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# Effects of repetitive work on maintaining function in Alzheimer's disease patients

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## Abstract

*The effects of repetitive work on Alzheimer's disease (AD) patient functioning were examined when nine veterans were moved from a work program to a traditional adult day care program. Subjects were reassessed four months after the move with the Mini-Mental State Examination (MMSE), Cognitive Performance Test (CPT), and Geriatric Depression Scale (GDS). Individual slopes were calculated for seven subjects who had longitudinal scores, and expected scores were predicted based on the rate of decline. Observed scores at reassessment were significantly lower than expected scores. The MMSE was on average 4.9 points lower, and the CPT .64 points lower than expected. The GDS did not change. The spouses of all nine patients reported declines in daily living activities. Compared to traditional day care activities, work activities involve sequencing skills and practice may translate to self-care activities at home.*

*Key words: Alzheimer's disease, Allen cognitive level, function, adult day care, Cognitive Performance Test*

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## Introduction

Use of adult day care centers by individuals with Alzheimer's disease (AD) has risen sharply to keep pace with the growing demand for community-based services and alternatives to institutional long-term care. Dementia-focused day care is widely available, suggesting that adult day care facilities now provide a primary mental health function. For example, day care participants were found to be very similar to the community-dwelling elderly population in most health indicators, but they had much higher rates of dementia and associated disabilities in function.<sup>1</sup> Little is known, however, about the effects of attending adult day care on a participant's ability to function. For example, the specific activities that support independence and preserve function, and their effectiveness at various stages of the illness, are not known. Sobel found that day care participants who played Bingo versus engaging in physical activity showed enhanced performance on verbal measures.<sup>2</sup> Likewise, clients with very mild AD, who had small-group psychosocial intervention within a day care setting, maintained cognitive abilities on the Mini-Mental State Examination (MMSE)<sup>3</sup> and improved on verbal measures.<sup>4</sup> Compared to day care users, a control group showed a significant difference in health indicators and a decline in health, including significant effects on the participants' well-being, depression, and agitated behavior.<sup>5</sup>

We formerly reported on the beneficial effects on behavior of the Adapted Work Program (AWP), a day program based on a sheltered workshop model for patients with dementia.<sup>6-8</sup> Positive and significant effects were found in

participant attendance, time studies (continuous work), productivity, and satisfaction interviews with the participants and their spouses. Symptoms of depression were significantly reduced in participants who entered the program with depression, as compared to a control group.

We report here the findings of a study that assessed the status of nine AD subjects who had participated in the AWP and moved subsequently to a traditional adult day care program. Fiscal decisions around budget deficits and resources resulted in closing the AWP and transferring, within a few weeks, the former workers to the traditional program. Although unfortunate, the AWP closure afforded us the opportunity to study the effects of changing the type of program activity on participants' function. The cognitive and functional status of subjects, including activities of daily living (ADL), was reassessed four months after the transition.

## Methods

### *Subjects*

Participants in the study were nine male AD subjects who had attended the AWP at the Minneapolis Veterans Affairs Medical Center prior to being discharged into a traditional adult day program, the Adult Day Health Care (ADHC), also located at the Center. The average age of subjects was 75.6 (SD = 9.3) years and ranged in age from 56 to 85 years. All subjects had been diagnosed with AD prior to starting the work program with a diagnosis conforming to the DSM-IV<sup>9</sup> and NINCDS-ADRDA<sup>10</sup> criteria and confirmed by clinicians at the Minneapolis Geriatric Research, Education and Clinical Center. Initial MMSE scores at AWP entry ranged from 7 to 26 with a mean of 18.6 (SD = 5.3). The average time in the AWP prior to being discharged to the ADHC was 36.3 (SD = 24.8) months, and ranged from 12 to 65 months.

### *Assessment instruments*

Functional status was assessed with the Cognitive Performance Test (CPT).<sup>11</sup> The CPT is a psychometrically validated performance measure of global function, organized into six "cognitive levels" that range from normal function (level 6) to profound disability (level 1). Based on the Allen Cognitive Disability Theory,<sup>12,13</sup> this instrument uses common ADL tasks for which the information-processing requirements can be systematically varied to assess ordinal levels of functional capacity; decimal modes further qualify behavior variations within each level. Cognitive status and depressive symptoms were assessed using the MMSE and Geriatric

Depression Scale (GDS),<sup>14</sup> respectively. Spouse caregivers completed a rating scale of participants' function and behavior at home and provided qualitative data concerning any change in health status or their efforts to provide care.

