Assessing Resident Outcomes

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The physical design of the nursing home environment has sustained significant criticism for its cold "institutional" ambiance and its detrimental effect on quality of life. Despite years of research regarding the relationship between environment and quality of life, it is still uncertain how best to individualize nursing care environments in a single congregate setting. In recent years, we have seen an increased awareness of the relationship between environmental design and the well being of nursing home residents, particularly in residents with dementia. Environmental design is regarded as a therapeutic resource to promote well being and functionality among people with dementia. Many features of environmental design including smaller size units, fewer resident rooms, more designated private rooms, smaller private dining rooms, separate and larger activity rooms, home-like furnishings, and softer lighting have been hypothesized to support residents' activities of daily living, behavioral patterns, and cognitive performance.

We were presented with a unique opportunity to influence the decisions regarding environmental changes and to evaluate the impact of those changes on the residents, their family, and the staff in Kingswood. The modifications in the physical environment attempted to capitalize on therapeutic goals and design principles for special care units for people with dementia to create a more responsive physical environment for physically and cognitively impaired frail elderly residents.

The newly designed wing provided us with a "living laboratory" in which to contrast the social "home-like" orientation of the new environment with the medical "institutional" orientation of the existing wings.

The nursing component of the study, reported in this chapter, utilized a two-group pre-test/post-test design. A sample of residents who eventually were located in the newly designed wing of the facility (Intervention Group) were compared with a cohort group of residents who remained in the traditional, medically-oriented setting (Control Group). The purpose of this study was to determine if residents living in the newly designed
environment showed significant improvement in cognitive, behavioral, and functional performance as compared to residents who remained in the existing environment.

Methods

Subjects
The total capacity of the facility after renovation and construction of the new wing was 86 beds. A purposive sample of 24 nursing home residents was identified through a review of quarterly resident assessment reports known as the nursing home Minimum Data Set 2.0 (MDS)³. The MDS is a federally mandated standardized assessment of each resident's functional medical, psychosocial, and cognitive status and is a part of the resident's permanent record. All Medicare/Medicaid certified nursing homes in the United States are required to perform MDS assessments upon the resident's admission to the nursing home, every 3 months after admission, and on any significant change in the resident's status.

Subjects were excluded if they were not residents of the nursing facility from July 1999 through June 2000, so that a 6-month pre and 6-month post comparison could be made. Twelve residents living at the facility in July 1999 were relocated to the newly constructed wing in January of 2001; they comprised the Intervention Group. The other 8 residents of the new wing were "new" admissions to the facility. Of the 66 remaining residents, only 12 were living in the facility between July of 1999 and June 2000, therefore, they comprised the Control Group. No random assignment to the intervention or control groups was possible as the decision to move residents into the new environment was made entirely by the nursing home administrators.

Instruments
The three instruments used in this study were derived from the MDS: the Cognitive Performance Scale (CPS),⁴ the Behavioral Problems Scale (BPS), and the Activities of Daily Living-Long Form (ADL-LF)⁵. The Cognitive Performance Scale was modeled after the Mini-Mental State Examination⁶ (MMSE) and the Test of Severe Impairment (TSI)⁷. The CPS is based on two direct measures of cognitive items (short-term memory and ability to make decisions) and three indirect measures of cognitive performance (comatose status, making oneself understood, and eating performance)⁸. The CPS is a single, hierarchical cognitive rating scale derived from a complicated set of scoring rules to assign nursing home
residents into 1 of 7 categories of cognitive impairment. The discrete scores of the CPS range from 0, indicating no cognitive impairment, to 6, indicating very severe cognitive impairment. The CPS has shown considerable agreement with the MMSE in the identification of cognitive impairment9. Both sensitivity and specificity measures for the CPS compared with the MMSE were .94 with 95% confidence intervals: .90 - .98; and .87 - .96 respectively.

The Behavioral Problems Scale (BPS) is an additive scale of five behavioral symptoms reported on the MDS: wandering, verbally abusive, physically abusive, socially inappropriate or disruptive, and resists care). Each behavioral item is coded according to the following scale: 0 (behavior not exhibited in last 7 days), 1 (behavior occurred 1 to 3 days in last 7 days), 2 (behavior occurred 4 to 6 days in last 7 days), or 3 (behavior of this type occurred daily). The BPS was found to have fair criterion validity when compared with other research instruments10. However, the initial BPS included only the first four behavioral items and no subsequent validity testing has been conducted since adding the item "resists care" to the MDS 2.0 version. It was believed that due to the small sample size in this study, a score of 15 would drastically skew the mean. Therefore, the behavioral symptoms were recoded into two discrete categories: 0 (behavior did not occur in last 7 days) or 1 (behavior did occur in last 7 days) and then summed for all 5 behaviors. The resulting range of BPS scores was 0 (no behavioral problems occurring) to 5 (severe behavioral problems occurring).

