Therapeutic Effects of an Outdoor Activity Program on Nursing Home Residents with Dementia

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Abstract

Objective: The purpose of this one-year study was to obtain preliminary information on the effects of an outdoor activity program, in comparison to an indoor activity program, on sleep and behavior in nursing home residents with dementia. Structured activity programs have been shown to improve dementia-related behavior problems, and there are some indications that improved behavior is associated with improved sleep. Previous research has shown that sleep disturbance is common in nursing home residents, and that limited exposure to light bright enough to entrain circadian rhythms contributes to their sleep problems. Thus, we expected to see improvements in behavior in both the outdoor and indoor activity groups, but improvements in sleep in the outdoor activity group only.

Methodology: A two-group (indoor program, outdoor program) two phase (baseline, intervention) design was used. Subjects were randomized to the indoor or outdoor program groups. Sleep and behavior disturbance were assessed over a 10-day period at baseline (usual activity conditions, which were expected to include little or no time spent outdoors) and at intervention (daily structured activity program offered outdoors or indoors). Sleep was assessed with wrist actigraphs with photocells, which also allowed for monitoring of light exposure. Behavior disturbance was assessed with the Cohen-Mansfield Agitation Inventory. Both activity programs were offered Monday – Friday over a 2 week period, included similar content and were offered by research project staff. The analytical approach emphasized primary changes between baseline and intervention measures of sleep and behavioral symptoms in the two activity groups. Because this was a pilot study, the significance level was set a priori at $p < 0.10$.

Findings: The outdoor activity group experienced significant improvements in maximum sleep epoch. Both groups showed significant improvements in total sleep minutes. There also was a significant improvement in verbal agitation in the outdoor activity group.
BACKGROUND

Planned outdoor spaces are a common feature of long-term care facilities. Popularized as part of the dementia special care unit initiatives in the 1980s and 1990s, planned outdoor spaces are generally assumed to be clinically important. However, there is little empirical evidence to support these expectations.

Poor sleep and behavior disturbances are prevalent among nursing home (NH) residents with dementia, and negatively impact their independence and quality of life (QOL) [4, 6, 9, 23]. Non-pharmacological strategies are needed to improve sleep and dementia-related behavior disturbance in this population. Previous research suggests that spending time outdoors, engaged in meaningful activity, may positively impact sleep and behavior disturbances.

Sleep

Numerous studies report that NH residents’ sleep is highly fragmented, as characterized by short periods of sleep throughout the day and night, frequent awakenings, and difficulty falling back to sleep, despite long periods of time spent in bed [1, 4, 8, 14, 28]. During the day, they are often drowsy and frequently observed asleep, in and out of bed. Some research suggests increased sleep disturbance is to be expected with advanced dementia [8]. Other research suggests that poor sleep and daytime drowsiness among NH residents can be attributed to insufficient and/or inappropriate physical and mental stimulation and structure during the day to keep residents awake and engaged, as well as nighttime NH environments (e.g., noisy equipment, staff talking loudly in halls) and care regimens (e.g., inconsistent or non-existent bedtime routines, 2 hour wet checks) that are not conducive to sleep [1, 14, 29, 31].

Although it is clear that there are many factors that contribute to poor sleep in NH residents, a critical determinant of sleep is human circadian rhythms. The major determinant of human circadian rhythms is exposure to bright light [18, 19]. The light that many NH residents receive is too weak for
circadian entrainment. There is extensive evidence that suggests spending time outdoors may result in improved sleep as a result of increased exposure to sunlight [11, 20, 28]. Previous research on bright light therapy in NH populations have typically had residents sit in front of light boxes which exposed them to light in the range of 2,000 to 2,500 lux for a prescribed period of time (e.g., an hour). Results have been promising, but mixed [5, 10, 20, 24, 28].

