5:30 p.m. This scheduling allowed for the 2-hour sessions of behavioral mapping to be conducted in between the time scans.
PHYSICAL TRACERS

Observing physical tracers after users have left a space is an unobtrusive way to explore patterns of space use. The selection of tracers used in this study included placement and use of dining room chairs, use of bookshelves in the hearth area, placement and use of shared television sets (e.g., whether they were on or off and whether any watchers were in reasonable visual distance of a television set that was turned on), and wear and tear on furniture and appliances. The results of tracers were annotated in a detailed journal.

PHOTOGRAPHS

We used photographs of a location or space taken systematically (e.g., a picture of each hearth bookcase at intervals; a picture of each kitchen counter) or taken to document a specific observed phenomenon, which might be construed either positively or negatively. This technique helped identify how the Green Houses were maintained, whether the interiors, including placement of furniture, accorded with the intent of the model, and resident activities. The informed consent included securing permission of residents or their agents for taking photographs for educational and research purposes.

TIME PERIODS AND LONG-RANGE FOLLOW-UP

Intensive data collection for the POEs occurred from May 2003 through December 2004. In 2006 and 2008 as part of a study of expanded Green Houses on the same campus, both authors made 4-day visits to the campus and systematically visited each of the original Green Houses and noted changes to the environment. All instruments and observational protocols are available on request from the first author.

FINDINGS

Design and Construction Costs

The architectural firm designed the Green Houses to be consistent with the idealized Green House model within the usual constraints of budget. Each house is designed with 10 private rooms enclosing common spaces and service areas located below the common spaces (Figure 1). The total area of each house is 6,040 gross square footage (gsf); bedrooms are 210 gsf and bathrooms are 50 gsf. The entrance area (#1) opens into the kitchen and dining area (#3) and into the hearth area (#2). The open kitchen design is surrounded by counter space, including a counter at wheelchair height. The kitchen area can be entered on both sides with no doors or gates obstructing entry. A metal shield is located on a shelf adjacent to each stove that can
cover the cook top if a staff member needs to leave the kitchen in the midst of food preparation. A pantry is located behind the kitchen and is not accessible directly from it. A den (#4), typically housing chairs, a card-table sized table set, and a television, is located behind the kitchen and out of view of the central shared space. A double door to the patio is located in the den area with an additional door off the kitchen. Each bedroom (#5) is private with a window, wide window sill, small closet, and built-in locked medication storage unit. A shower is located in the bathroom with a fold-down shower-chair attached to the wall between the lavatory and sink. No door separates the bedroom from the bathroom. In each room, the hardware was installed for ceiling lifts from the bed to the bathroom.
The office (#6) fulfills many functions, including storage of drugs needing refrigeration, location of medical records, computer, and fax, office space for professionals on the clinical support team, and occasional break space for staff. A beauty salon (#7), spa with whirlpool bath (#8), and utility room (where storage and the washer and dryer are located) (#9) completes the plan. An additional bathroom (not numbered in the plan) is located in this service area, fulfilling the requirement for a staff and visitor bathroom. A service door is located off the utility area. Allocations of space per house and construction costs are summarized below:

**Space Allocations**

<table>
<thead>
<tr>
<th>Description</th>
<th>Square Feet (gsf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resident room/bath</td>
<td>260 gsf</td>
</tr>
<tr>
<td>Total room &amp; bath</td>
<td>2600 gsf</td>
</tr>
<tr>
<td>Social shared areas</td>
<td>2529 gsf</td>
</tr>
<tr>
<td>Support services areas</td>
<td>818 gsf</td>
</tr>
<tr>
<td>Maintenance/mechanical</td>
<td>93 gsf</td>
</tr>
<tr>
<td>Total gross area/house</td>
<td>6040 gsf</td>
</tr>
<tr>
<td>Total gross area/project</td>
<td>24,160 gsf</td>
</tr>
</tbody>
</table>

**Construction Costs**

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soft costs</td>
<td>$256,435</td>
</tr>
<tr>
<td>Building costs</td>
<td>$2,355,313</td>
</tr>
<tr>
<td>Site costs</td>
<td>$558,341</td>
</tr>
<tr>
<td>Total project cost</td>
<td>$3,170,089</td>
</tr>
<tr>
<td>Project cost per gsf</td>
<td>$131</td>
</tr>
</tbody>
</table>

The Green House sponsor sought to meet the intent of each federal and Mississippi nursing home regulation while avoiding institutional hallmarks. Because each self-contained Green House held fewer than 20 residents, Mississippi regulations allowed for noncommercial appliances. The requirement that dishwashers be contained in a separate room was interpreted as being met by their enclosure in their own small “rooms” beneath the sinks. The requirement of a public restroom for men and women was deemed met because the main nursing home to which the Green Houses were affiliated had gender-specific bathrooms. The Survey and Certification agency was enthusiastic about testing the model and was flexible as long as the purpose of each regulation was met; for instance, the Green House does not have a nurse’s station, but all of the functions of a nursing station are met. Ultimately, the only built elements that appeared distinctly institutional were the two illuminated exit signs that are both visible from the central area.

Originally, the sponsor hoped that furnishings for the bedrooms would largely be provided by residents and their families, but because the initial residents were all current residents of the traditional nursing home and most
were Medicaid participants, many had little furniture to bring. There were, of course exceptions, with rooms that were elaborately appointed by the resident and family. Family and community members were encouraged to volunteer furnishings for the resident rooms and the shared areas, although basic dining room, hearth, and den furnishings were purchased. Early on, an executive from corporate headquarters ordered hearth furniture from a supplier that proved unsuitable both in high cost and institutional appearance. These sofas and chairs were replaced by lounge chairs purchased from local retailers, which were both less expensive and consistent with the types of furniture preferred by older people living independently in that community.

Performance Evaluation

The performance evaluation comprises a large amount of observation, organized according to three general elements. We have compressed that information into three tables.