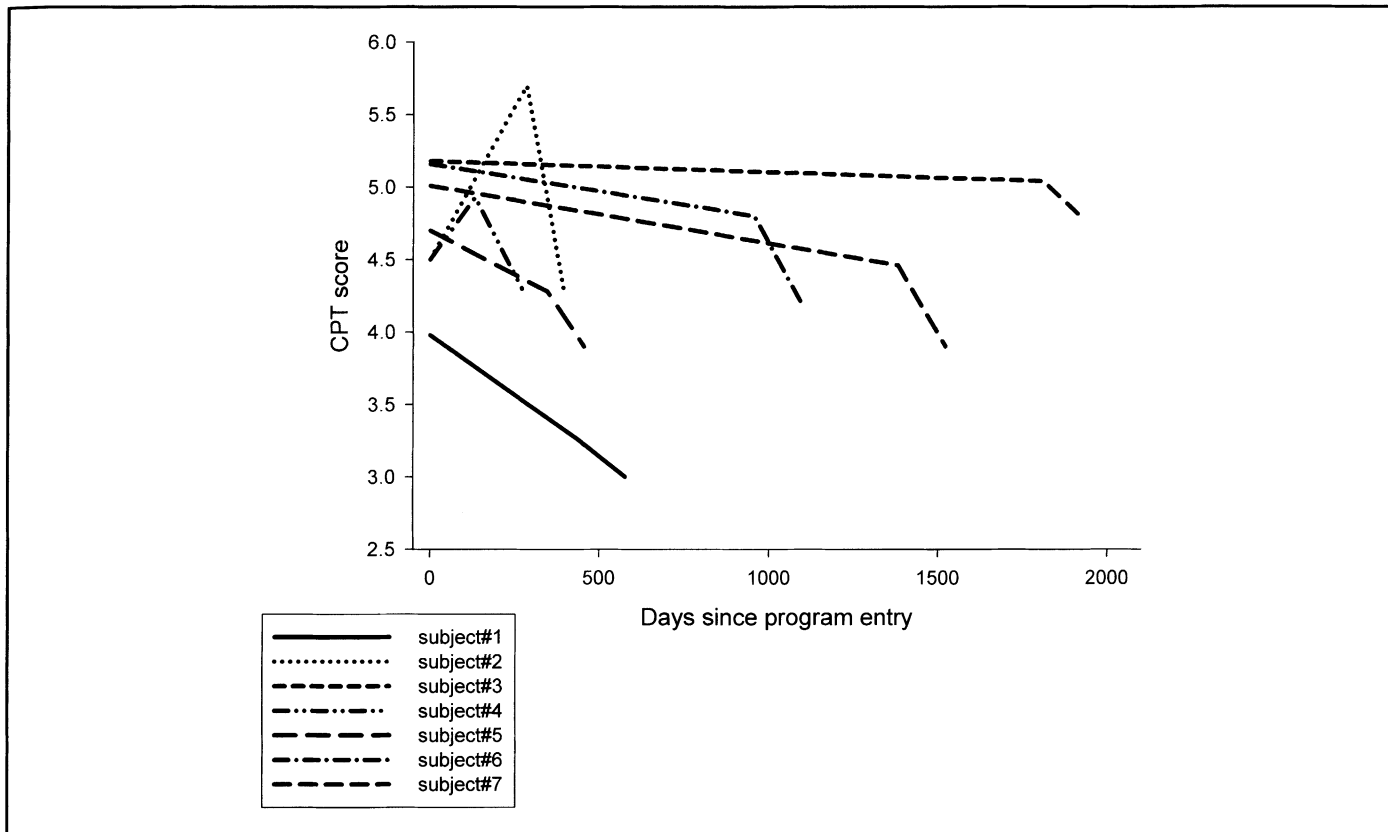
### *Setting*

The AWP was a novel adult day care program for patients with dementia, providing work individually adapted to the abilities of each participant. The program is based on the Allen model and ordinal scale of function, which emphasizes compensations and task reduction for each progressive stage. Performance abilities assessed by the CPT were measured prior to starting the program and serially to assign and adapt jobs. Hospital departments provided repetitive work and veterans' groups provided funds to pay a small wage. Jobs included packaging, shredding, folding laundry, crushing cans, stapling, and stamping and sending out mailings. The program accommodated up to 14 patients at a time and was supervised by an occupational therapist and Certified Occupational Therapy Assistant (COTA).