Behavior Disturbance

In addition to cognitive losses, persons with dementia often experience behavior changes and disturbances. More aggressive types of behavior disturbance have been estimated to occur in less than one-fourth of those with dementia, with less aggressive behaviors, such as verbal agitation, estimated to occur in over 90% of those with dementia [15, 22]. A large number of correlates of behavioral symptoms of dementia have been reported, including cognitive status, dependence in ADLs, age, sleep disorders, over- and under-stimulation, and depression [6, 15, 22, 23, 25]. Several explanations for dementia-related behavior disturbances have been advanced. Catastrophic episodes and other extreme forms of behavior disturbance may result from a combination of greater sensitivity to environmental stimulation and an inability to cope with or escape these stressors [21]. Another view is that behavior disturbances are a manifestation of unmet needs, such as hunger, pain, fear, disorientation, boredom, frustration, lack of autonomy and privacy, etc. [2]. Structured activity programming that address unmet psycho-social needs and are geared to participants’ preserved cognitive abilities have generally been effective in reducing behavior disturbance [2, 7, 30]. A limited number of studies have examined the effect of light therapy on agitation [26, 27, 28]. Results have been mixed.

There is evidence that sleep and behavior disturbances are related. One study reports that disruptive vocalizers are more likely to have poor sleep [12] and another found that less pacing and fewer repeated requests for attention were associated with improved sleep efficiency (time
asleep:time in bed) [14]. Research also has linked behavior disturbance and depression [25].

This Study

Planned outdoor spaces for individuals with dementia were initially conceived as a restraint-free, FTE-neutral means of managing exiting behavior, one type of dementia-related behavior disturbance, and providing safe access to the outdoors for residents with dementia. It was expected that the presence of outdoor space would attract residents with dementia and be associated with less exiting behavior, even in the absence of outdoor activity programming. However, when access to outdoor space was provided, those with a history of exiting neither started using the outdoor space nor stopped exiting the unit [17]. In addition to those at risk of exiting, our preliminary research and that of others [16] suggest that self-initiated outdoor space use by most NH residents with dementia is limited. Outdoor space that is appealing to the senses and easily accessed does not overcome barriers to resident-initiated outdoor space use that stem from dementia-related deficits in cognitive abilities to initiate and carry out activities. A “build it and they will come” approach is not sufficient to ensure residents will go outdoors and receive bright light exposure.

In this project, we used an outdoor activity program as a device to get residents outside and to keep them outside and awake for the bright light exposure treatment period. Because activity programs are known to have a social effect, an indoor activity program was chosen as the comparison group.

The purpose of this study was to obtain preliminary data on the effect of bright light exposure and participating in a structured outdoor activity program, in comparison to an indoor activity program, on sleep and behavior disturbance in NH residents with dementia. We hypothesized that the outdoor group would experience improvement in sleep, and that both groups would experience improvements in behavior disturbance.
METHODOLOGY

Subjects were recruited from a single NH. The final sample consisted of 20 residents, 10 per activity group. A two-group (indoor program, outdoor program) two phase (baseline, intervention) design was used. Subjects were randomized to the indoor or outdoor program groups.

The content of both activity programs was equivalent. Programs emphasized horticultural activities with other activities, such as singing and telling jokes, added to respond to participants’ interests and abilities. Each program was offered for 1 hour a day for 10 days (M-F). The outdoor program was scheduled for late morning and the indoor program for early afternoon. Project staff reminded participants of the program, helped them get ready to go if needed, and escorted them to and from the program. Project staff provided the programs.

Sleep status was monitored between 7 PM and 7AM for 10 days at baseline and 10 days at intervention. Sleep was assessed with wrist actigraphs with photocells, which also allowed for monitoring of light exposure. Wrist actigraphy has been used successfully in a number of studies assessing sleep in frail, demented nursing home residents [1, 4, 5, 29], and has been shown to be correlated with polysomnographic evaluations of sleep [3].

Dementia-related behavior disturbance was assessed with the Cohen-Mansfield Agitation Inventory (CMAI) [13]. Primary care staff were interviewed to determine the frequency of 14 behaviors during the baseline and intervention periods.

The primary comparisons were changes between baseline and intervention measures of sleep and behavior disturbance in the two activity program groups. Because this was a pilot study, the significance level was set at $p <0.10$.