**Technical Elements**

As the term suggests, the technical elements encompass myriad details about the setting itself, including details of lighting, heating and cooling, plumbing, hardware, doors, windows, appliances, acoustics, temperature, and communication systems. Table 1 summarizes these findings, illustrating both the original design plan and modifications that were made or thought necessary for subsequent projects. For example, the residential grade appliances did not stand the test of such frequent use and ad hoc arrangements were made to close off the kitchen from residents at specific times. In some instances, staff behavior interacted with the design (e.g., lighting largely depended on staff drawing blinds in residents’ rooms). In general, the design was effective in minimizing distances for residents and staff to traverse.

**Functional Elements**

In this category, we place the prosthetic and therapeutic elements of the environment that support resident and staff functioning in the space, including topics such as accessibility, stimulation, challenge, sensory compensation and enhancement, and adaptability and responsiveness to change in resident functioning (Table 2). Again, the environment was largely supportive, but specific suggestions were made in several areas.

**Behavioral Elements**

Here environmental features interact with management decisions, programs, and policies as well as resident and visitor preferences to affect how the environment is used to enhance quality of life (Table 3). In this section,
TABLE 1 Technical Performance Evaluation of the Green Houses

**Lighting**

**Overview:** Natural light is in abundant supply in the green houses. Glare is not a problem. Resident rooms have blinds on windows to control light levels. Illumination levels could be improved on, especially in bathrooms. For adequate illumination in bedrooms, residents need to supply lamps. Task lighting is adequate in kitchen area. Ceiling lights in the bathrooms are rusting out. In the kitchen/hearth area there are 14 lights, mostly canisters that use energy efficient compact fluorescent light bulbs of 26 & 13 watt. Most often, every light in the main shared area is on throughout the entire day.

**Switches and outlets:** The toggle light switches in the bedrooms are small and difficult for residents to use. (A more appropriate switch would be a lighted rocker or pressure type switch). One overhead light is located in the middle of the room so that wherever the bed is located, it could not be used for task lighting for the bed. Two overhead light switches are placed in a location on a side wall next to the spot where the bed was almost always located (because of being the shortest distance for a ceiling lift between bed and bathroom). Because of limited wall space, residents tend to place shelving units in front of the switch, thus obscuring it and making its use difficult. Electrical outlets are insufficient for well placed night lights or task lighting or for electrical appliances and equipment, including entertainment equipment. Lights are not on a rheostat. No switches are illuminated.

**Bedroom lighting:** There are 2 ceiling-mounted light fixtures in bedroom and no wall-mounted fixtures. There is no night light in bedroom. The wall-mounted medicine storage cabinet in each bedroom lacks task lighting.

**Bathroom lighting:** Bathroom lighting includes one wall-mounted light fixture and one ceiling mounted light fixture There is no night light in bathroom.

**Window blind use:** Green Houses differed in use of blinds. From observation, the elder rarely operated the blinds independently. If open, staff, generally opened them in morning. Some house interiors are very dark, relying on electric lights while others are filled with sunlight. For example, on 7-13-05, between 11:00 a.m. and 1:00 p.m blinds in elder rooms were as follows: House 1: 3 open, 7 closed; House 2: 2 open, 8 closed; House 3: 7 open, 3 closed; House 4: 5 open, 5 closed.

** Appliances**

Residential rather than commercial models are being used for these appliances, which is permitted if a nursing home serves fewer than 24 people. During observation periods, one or more of these appliances were often out of order. For example, during one visit the washer was broken and the laundry needed to be done at the main nursing home. Two dishwashers are in each house. Disinfectant soap is used because the dishwasher water temperature cannot reach the required 180 degrees. The icemaker placement next to the dishwasher is not optimal because the heat the dishwasher generates increases the load on the icemaker. The range is gas and a stove guard is available to trap pots in case the staff member cooking is called away. For future developments, use cook tops that are cool to the touch. Smaller appliances such as griddles, deep fryers, blenders, coffee makers, and microwaves are constantly in use and often replaced.

** Heating and Cooling**

**Temperature control:** Individual temperature control units are located in resident rooms giving them the opportunity to regulate the temperature. Background fan noise is not a problem. Vents directly above dining area create drafts, especially when AC is on.

**Safety/Security**

**Wireless communication:** Call station systems in resident rooms are powered by batteries (150+). A computer system warns when batteries are low, but once a month all bathroom pull chord and bed push buttons are tested. Some corrosion has affected bathroom pull cords. Instant notification for the call system is provided with a pager. Resident assistants wear pendants that have the ability to alert Clinical Support Team of an emergency situation. The wireless communication system is supplemented with 2 land telephone lines located in the office. Sprinkling systems are located in each house. Fire detection alarms follow city codes.

(Continued on next page)
| Exit and entrance control: A keypad code is required to open the front doors; competent elders and frequent family visitors are aware of the code. After one elder in House 1 escaped through a window (with no negative repercussions), limited-opening hardware was installed in all the windows. The yards are enclosed with a 6-foot high metal fence. A gate to the yard is opened with an access code. |
| Secured access into kitchen: Initially, staff purchased screens for the dementia Green Houses to cut off kitchen access when kitchens were unoccupied or meal preparations were underway. These temporary screens proved dangerous to elders and gates were installed to block entry to the kitchen. Magnetic pulls on kitchen cabinets provide secured access to cabinets. |
| Emergency exit: Travel distance between exit access doors and exits is less than 40 feet. Travel distance from the center of the Green House to the nearest exit is less than 40 feet. Travel distance from elder rooms to the nearest exit is less than 50 feet. |
| In house security system: No private security system is installed. |
| Biohazard waste: It was intended that biohazard waste be kept in the service area in close proximity to laundry facilities. Two years later, 2 storage units with red bio-hazard signs are located between houses on the campus; one of these storage units previously housed lawn equipment. |

**Acoustics**

Compared to many nursing homes, the houses are acoustically quiet. There is no overhead paging system. The generous use of carpet, casters on dining chairs, and ceiling materials combine to reduce noise. The frequently ringing doorbell and the alarm if the door is opened without the code are the most common noises. When televisions were relocated to the hearth area, a new source of noise was introduced.