The ADHC is a traditional adult day care program located adjacent to the AWP. In this model, the majority of the day is spent in large group leisure-oriented or verbal activities, including Bingo, ceramics, music, and current events. While some work activities were incorporated into this program, the work is no longer tailored to individual capabilities. Each day 35 to 40 participants attend the ADHC. Staffing includes a registered nurse, nurse practitioner, recreational therapist, COTA, nursing assistant, and volunteers.

### *Procedure*

Consent was obtained through the Institutional Review Board to evaluate the former AWP participants, including the status of their function at home. Subjects had been discharged from the AWP and admitted into the ADHC, where they spent the same amount of time per week (three four-hour days in AWP versus two six-hour days in ADHC), with an equivalent staff-to-patient ratio. Subjects were reassessed with the MMSE, CPT, and GDS four months after the transition from the AWP to the ADHC. These assessments had been routinely administered at six- or 12-month intervals for all participants during their enrollment in the AWP. At the four-month period, spouses also completed a questionnaire to rate behavior and ADL changes at home. An occupational therapist with no previous knowledge of the former workers or their previous CPT scores administered all CPT assessments, and a gerontologist who was not



**Figure 1. Change in CPT scores.**

involved in the AWP or ADHC administered all MMSE and GDS assessments and collected the caregiver questionnaires. Longitudinal scores on the CPT and MMSE were available for seven of the nine subjects prior to discharge from the AWP with an average of 5.4 (SD = 3.2) data points and range of 2 to 10 data points available per subject for each assessment. All nine subjects completed the GDS and their spouses completed the caregiver questionnaire.

### Data analysis

A regression line for each patient was calculated from test scores obtained during the AWP, and expected scores were predicted based on the calculated rate of decline. Expected scores on the MMSE and CPT were compared to the observed scores obtained from the post-AWP assessments. Frequencies were analyzed for items on the caregiver questionnaire.