The MDS ADL-Long Form is a summary scale of seven selected ADL self-performance items: dressing, personal hygiene, toilet use, locomotion on the unit, transfer, bed mobility, and eating. Each ADL self-performance item is coded according to the following scale: 0 (independent), 1 (supervision), 2 (limited assistance), 3 (extensive assistance), 4 (total dependence), or 8 (activity did not occur). Following the procedure used in the development of the scale, a response of 8 (activity did not occur) was recoded to 4 (total dependence) before adding the seven ADL items11. The resulting scale ranged from 0 to 28. Lower ADL scores indicate residents who are more independent in the performance of the selected items, whereas higher ADL scores point to growing dependence upon nursing staff. The alpha (KR 20) measure of item internal consistency for the ADL-LF equals .94; the scale mean is 15.24, the median is 16.0, and the standard deviation is 9.2512.
Data Collection
Written informed consent from the nursing home administrator was obtained before data were collected. Construction of the new wing began in the fall of 1998 and ended in early January 2000. Residents were gradually moved (over several weeks) into the new environment, while other residents were reassigned to rooms in the older wings. An exact moving date was difficult to determine from the chart review and staff members were unable to indicate when each resident was moved. Data collection was carried out from June 22 to July 18, 2000. A one-year follow up was conducted on February 17, 2001. The nursing home staff, following the guidelines published in the MDS protocol, filled out the MDS quarterly assessments and the author manually collected the data required from each MDS to calculate the three sub-scales. Data was collected at two intervals for all 24 subjects: 3-6 months before the move and 3-6 months after the move. A second post-move data collection 12 months following the move yielded data for only 9 subjects (62% attrition rate). The high attrition rate 12 months post move can be attributed to two factors: death/illness and unavailability of MDS data. Six residents died and one resident was discharged to the hospital between 6- and 12-months following the move. In addition, the administrators chose to suspend MDS quarterly assessments during December 2000 and February 2001 due to a staffing shortage and the loss of the director of nursing. Therefore, data for eight subjects were not available 12 months following the move. At one-year following the move, there were only four observations in the Intervention Group and 5 observations in the Control Group. This facility was not required to complete MDS assessments on all residents because they do not receive Medicare/Medicaid reimbursement. Because individual resident data is recorded quarterly following the resident’s admission, each resident’s assessment was due at different intervals, therefore, the date of the MDS assessment closest to the 6-month pre, 6-month post, and 12-month post data collection time was used.

Some residents in the Control Group were moved out of their old rooms for renovation and then moved into a new room either next door or across the hall on the same wing. Room numbers recorded on the MDS quarterly assessments were used to determine if the assessment took place before the move or after the move. The assessment immediately prior to a room change was identified as the baseline MDS information (from 6/7/99 to 9/28/99) while the most recent assessment available in the summer of 2000 was identified as the 6-month post-move data (from 3/29/00 to 6/17/00). The most recent MDS
assessment available in February 2001 was identified as the 12-months post move data (from 9/28/00 to 2/7/01). As discussed earlier, data was available for only nine subject's 12-months post-move. Demographic information was also collected from the MDS for all 24 subjects including gender, age, race, occupation, education, and payment source.

Data Analysis
All data was entered into an Excel spreadsheet and verified by the author. SAS software (SAS Institute, Cary, North Carolina) was used for all data analyses. The intervention and control groups were compared on demographic variables including age, gender, marital status, and education level using the non-parametric Wilcoxon rank-sum test or a Chi-square test for homogeneity of proportions. In order to compare the groups relative to the CPS, BPS, or ADL scores, it is important to take into account the value of these scores at baseline. Consequently Cochrane-Mantel-Haenszel methodology was used to allow an analysis stratifying on the baseline values. In essence this allows an analysis which accounts for possible differences in the scores at baseline.