**Interior Finishes**

These finishes are attractive, provide contrast, and offer different textures. Bedrooms are individualized by use of different paint colors.

**Maintenance:** Maintaining wall coverings from damage by wheelchairs is a problem, and maintenance staff suggests using a material other than drywall for the walls would have been preferential. Cracks in the ceiling soffit area of each house suggest an impending problem. Maintenance of the kitchen areas differed between houses with some showing more wear and less cleanliness than others. Initially, some of the countertops slanted to the degree of dishes sliding off.

**Spatial definition:** Very good, especially in visually separating the dining area from the hearth area though this differentiation could be further enhanced by use of zone lighting.

**Windows**

Minimum window regulated size in a resident room is 12.5 square feet. Green House windows are 18 square feet with sills 34 inches from floor. The value of the larger windows greatly outweighs the security issue of elopement. Opening blinds during the day would further enhance the benefit from the larger window.

**Doors**

**Thresholds:** Recommended threshold levels of less than 1/2 inch is achieved although differing heights of floor coverings in shared areas and doors to outside are problematic. Some elders are tripping on the strip between the dining and hearth area.

**Access:** The Green House has three doors to the outside. The wide front entrance provides good access for emergency gurneys and an ambulance can backup directly to the covered entrance area. The side door into the service area is also beneficial. The glassed door onto the patio is obviously convenient for entry and exit, bringing barbecued foods easily inside, and permitting staff observation and resident previewing. Staff who smoke tend to use the patio for breaks. The only other entry to the yard and patio is a gate which can be opened with an access code.

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**Automatic door opener:** There are no automatic door openers in the Green Houses, although one providing better access to the patio would be a benefit. Hardware is lever type that passes the fist test.

**Immediate Neighborhood**

**Roads:** The Green Houses were built in an undeveloped part of the campus near independent housing where roads needed to be constructed. All Green Houses are side-by-side on the same street. The road is paved and can accommodate cars passing each other, but not when cars are parked on both sides, which is most of the time.

**Sidewalks:** No paved sidewalks are available for the street at the front of the house, though there are paved walkways from the side entrance to the street.

**Parking:** No off-street parking is available. Parking for staff and visitors is parallel on both sides of the one-way street. By 2006, 6 additional Green Houses were constructed and a circular road was completed.

**Distances:** The Green Houses are in easy distance of each other and are approximately a 10-minute walk from the original nursing home.

**Development possibilities:** Additional proximate land is available where more convenient community center, health center, and staff offices could be developed, but the main nursing home (now with only 24 beds) is used for that purpose.

Observations relate to such abstractions as privacy and individuality, meaning-making, and socialization and development of community. The Green House environment was meant to support a vision of care and community that was also under development. Generally, the openness of the kitchen, dining, and hearth areas enhanced the sense of community and facilitated communication. Television use did not occur as planned. Originally kept out of the hearth area, they gradually migrated there without a purposive design, such as being placed in a closeable cabinet at proper resident height. The elements in Table 3 showed considerable variation across the 4 houses, with residents at Laney and Page House spending more time in the shared areas than did the residents of the other two houses. During the course of our observations, we noted a period when clutter was evident, but during our last observation that problem had almost disappeared.

**Interviews**

**Residents and family responses to bedrooms**

At each of four data collection times, Green House residents responded to the open-ended question “what do you like best about your current living situation” with high praise for the environment. Comments include “best thing to hit the universe,” “I am very satisfied with my home,” “this is my little house and I take care of it,” and “it is like a home away from home.” Similarly Green House family members were enthusiastic. One responded: “It’s a beautiful home. She didn’t live this good at home. It is just a luxurious place.” Another responded: “I think her living area is spacious. The
### Human Factors

**Anthropometric considerations:** Most features in the Green Houses anthropometrically support elders and resident assistants. The exceptions are that some of the kitchen cabinets are located too high, some toilets are too low, and an automatic door opener has not been installed. The bathrooms need counter space around the sinks. Paved sidewalks are needed in front of the Green Houses.

**Wheelchair accessibility:** This is adequate except at the shampoo bowl in the beauty shop, where wheelchairs cannot get close enough.

**Furniture:** Overall the furniture supports functional competence although many of the hearth chairs are too over-stuffed for ease of access. The outdoor area needs covered seating because of the heat.

**Lifts:** Each bedroom is equipped with tracking for a lift that extends from the bed to the bathroom lavatory and shower space. Initially, ceiling reinforcement was required to support the system. Difficulty with track slippage required modifications to each track to prevent future lift accidents. The lifts are used often and staff is positive about them. Suggested extension of lifts to hearth area was discouraged because of the intent to keep area residential in appearance.

**Mobility facilitation:** The wider hallways facilitate ease of passage and the residential scale provides shared spaces within a manageable distance. At year 2, some of the hallways were cluttered with medical equipment and unused dining room chairs became an obstacle when stored in the hearth area.

**Activities:** The intent of the Green House activity program is that elders would assist in cleaning, laundry, washing dishes, and food preparation to the extent they wish, and that such activity plus normal interactions would, in part, substitute for formal organized group activities. Also, resident assistants were expected to encourage and facilitate solo and group activities that residents chose. The kitchen and dining table did become the fulcrum of activity, but only a minority of residents was seen involved in meal preparation and domestic activities. The original model called for televisions in the sunroom only (as well as televisions residents might opt to have in their own rooms). Rather quickly, staff moved televisions from the den into the hearth area, at first temporarily and eventually permanently—in one house we observed two televisions in the hearth area. Some equipment for other activities was stored in the hearth bookcases and an occasional card table with a puzzle was seen. Two of the houses had pianos in the hearth area and for a time one had a loom where two residents were weaving.