RESULTS

The sample consisted of 19 men and 1 woman. Their age ranged from 64 to 90 (79.7 ± 8.3). Five
participants (25%) were African-American and 15 (75%) were Caucasian. The two activity groups were similar with regard to age, race, and education. Although the average length of staff of the outdoor group was about 3 times longer than that of the indoor group (outdoor m/sd 1,546 ± 1,216 days; indoor m/sd 450 ± 371 days; $p < .01$), the average stay in both groups was more than 1 year. The sample had multiple medical diagnoses with cardiovascular (n=14 participants) and neurological (n=18 participants) diagnoses the most prevalent. About one-fourth had mood disorders: none were bipolar or schizophrenic. The sample included mild, moderately, and severely cognitively impaired individuals, as measured by the Mini-Mental State Exam (MMSE) (mean = 15.3 ± 8.4) [39]. Participants randomized to the outdoor group were more demented than those randomized to the indoor group (outdoor group mean MMSE = 11.70 ± 8.51, indoor group mean MMSE = 18.90 ± 6.90; $p = .05$). Three-fourths of the participants were wheelchair users. More than half the participants in each group were “independent” or required “supervision only” for bed mobility and locomotion on and off the unit.

The outdoor group participated an average of 8.6 (of 10) days of the intervention and the indoor group participated an average of 7.8 (of 10) days. The most common reason for nonparticipation was attendance at special activities offered during one week of the intervention by the Recreational Therapy program (11 person days). The next most common reasons related to participants reporting not feeling well or not wanting to get out of bed (7 person days), clinical appointments (6 person days), and refusal (5 person days). Although the 2 groups were nearly equal in number of days missed for clinical reasons and refusal (4 for indoor group, 5 for outdoor group), the indoor group missed 5 times more days than did the outdoor group due to competing events (9 and 2 person days, respectively) and due to reporting not feeling well or not wanting to get out of bed (6 and 1 person days, respectively). These data suggest activities held outdoors are especially appealing, even when content is the same as that offered indoors.
During baseline, there was no difference \((p=.990)\) in the average maximum light exposure of participants randomized to the indoor and outdoor intervention groups. The outdoor group’s average maximum light exposure was significantly higher during intervention than at baseline \((p=.000)\), but the indoor group’s did not differ significantly between baseline and intervention.

**Sleep**

Sleep was monitored for a total of 234,000 minutes. Three summary sleep measures were used in analyses: frequency of wakes (standardized over a 10 hour night to account for differences in numbers of minutes monitored post sleep onset within and across participants), average maximum sleep duration (average time, in minutes, of longest sleep period each night of data collection) and average nightly total minutes of sleep.

A conservative approach was used in determining the *frequency of wakes*: wrist activity indicative of an awakening was classified as a wake only when it followed 10 or more minutes of wrist activity indicative of sleep. Over 2,000 wakes were identified. The outdoor activity group experienced an average of 5.02 \(\pm\) 2.53 wakes per 10 hour night during baseline (Table 1). Wakes declined to 3.80 \(\pm\) 2.49 per 10 hour night during intervention. This decline in wakes \((p = 0.11)\) approached the significance level set for the pilot study \((p < 0.10)\). In the indoor group, there was no significant change in number of wakes from baseline to intervention \((6.18 \pm 1.99\) wakes vs. \(5.37 \pm 2.08\) wakes). Baseline and intervention wakes per 10 hour night were inversely correlated with MMSE scores in both groups. Thus, more demented participants (lower MMSE score) woke more often.

INSERT TABLE 1 HERE
The outdoor activity group’s longest sleep periods improved significantly from baseline (274 ± 169 minutes) to intervention (345 ± 210 minutes) (\( p = .08 \)). The indoor group’s longest sleep period also increased from baseline (226 ± 71 minutes) to intervention (272.44 ± 153), but the change was not significant. Total minutes of sleep during intervention increased significantly in both groups.

**Dementia-Related Behavior Disturbance**

CMAI ratings were used to construct 3 subscale scores: aggression, physical agitation, and verbal agitation. Verbal agitation occurred most frequently in both groups at baseline (Table 2).

In the outdoor group, the frequency of aggression, physical agitation, and verbal agitation decreased from baseline to intervention. The decline in frequency of verbal agitation in the outdoor group was significant (\( p = .01 \)). In the indoor group, the frequency of aggression and verbal agitation also decreased from baseline to intervention, and physical agitation increased. However, none of the changes in behavior disturbance in the indoor group were significant.