Results
Of the 24 subjects, 5 were men (21%) and 19 were female (79%) (see Table 1). One hundred per cent of the subjects were white. Four subjects had never married, four were still married, and 16 were widowed (see Table 2). There were no significant differences between the intervention and control groups on gender, marital status, age, education level, pre-CPS, pre-BPS, or pre-ADL scores (see Table 3). The mean age for the Intervention Group was 86.65 and 90.65 for the Control Group (range 76 – 99 years of age). Education level is recorded in 8 categories on the MDS signifying the highest level of education obtained by the resident. Category 1 indicates no schooling; 2, an 8th grade education or less; 3, completion of 9th-11th grades; 4, a high school education; 5, technical or trade school; 6, some college education; 7, the completion of a bachelor's degree; and 8, a graduate degree. The mean (median) education level for Intervention and Control groups was 5.58 (5.0) and 5.41 (5.5), indicating that most had some education post high school.
Table 1: Comparison of Gender

<table>
<thead>
<tr>
<th>Gender</th>
<th>Intervention Group</th>
<th>Control Group</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>2</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Female</td>
<td>10</td>
<td>9</td>
<td>19</td>
</tr>
<tr>
<td>n</td>
<td>12</td>
<td>12</td>
<td>24</td>
</tr>
</tbody>
</table>

Table 2: Comparison of Marital Status

<table>
<thead>
<tr>
<th>Marital Status</th>
<th>Intervention Group</th>
<th>Control Group</th>
<th>Total</th>
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<tbody>
<tr>
<td>Never married</td>
<td>1</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Married</td>
<td>2</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Widowed</td>
<td>9</td>
<td>7</td>
<td>16</td>
</tr>
<tr>
<td>n</td>
<td>12</td>
<td>12</td>
<td>24</td>
</tr>
</tbody>
</table>

Table 3: Comparison of Age, Education, & Baseline Variables

<table>
<thead>
<tr>
<th>Baseline Variable</th>
<th>Intervention Group</th>
<th>Control Group</th>
<th>Wilcoxon test statistic</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>86.65</td>
<td>90.65</td>
<td>-1.357</td>
<td>0.175 (NS)</td>
</tr>
<tr>
<td>Education</td>
<td>5.583</td>
<td>5.417</td>
<td>0.149</td>
<td>0.881 (NS)</td>
</tr>
<tr>
<td>Pre-CPS</td>
<td>3.166</td>
<td>3.416</td>
<td>-0.417</td>
<td>0.677 (NS)</td>
</tr>
<tr>
<td>Pre-BPS</td>
<td>0.666</td>
<td>0.916</td>
<td>-0.032</td>
<td>0.975 (NS)</td>
</tr>
<tr>
<td>Pre-ADL</td>
<td>16.416</td>
<td>16.000</td>
<td>0.435</td>
<td>0.664 (NS)</td>
</tr>
</tbody>
</table>

The main analysis of interest was to determine if residents living in the newly designed environment showed significant improvement in cognitive, behavioral, and functional performance 6-months following the move as compared to residents who remained in the existing environment. This analysis was performed by grouping subjects with similar baseline variables to form strata. We then compared the two groups using a stratified version of the Wilcoxon rank sum test by using the Cochran-Mantel-Haenszel methodology. There were no significant differences found between the two group’s CPS (p-value 0.168) and BPS (p-value 0.364) scores 6-months post move, however, there were significant differences found at the .05 level of significance for the 6-months post ADL scores (p-value 0.016) (see Table 4).

Since higher ADL scores indicate increased dependence on staff for the performance of self-care, residents who were relocated to the new wing declined in self-performance whereas residents who remained in the same environment did not. A plot comparing the pre and post ADL scores by group illustrates these results (see Figure 1). The reference line in this graph corresponds to
no change from baseline to 6-months score. Points above the line (which are mostly solid dots corresponding to the intervention group) represent subjects with higher (worse) scores at 6-months than at baseline. Similarly, points below the line (which are mostly open circles corresponding to the control group) represent subjects with lower (better) scores at 6-months than at baseline.

Table 4: Comparison of Groups at 6-Months Post-Move Using the CMH Method

<table>
<thead>
<tr>
<th>Outcome Variable</th>
<th>Cochran Mantel Haenszel Statistic</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-months Post-CPS</td>
<td>1.898</td>
<td>0.168 (NS)</td>
</tr>
<tr>
<td>6-months Post-BPS</td>
<td>0.825</td>
<td>0.364 (NS)</td>
</tr>
<tr>
<td>6-months Post-ADL</td>
<td>5.806</td>
<td>0.016 *</td>
</tr>
</tbody>
</table>

* p < .05

Figure 1: Plot Comparing Pre and Post ADL Scores by Group
Compare pre and post ADL scores by group

The one-year post move data was analyzed using the same Cochran-Mantel-Haenszel technique. No significant differences between the two groups were found for any of the three variables, when adjusting for the baseline variables. The p-values for 12 months post-move were 0.7655 for CPS scores, 0.1679 for BPS scores, and 0.2516 for ADL scores (see Table 5). As mentioned earlier, the attrition rate from 6-months post-move to 12-months post-move was 62%. In the analysis of the one-year
results, one must note the small number of observations for the Intervention (4 subjects) and Control Groups (5 subjects).