**Laundry:** The laundry room as designed was unsafe for elders to be in alone because it was also a storage area for chemicals and biohazard waste until the latter were moved to outdoor storage areas. Unfortunately, the laundry area was not placed in a small designated space with a counter for folding clothes and a locked storage cabinet for laundry products that might be deemed dangerous.

**Bathrooms:** Each elder has a private bathroom that is easily reached from anywhere in the Green House. Another bathroom is located in the service area, which meets the requirement for a staff bathroom and also serves the spa and beauty parlor area. An eye washing station is incorporated into the sink. It was the intent that visitors would largely use the elder’s own bathrooms, but without doors to the bathrooms in the bedrooms, visitors complained of a lack of privacy and typically used the staff bathroom. The bathroom faucet hardware consists of two levers, whereas a single lever would have been preferential to minimize the likelihood that a faucet is left on and for easier achievement of a comfortable water temperature.

**Beauty shop:** A well-used beauty shop is located in an alcove in the service area. It is difficult to place a wheelchair directly in front of the sink and the space does not have a mirror or adequate lighting but it is used often despite the shortcomings.

### Spatial Factors

**Space:** Space per resident in the Green Houses far exceeds regulatory requirements for 10 residents. The living room area is 704 net square feet (NSF). (18 NSF of lounge space per

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TABLE 2 Functional Elements in Green Houses (Continued)

resident or 180 NSF is required). The dining room area provides 357 NSF, whereas 150 NSF would have been required. The small den provides an additional 150 NSF and the accessible patio provides more space.

**Location in relation to work space:** Staff workspace is obviously not limited to any one location, although the office serves as the clinical support team base, houses the computer for the minimum data set (MDS), and serves as a staff break area. Cross-contamination is a theoretical concern as staff routinely moves between the kitchen area and the public and private living areas. The den is out of view of the kitchen; the advantage is that it offers another potentially private space for residents and for family groups to visit residents, but the downside is that it is inconvenient for staff to facilitate access or monitor the room.

**Storage:** Storage in the Green House is limited both for residents’ personal items and for supplies and equipment. The bedroom closets are small, the bathroom counter space is extremely limited, the narrow glass shelf above the towel bar is inadequate, and the bathroom medicine cabinet is not deep enough to be useful as a storage area. Several residents hang clothes from the lift tracks and others bring portable wardrobes into their rooms. The pantry area for food storage is not optimally located in relation to the kitchen. There is no front entrance closet. A front coat closet is generally included in residential settings and would be useful in the Green House as well.

**Communication**

**Signage:** Initially, other than required emergency signage, posted signs were minimized. Slowly, signage has increased and it is often in the form of reminders to staff about required tasks posted on the side of the refrigerator. The required printed daily menu is usually sitting on the counter or posted on the refrigerator. Its font size is small. The posted message at the front door inviting guests to ring the doorbell is inviting and easy to read. A plaque with the name of the house hangs from each mailbox. Most elders have attractive name signage next to their doors. On one common-space refrigerator a dietary requirement for an elder is posted in letters large enough for a visitor across the counter to read. In some houses, color-coded advance directives were noticed on each elder’s doorframe.

**Telephone:** Elders have telephone jacks in their rooms. At baseline, 33 of 40 elders had a telephone in their room. Elders may use the cellphone at the kitchen counter, but the cellphones are awkward to use and they are an integral part of the call system. There is a need for access to a telephone with large numbers, preferably next to a lighted section in a quiet area.

**Staff Communication:** In each house’s office, a large plastic shoe bag with pouches (intended for storage of shoes) hangs from the door. This is the space where resident assistants receive memos and other campus information.

bathroom is perfect for a resident. She’s living in high cotton right now.” Respondents also expressed concerns and ideas for environmental improvement. Among resident criticisms were the small size of the bathroom (e.g., “the bathroom is not big enough to cuss at a cat without getting hair in your mouth”), the lack of bathroom door, and the lack of access to the public area bathroom. Other miscellaneous comments included that the bathroom mirror was too small, the grab-bars were misplaced, the medicine cabinet was too small, and the bathroom was damp (a function of poor placement of the shower). One resident complained that the toilet leaked. The most common suggestion for the bedrooms was that there should be more space in general and more closet space in particular. One resident felt noise carried from the
TABLE 3  Behavioral Elements in Green Houses

Use of Shared Space

Overview: The four Green Houses diverge into two groups: House 1 and 2 that are dementia-specific and House 3 and 4 that serve a mixed population. In all four Green Houses, the kitchen and hearth area were heavily used; often one or more resident was seated at the dining room table at non-meal times; the patios were used by residents; and the den was infrequently used. We found differences in the way space was used between these two houses.

Houses 1 and 2: Elders in these houses tended to spend their days sitting in the hearth area as a group, seldom spending independent time in their rooms unless in bed. Often, some of these residents sat the dining room table, even when staff meetings occurred there. Use of the service area and the kitchen area tended to be discouraged. Elders used the outdoor space frequently, sometimes with assistance and other times independently. Meal times began earlier and last longer in those houses (often up to 1.5 hours) and residents tolerated the long meal periods well. Licensed nursing staff, other clinical support team members, and other visitors who were there at meal-time assisted the residents with eating. One resident who was easily distracted at meals received his meals at the low kitchen counter. The hearth area is used throughout the day. Visitors often remained in the hearth area with their relatives. Initially, the television was in the den area, then it was moved between the den and hearth and 2 years later it is a permanent fixture in the hearth area. The extensive use of the hearth area in these houses has implications for the need for clear space for wheelchair placement, the need for furniture that can withstand the wear and tear, and the removal of obstacles. Over time, most residents were in wheelchairs most of the time, and were not transferred to dining chairs during meals. Photographs reveal clutter from dining room chairs that were moved to accommodate wheelchairs at meals and never returned; possibly off-site storage is needed for those chairs. Not uncommonly, 3 or 4 large extra water bottles for a drinking fountain were placed on the hearth floor near the kitchen counter rather than being stored elsewhere.