**DISCUSSION**

The study sample experienced many of the sleep problems reported in the literature. The average maximum sleep periods ranged from nearly 4 to nearly 6 hours long and represented 54% to 70% of the total 7 to 8 hours of sleep. The 7 to 8 hours of sleep that these subjects averaged were often obtained over a 10 to 12 hour period between 7PM and 7 AM with the time they attempted to sleep broken up by a large number of wakes. Finally, the subjects’ sleep was highly variable from person-to-person and night-to-night.
During intervention, the outdoor group’s average maximum sleep periods improved by over an hour, and their total minutes of sleep improved by about 50 minutes. These changes are consistent with the literature and were expected. The total minutes of sleep in the indoor group unexpectedly also improved. One recent study [30] has suggested that activity programs may have a positive effect on sleep.

This sample experienced low rates of all three types of behavior disturbance at baseline, resulting in limited room for improvement as a result of the intervention. The failure to obtain a significant improvement in behavior disturbance in the indoor group may be related to these low baseline rates, the size of the sample, or both.

This pilot study had several limitations. Data collection was limited to one NH and the sample was small. Moreover, because of the nursing home’s census, all but one of the subjects was male. Additional research is needed with a larger, gender balanced sample.

In conclusion, the results of this pilot study suggest that structured activity programs that capitalize on the availability of planned outdoor space to provide bright light exposure are a promising means to improve sleep and behavior in NH residents with dementia. Although our program emphasized horticultural activities, a variety of other activities could be conducted outdoors if appropriate seating and work surfaces were available.

Acknowledgements

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3E. Literature References


10. Campbell SS, Dawson D, Anderson MW. Alleviation of sleep maintenance insomnia with timed
exposure to bright light. JAGS 1993; 41:829-836.


31. Schnelle JF, Cruise PA, Alessi CA, Ludlow K, Al-Samarrai NR, Ouslander JG. Sleep hygiene in

Table 1. Sleep of Indoor and Outdoor Groups at Baseline & Intervention.

<table>
<thead>
<tr>
<th>Sleep Variables</th>
<th>Indoor Activity Group</th>
<th></th>
<th>Outdoor Activity Group</th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Baseline</td>
<td>Intervention</td>
<td>Baseline</td>
<td>Intervention</td>
</tr>
<tr>
<td>No. wakes/10 hr. night</td>
<td>6.18 (1.99)</td>
<td>5.37 (2.08)</td>
<td>5.02 (2.53)</td>
<td>3.80 (2.49)</td>
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<tr>
<td>Max min. sleep duration</td>
<td>226.83 (70.45)</td>
<td>272.44 (152.83)</td>
<td>274.42 (169.46)</td>
<td>345.31 (210.29)*</td>
</tr>
<tr>
<td>Total sleep minutes</td>
<td>416.73 (50.72)</td>
<td>477.39 (101.62)*</td>
<td>441.33 (181.76)</td>
<td>492.93 (179.05)*</td>
</tr>
</tbody>
</table>

1 Based on wrist actigraphy.

* p < .10

Table 2. Behavior Disturbance in Indoor and Outdoor Groups at Baseline & Intervention.

<table>
<thead>
<tr>
<th>Behavior Disturbance</th>
<th>Indoor Activity Group</th>
<th></th>
<th>Outdoor Activity Group</th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Baseline</td>
<td>Intervention</td>
<td>Baseline</td>
<td>Intervention</td>
</tr>
<tr>
<td>Aggression (range 4-20)</td>
<td>6.30 (2.91)</td>
<td>5.40 (2.88)</td>
<td>6.50 (2.92)</td>
<td>5.90 (2.23)</td>
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<tr>
<td>Physical Agitation (range 5-25)</td>
<td>6.00 (2.31)</td>
<td>6.50 (1.90)</td>
<td>7.70 (3.30)</td>
<td>7.10 (3.07)</td>
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<tr>
<td>Verbal Agitation (range 5-25)</td>
<td>8.60 (4.22)</td>
<td>7.80 (3.94)</td>
<td>9.60 (3.03)</td>
<td>7.10 (2.42)*</td>
</tr>
</tbody>
</table>

1 Based on nurse ratings using the Cohen-Mansfield Agitation Inventory. Lower scores indicate less frequent occurrence of behavioral symptoms

* p < .05