Table 5: Comparison of Groups 12-Months Post Move Using CMH Method

<table>
<thead>
<tr>
<th>Outcome Variable</th>
<th>Cochran Mantel Haenszel Statistic</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>12-months Post-CPS</td>
<td>0.0890</td>
<td>0.7655 (NS)</td>
</tr>
<tr>
<td>12-months Post-BPS</td>
<td>1.9014</td>
<td>0.1679 (NS)</td>
</tr>
<tr>
<td>12-months Post-ADL</td>
<td>1.3145</td>
<td>0.2516 (NS)</td>
</tr>
</tbody>
</table>

Discussion

Confidence in the results of this study is impaired by the small sample size raising a concern for the validity and generalizability of the findings. The relative smaller power associated with small samples makes it difficult to detect any but relatively large differences in the outcome variables. This is especially true for the 1-year data. Unfortunately, this problem is typical in research regarding design and dementia and reflects the limited populations of residents at a single facility. In a recent review of 71 empirical studies addressing therapeutic design environments for people with dementia, Day and colleagues found more than 30% of the studies used samples of fewer than 30 participants and many had less than 10 participants.

One strong point of this study was the use of a comparison group. The control group had many similarities with the intervention group at baseline and on demographic characteristics, therefore, one can infer that the groups were comparable at the start of the study. Another strength of the analysis was adjusting for any baseline differences between the groups regarding cognitive, behavioral, and functional behaviors. This was especially important considering a random assignment to the intervention and control groups was not possible.

Although an improved relationship between a specially designed environment and the cognitive, behavioral, and functional well being of the residents could not be proved there are several edifying points. First of all, the potential impact from individual design features can be buried by simultaneous changes in other arenas. During this study a new director of nursing was gained and lost. This change created various rippling effects impacting the delivery of nursing care as well as attitudes of nursing staff, residents,
and their families. No specialized training program was implemented along with the newly designed unit for residents with dementia. An inflexible attitude was reflected in one focus group interview with several staff members. In response to a question regarding any changes in care delivery, one staff member said “Just because you have a new person or you change someone’s room, you don’t change their level of care because they get the very best that we can possibly give them.” Another staff member commented “The care shouldn’t change at all just because they’re in a different room or down the hall.”

Secondly, there are intended and unintended consequences associated with renovation and relocation to a new specially designed unit. The intended consequences of improving cognitive orientation and memory, decreasing wandering and disruptive behavior, and supporting independent activities of daily living can be thwarted by the unintended consequences of mass confusion, noise, and over stimulation found during construction and moving. Residents with dementia need time to become acclimated to new surroundings and their functional abilities often decline during prolonged periods of stress and change.

Thirdly, the ability to measure resident outcomes responsive to change in the environment is difficult. Quality of life measurements are difficult to obtain. Behavioral problems, cognitive performance, and activities of daily living were used in this study as proxy measures for quality of life. The use of MDS data also poses some concern regarding the consistency and reliability of staff-reported data from the quarterly assessments. The information used in the calculation of CPS, BPS, and ADL scores must be interpreted with caution. These items may not be sensitive to environmental change or they may be responsive to other confounding factors. Reportedly, the ADL-LF is more sensitive in identifying residents whose ADL status is beginning to change because it can identify more minor, incremental changes than its hierarchical counterpart.

Finally, any positive changes associated with the environment can be obscured by the steady rate of decline seen with stages of dementia. High mortality rates are prevalent among studies that include residents with dementia. Inferences about cause and effect cannot be drawn from a quasi-experimental study such as this. It is difficult to know whether the functional decline seen six months following relocation could be attributed to the newly designed environment or to the various other changes (i.e. short staffing or the disease process associated with dementia).

In conclusion, future research should address the complex nature of global environmental interventions by
attempting to clarify the particular characteristics of an effective design intervention. Additionally, changes in environmental design should be accompanied by programmatic changes that educate and empower staff members to provide for special needs of residents with dementia. More research is needed to confirm findings from existing research and explicate the therapeutic impact of design in dementia care settings.

References

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