Houses 3 and 4. In these houses, elders do have access to the kitchen. Some assist with washing dishes, setting the table, cleanup, or laundry. A large group of elders is seldom found sitting together in the hearth where, as with House 1 and 2, the televisions have been relocated. For the most part, elders spend time in their own room and entertain visitors there as well, though visitors and/or residents are often seen spending some time at the dining table having a snack and/or conversing with staff. Elders often come into the kitchen area to chat for a moment or have a cup of coffee and then return to their rooms. Because the distance between resident rooms and shared spaces is manageable, elders can come into the hearth area or kitchen for a snack and return to their rooms, and they can preview the space.

Privacy and Territoriality

Privacy: Privacy within shared space is available both in outdoor areas and in the den. Elders tend to sit in the same location at each meal for dining. Elders’ doors are often closed in Houses 3 and 4 and are usually open in Houses 1 and 2. Four elders have installed curtains to separate the bathroom from the bedroom. Lack of doors for the elder’s bathrooms was the biggest problem related to privacy.

Controlled access: Controlled access to private space is most notable by the number of elders who have chosen to keep their doors closed, even when they are not in them. This shows a sense of ownership of that space, which is not possible in a shared room. In public spaces, privacy is attainable in the den area and outside spaces. The hearth area was furnished with single-person chairs only; at Year 2, one house moved the couch from the den into the hearth area. The height of the bookcase and fireplace facilitate privacy for the bedroom directly behind the hearth area.

Dignity

Space is lacking for storing incontinence products either in residents’ rooms or in supply areas. There was no designated storage site for dirty linens designed into the original plan. Large gray covered waste baskets with labels are used. In some rooms, the baskets are stored in the bathroom and in other rooms the baskets are stored in the bedroom area. Lack of bathroom doors was also seen as a dignity issue by both residents and visitors.

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TABLE 3  Behavioral Elements in Green Houses (Continued)

Image/Meaning
The residential scale of each Green House and the design of a kitchen open to the dining room and hearth area convey the image of a family room in a conventional house. The large dining table, the personalization of each house, the absence of overhead paging, the comfortable light levels and the dignified furnishings all combine to create a comfortable and inviting setting. The Green Houses convey a message of something special and elegant, and behavior is shaped by the expectation. In House 3 and 4, a family feeling was also cultivated—for example, paper plates were used occasionally for dinner after a busy day and a patio barbeque was used for outdoor grilling. Food such as fresh baked cookies and beverages is generally offered to visitors and available to residents. Residents can view groceries being delivered to the Green Houses. Efforts were made to create meaning and tradition. The Green Houses were each named after the oldest resident among those who first moved in. Initially, in each house staff developed a guest book for their house and asked visitors to sign it. At a later date, the guest book was replaced with a photograph album of celebrations held in the house. In House 4, residents were encouraged to bring cuttings from their family gardens, and a specially chosen tree was planted in memory of each deceased resident. In the last period of observation, we noted that House 3 had dedicated one wall as a picture gallery; 8 by 10 pictures of each elder from their younger days are clustered together, including pictures of deceased elders and one elder who briefly moved in and moved back to assisted living. One house named the den after a deceased resident. These memorials attest to the sense of community experienced by staff yet they raise questions of the practicality and sustainability of dedicating limited space to remembering deceased residents, which may detracts from meaningful symbols for new residents.

Personalization and Individualization
Personalization of both private and shared spaces is encouraged. Each Green House has taken on an identity all of its own through decoration choices and the posted greeting at the front entrance. Elder rooms are personalized in different ways, some elaborate and some decorated simply. In year 2, the rooms in Houses 1 and 2 were more barren of personal objects while the rooms in Houses 3 and 4 had filled up with personal items. As outliers, one room is completely void of any item whereas another room is stuffed with furnishings brought from home. In one house, the hearth displays weaving done by several residents. In our years of observing these 4 Green Houses, we saw no example of an animal, fish, or bird living in the private or shared space.

Socializing and Community Building
The philosophy of the Green Houses is that each be a self-contained functioning household within a community of similar households and a larger community. During the first year of the Green House, many visitors came from the outside and residents were engaged with them. We also noted that some family or friends visited very frequently. In House 4, one elder’s husband was present for almost all dinners and became a virtual community member. Birthdays are celebrated on the precise day, with staff baking a typical normally sized birthday layer cake rather than a large sheet cake. Yet the opportunities to socialize and form relationships with other residents in the house and with residents in other Green Houses are fairly limited; we did not observe staff spending time facilitating residents visiting each other in their rooms. In House 4, two residents became very close friends and were almost inseparable. On Sunday, we observed no particular activity to create religious observances or help residents visit other churches. A minister visits during the lunch hour on occasion and preaches as the residents eat. Lack of paved sidewalks creates a difficulty for residents who might wish to walk or wheel in the area and family members who might wish to take such walks.

Management Philosophy
Viability of model: The guiding philosophy and organizational requirements are specific in the Green House model. They may be unrealistic in the expectations that the dementia

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and non-dementia house will function in similar ways, especially on matters such group
decision-making on menus and collection of house recipes. Possibly the specificity of the
prohibition of television in the hearth area was a misplaced value judgment, although the
return of the televisions may also be an example of staff reverting to what is easy and
familiar rather than individualized facilitation of residents to watch the television of their
choice. A required criterion to be considered a Green House is that “all spaces must be
accessible to elders,” yet this proved unattainable in houses where the majority of the
residents had substantial degrees of dementia. A single large dining table for residents and
guests is required in the model, yet some feedback suggested that some residents and
family found the large table size impractical. On a positive note, frontline staff greets
guests in a welcoming way and exhibit pride in the Green House, and licensed nurses can
be observed assisting front-line staff and modeling good care practices; both of these
results were envisaged by the model.

**Sustaining the model:** Three years later, when 10 Green Houses were on the campus, a
new food service contractor modified and centralized meal functions, moving the larger
meal to noon, requiring preparation of many choices of menu within each single house
rather than developing group choice with alternatives and rotating food items that were
unfamiliar to the local palate. As a result, line staff spent even more time in the kitchen
(e.g., baking alternative desserts and preparing alternative salads and main courses) and
enormous quantities of garbage were observed. Staff in House 4 from the original group
was well enough socialized to the original vision that it refused to comply with the new
regime, whereas the other 3 houses made the changes. By the end of year 2, other signs
of “institution creep” had occurred in all houses, especially in House 1 and 2. Medical
equipment began to clutter the hallways and some spaces where furniture was moved out
became empty spaces. Several houses re-invented a med cart (e.g., using a wheeled tea
trolley). In a visit to the original Green Houses in August 2008, we found that the
institutional markers had once more disappeared, the clutter abated, and the
housekeeping improved. During that visit, the food service functions were not assessed.

common areas, one found the room cold, one would have liked better
reading light, and another found the ceiling lift frightening. One resident
considered the built-in medication chest area (which permitted medications
storage in resident rooms) to be a waste of space. Family members made
similar comments about lack of bathroom privacy, toilet leaks, dampness,
the need for public bathrooms for visitors, a lack of storage space, a need
for shelf space, and a need for better access to lighting. One family member
complained of bare walls and said the resident was prohibited from putting
items on the wall (possibly a misunderstanding and definitely contrary to the
model expectations).

**STAFF RESPONSES TO BEDROOMS**

Staff critiqued the shower and toilet configuration in the bathroom, called
for better shower drainage, and found the shower seats problematic (too
low, uncomfortable wooden slats, no support to hold elder up, and an
imprint is left on the resident’s skin). Other staff comments included that
grab bars were too high for the residents; a portable shower chair would be
preferable to the built-in wooden bench; the bathrooms were too small; a container was needed for dirty linen; no space was provided for biohazard materials; bedrooms were too small for wheelchair use; carpets could not be kept properly clean; closets were too small; and window alarms for security purposes might be useful in dementia houses.

**Resident and Family Responses to Shared Spaces**

Four residents and one family member commented negatively about the large dining table, referring to noise, congestion, and chaotic meal-times, suggesting that smaller tables would be preferable. During one follow-up period, a resident in one house ate at a small table placed nearby for that purpose. A family member commented that the dividers to keep residents out of an unoccupied kitchen were dangerous to residents (as noted in Table 1, these screens were a temporary solution and quickly replaced by sliding doors). One resident thought the hearth area had insufficient space for activities and one wanted a television there (as noted, televisions were found in the hearth by the end of the observation period). A family member felt that the hearth area was too cold and another felt that the furnishings and carpet were showing wear and tear. A few residents made comments about the outdoor areas (too isolated without enough cars and people to watch, a need for more covered outdoor seating, and insufficient access to outdoors due to lack of automatic door opener or staff assistance). Other family member saw a need for a covered portico at the Green House entrance to facilitate picking up elders during inclement weather, more parking spaces, better maintenance of the grounds, a better security system, reduced access to the front door code, and removal of Halloween decorations still up at Christmas.

**Staff Responses to Shared Spaces**

Staff critiques included that the whirlpool bath design does not support the elders in a sitting position; a call button is needed on the wall adjacent to the tub; the cabinets in the beauty shop area prohibited wheelchairs to be positioned directly in front of the rinsing sink; the pantry should be in closer proximity to the kitchen; the cabinets are placed too high, necessitating use of a step ladder; the refrigerator doesn’t hold the temperature at the required level; the residential appliances were always breaking down, including the laundry appliances; the kitchen sink faucet needed to extend further; (in one house) the counter tops were slanted to the degree that dishes slid off and (in another house) a bubble appeared in the counter top laminate. In addition, staff commented on the need for more electrical outlets in the hearth area; the need for a lift track for the dining and hearth area; the potential tripping hazard of the transition strip area between carpet and floor; and the need for
a water faucet in the courtyard. Staff expressed some timidity about being alone with the residents, especially at night. The abundant windows were a plus during the day, but resulted in some staff being frightened at night during storms.

Unstructured interviews during observation periods confirmed the impressions. Family visitors were generally enthusiastic and appreciative; some indicated they and other family members found visiting Green Houses much more pleasant than visiting the traditional nursing home; some family worried about security at night and wondered if a typical private-home security system was needed.

DISCUSSION

These four Green Houses represented an ambitious effort to create home in a small-scale nursing home through mutually reinforcing physical designs, organizational structure, and staff roles. The study has limitations. Although we have amassed substantial detail during systematic and frequent observations, we are still limited to those observation periods. Furthermore, we cannot attribute the effect of the environment, compared to the effect of the model for staff deployment or staff training. Similarly, we cannot attribute reasons for differences in the way the spaces were used across the houses; it could be because of the mix of residents, the mix of staff members, or both.

Overall, the design goals of the Green House model were met. Most of the private and shared spaces were utilized as envisioned, with some exceptions that were mentioned in the tabular data presentation. The tables purposely highlight areas for potential improvement, but the overall thrust of the POE is positive.

How Private Space Informed Resident Experiences

Residents and family appreciated having a private bedroom and bathroom, and this positive reaction outweighed responses to design problems noted for the bathrooms. Residents of Franks and Martin Houses, in particular, used their bedrooms to entertain guests and to undertake projects and activities on their own. Should the widespread use of the private rooms (sometimes in preference to the shared space) be seen as a success or failure of the model? This study cannot fully answer that question, which we flag for further research. However, it appeared that many residents, especially those who were more cognitively alert, valued time alone in their rooms and that they or their visitors often chose to spend some of their visiting time in the rooms. The conventional wisdom that nursing home bedrooms may be small because most residents spend most time elsewhere may need to be
reconsidered in situations such as Green House where residents have private space that they largely control.

In all houses, but especially Franks and Martin, some residents and family members personalized the rooms a great deal. Given that all residents had initially moved from a traditional nursing home and had given up possessions, we would expect the personalization to increase as residents enter the Green Houses directly from the community or from assisted living settings. Of course, residents entering from such community settings may take private rooms for granted and have higher expectations for living space in their own quarters and for personal storage space.

How Public Spaces Informed Resident Experiences

The kitchens, dining areas, and hearth areas conveyed the sense of normal living, engendered staff pride, and in general shaped the Green House experience positively. This was amply reflected in comments of residents, family, and staff and in observations of how the central space was used. The kitchen and dining table area served as a hub for the house, and from there the hearth residents could observe a wide range of activities—arrivals and departures of visitors and deliveries and the preparation of meals. Visitors tended to greet all residents by name. The patio area was particularly heavily utilized and the den area was lightly utilized. The latter may be because it is too small to accommodate simultaneous activities for the entire household, because the den area is at the back of the house out of sight from the dining or hearth area and frontline staff lack visual access, or simply because staff did not prime the pump to encourage groupings of residents or families to use the den.

Extent to Which the Green Houses Were Homes

Residents and family members often used the term “home” to describe the Green Houses; one resident called it “my home away from home.” The hallmarks of home include personal symbols of home and resident autonomy and control over space and time. Seeing a resident’s cane or walker stationed in shared space or a sweater draped over a chair is suggestive of a home, where all possessions are not kept in the bedroom. The private bathrooms also permit toiletries to remain there and an improved bathroom design will further improve that capability.

Family members reported an increase in their visiting patterns because “it doesn’t feel like a nursing home.” Extended families gathered in the hearth area. In Martin House, two musically inclined resident assistants on the second shift tended to harmonize at the piano and several residents appear to enjoy the singing. One pair of residents started a quilting project, and their loom stood in the hearth area. One husband dines at the Green
House almost daily and spends time with his wife in her well furnished
room or on the patio, landscaped with cuttings from their former garden.
Bridal and baby showers for staff have been held at the houses with elders
included in the festivities.

In theory, the Green House spaces should support a wide range of solo
and natural activities occurring in pairs or smaller groups, but such activities
do not arise automatically. We did not observe staff facilitating arrangements
to use resident’s rooms, den, or patio to encourage resident clusters. During
our observations, we noted that staff always welcomed residents to the dining
room table at any time, even if they themselves were having small meetings
there. However, we also saw few creative efforts to facilitate individual ways
of utilizing the space. Nonetheless, we noted that a few residents took on
household tasks such as drying dishes, sweeping, and doing personal laundry
for the house.

Green Houses as a Work Place for Staff

The Green Houses function relatively well as a workspace for staff. Some of
the biggest challenges concerned storage space and finding optimal locations
for all supplies, including health care equipment, cleaning supplies, and food
supplies. These challenges were addressed operationally by determining
how much of various commodities to keep in each house through trial-and-
error. A photograph showing a pantry shelf with a dozen or so industrial
size mustard jars reveals an early stage in working out these details; later,
more modest quantities were stored.

Professional members of the clinical support team, especially licensed
nurses, had adjustments to make to the new environment. Some tried to
restore the former set up by developing makeshift medication carts (e.g.,
on a tea trolley) despite the fact that medications were stored in resident’s
rooms. Office space for professionals was not optimal; department heads,
including the Green House administrators (or “guides” as they were called),
the director of nursing, the director of activities, and the director of social
work had offices in the main nursing home, several blocks away from the
Green Houses. Clinical support team nurses (“charge nurses” in a traditional
home) worked out of their cars or in the Green House offices; when they
did the latter, space for the frontline staff was not optimal. The dining room
table became the nerve center for many operations, including staff meetings,
giving rise to some privacy concerns.

Differences Among Houses

The Green Houses developed individual differences that reflected the character-
istics, needs, and preferences of the residents living in each house, the
personalities and interests of the visitors, and the imagination and particular
skills of frontline staff members. However, the differences among houses
were not as pronounced as the differences between Houses 1 and 2 versus Houses 3 and 4. In Laney and Page Houses, life was focused on the hearth area with little independent initiation of activities by residents. As a result, the furnishings in the houses showed wear at a greater rate than the other houses. In Franks and Martin Houses, even though each was home to some residents with dementia, the entire living space was more likely to be used and residents also used their own rooms more during the day, often keeping the doors closed for privacy when they were in and out of the rooms. Although houses became differentiated from each other, the rhythm within each house seems identical from day to day; weekdays seem similar to Saturday and Sunday.

With the emphasis on building a residential setting, it is possible that insufficient attention was given to building an environment that supported care tasks. Nursing home services require extra storage space not found in typical residential designs. The Green Houses provide the elders with privacy and community ambience exceeding traditional nursing homes but fell short of providing adequate space for care and related equipment. The intent was that the spa rooms accommodate therapy sessions, but the therapists found the space inadequate, preferring to use the kitchen counter as the balance beam and a walk around the hearth area as the exercise route. The spa area (except for the beauty parlor) was generally underutilized—to use it fully would require staff to initiate and offer a spa experience at various times of the day and evening for residents.

Design Directives

The intent of the Green House design is to create an environment that enhances opportunities for a good quality of life in a genuine home environment. Overall, the project goals have been met but some areas can be improved on for future projects.

Plans for improvement include the following: provide doors for the bathrooms, which will not interfere with the track installation into the bathrooms if a few inches clearance is provided between ceiling and door top; isolate the shower installation in a location where other fixtures remain dry when the shower is in use; install bathroom storage with capacity to store incontinence products; in the kitchen, increase counter space for elder's personal items, install single lever faucet hardware, and replace the bathroom light switch with a motion activated switch; and in the bedroom, increase the number of light switches and electrical outlets in bedrooms, provide additional lighting and night lights in rooms, replace all conventional toggle switches with pressure or rocker type switches and install a light in the medication storage cabinet.
Many recommendations concern central storage and storage in each house. At year 2, “institutional creep” became evident as medical equipment started appearing in the corridors, not because staff was neglectful in storing the equipment, but rather because there was no designated storage location, creating a need to create storage space for medical equipment and plan for space to store hazardous waste. The original intent of the model was that residents be transferred from their wheelchairs to dining chairs. This happened infrequently, and as a result during meal times the unused dining room chairs were pulled away from the table, sometimes remaining out of place for days on end, creating a consideration for a central shared storage location where extra furnishings, water bottles, and other items common to all Green Houses but not used all the time could be stored; this would both alleviate the problem of in-house storage and reduce costs because in any given house needs may be different. Also, consideration should be made for bookcase shelving in back of hearth for additional secure storage. A coat closet in the vestibule area could be included and using such a space for miscellaneous storage of walkers, activity equipment, and out-of-season decorations should be avoided. Also, more countertop appliance garages could be added to free up space and render items more secure. In lieu of staff mailboxes, a shoe storage bag was hung on the door to the office with each slot identified with a staff name. In future buildings, a bank of mailboxes should be included.

For the comfort of the residents, relocate or redirect air vents away from ceiling above dining chairs. An automatic door opener to the outdoor patio would greatly increase accessibility for residents. Consideration should be made when designing and equipping the dens as spaces conducive to solo and small-group activities, paying attention to providing flat surfaces, adequate lighting, and storage space. Wall-mounted wheelchair-accessible flat surfaces that fold down when not in use would provide activity space if the room is too small to accommodate a permanent card-table size table along with other furniture. Consideration should also be made for including a computer, sewing projects, puzzles, and large print books and providing enclosed storage for supplies. The den could be a bit larger to accommodate such activity without losing its cozy quality.

Garbage quantity and collection frequency are problematic, so consideration should be made for installing an industrial sized trash compactor in a central campus space or placing smaller units in each house. The trash cans are often over flowing, suggesting inadequate capacity. Biohazard waste should be stored in secure space other than lawn storage shed. Building a community center on the campus near the Green Houses that serves multiple functions such as a gathering place for elders, a wellness center, medical treatment office, offices for clinical supports team members, and central storage should also be considered. Sidewalks in front of all houses adjacent...
to the road should be installed; the only place to take a walk is down the middle of a one way street with parking on both sides.

Update and Conclusions

By 2006, 6 more Green Houses were opened on the Tupelo campus, leaving only 24 licensed beds in the original nursing home. The new Green Houses were constructed to apply many of the lessons learned from this POE; the bathrooms were improved and included doors and the pantry was built to be accessible from the kitchen. Some decisions, including using difficult-to-access armoires rather than closets, eliminating the drive-up possibility at the front door, and eliminating the popular shampoo sink in each service area all need further study. The new Green Houses were constructed as 12-person houses, changing the footprint and introducing some new issues discovered in a subsequent POE under preparation. With 10 Green Houses in operation, the utility of a community center and paved sidewalks seems even more evident. The sponsor of these Green Houses has collaborated with a community agency to open a new campus in Yazoo, Mississippi, with 6 Green Houses—this project returns to 10-person Green Houses and differs from the prototype in that it is not part of a multilevel campus.

In November 2005, the Robert Wood Johnson Foundation initiated a 5-year rapid replication project with the aim of expanding Green Houses into all states. Managed by NCB Capital Impact, the project has helped launch about a dozen Green House nursing homes as well as some other Green House settings with different licensure (assisted living and adult foster care) (2009). These next-generation Green House projects bear similarities to the original prototypes but have benefited in their designs from the experiences with the first four Green Houses. Also, some of the operating or planned Green Houses have adapted to different climate, landscape, or community conditions. To our knowledge, all other projects limit themselves to 10 people in a Green House. Some have provided even more space in the bedrooms and bathrooms. Some Green Houses have been equipped with garages, which allow for residents to enter a car from indoors and offer extra storage. Several have off-street parking. We expect to see continued creativity with Green House and small-house models. In 2008, the Green House project launched a design contest to create new designs consistent with Green House philosophy for separate categories of urban, rural, and suburban locations. The winning concepts are found on the web (Ideas Institute 2009).

This article has illustrated the rich results from investment in POE. We had the luxury of conducting a longitudinal POE, which allowed us to monitor environments and their use over time. But one-time POEs can also be amply rewarding in the insights that they generate. The small-house nursing home is a relatively new phenomenon that could be well-served if POEs are
designed for each new project. Premature orthodoxy about Green House designs or development of a single model would seem contraindicated and it is highly likely that as some design features are corrected based on experience, other issues will emerge.

Many of the features introduced in the Green House are also found in larger nursing homes, especially those organized into households and neighborhoods. It is a general trend in nursing homes that are changing their culture to move toward the decentralization of dining and to establishing some capability of cooking or heating of food or doing personal laundry in the smaller units where resident live. The key differences between Green Houses and neighborhood models are the smaller scale of the Green House, the self-contained nature of each house, and the extent to which food preparation occurs in the houses. Comparisons between Green Houses or small-house nursing homes and well-designed neighborhood models would be useful.

This POE suggested that the Green House designs with their emphasis on privacy and convivial shared spaces were well received by all the users—residents, visitors, and staff—and encouraged much of the family-like behavior the model hoped to achieve. The study illustrated the richness of ideas for improvements that are generated by the ideas of users and from structured observation. The POE also demonstrates that changing the physical environment is not always sufficient, but that staff need to assist residents to take advantage of the setting, and consciously avoid old habits.

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