### Results

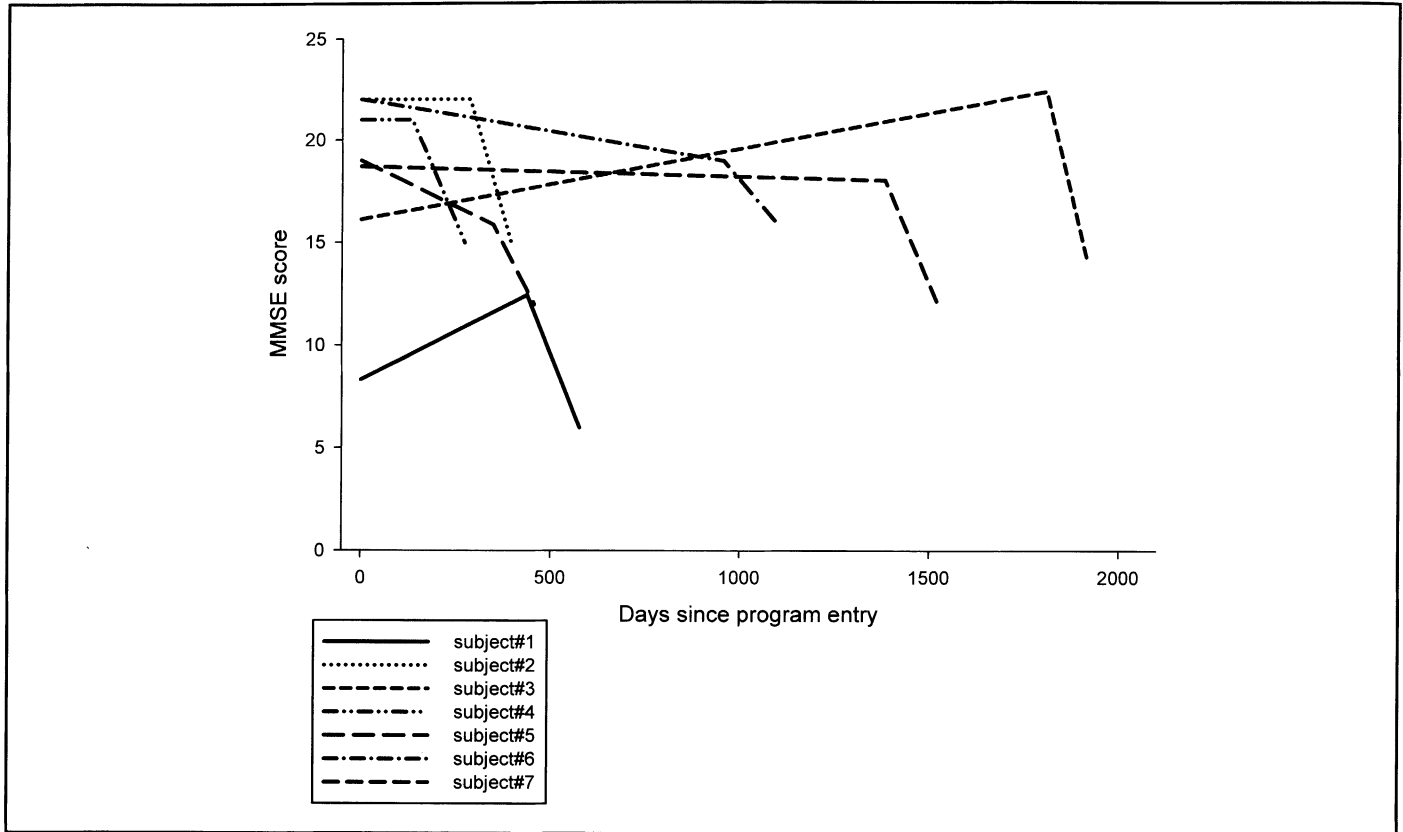
For the seven patients whose CPT and MMSE scores were available, observed scores were lower than expected on both tests. In a paired samples test, the mean difference between expected and observed MMSE was 4.9 (95 percent

confidence interval 2.7-7.1,  $p = 0.002$ ), with an expected mean of 17.7 and an observed mean of 12.9. The MMSE is expected to decline only two to four points per year in AD.<sup>15,16</sup>

The mean difference between expected and observed CPT was 0.64 (95 percent confidence interval 0.1-1.2,  $p = 0.036$ ), with an expected mean of 4.7 and an observed mean of 4.0. Compared to a historical control group, the seven subjects declined at a significantly faster rate ( $t [64] = 1.96$ ,  $p = 0.05$ ). Annual mean slope in CPT was  $-0.07$  (0.32) for the former AWP workers compared with  $-0.40$  (0.25) in a control group with longitudinal scores over a four-year follow-up period ( $N = 52$ ).<sup>11</sup>

Figures 1 and 2 illustrate the change in CPT and MMSE scores respectively, calculated by regressing multiple scores for each subject against their test dates, after their entry into the AWP.

The line from entry to the inflection point represents the trajectory of scores obtained during work program participation, and the inflection point represents the expected score four months after program termination. The line connecting the expected score (inflection point) to the end-point indicates the decline observed at retest four months after the transition from the work program to the traditional program.



**Figure 2. Change in MMSE scores.**

Eight subjects scored three or less on the GDS, indicating no or negligible depressive symptoms. One subject scored a nine, suggesting a moderate level of depressive symptoms. All scores were consistent with previous scores in the AWP.

On a scale of one to 10, with five representing no change and one representing a large decline or an increase in assistance needed, spouses rated changes in patient function at home. The qualitative data they supplied described any change in health status or caregiving effort. Table 1 shows response frequencies for specific questions and tasks. No categories showed improvement (scores above five).

All nine spouses reported declines in patient function and ADL, with most reporting significant declines and an increase in their efforts to provide care. Health status also declined in some subjects, even though they were attending the traditional program; three of nine spouses reported unscheduled visits to the hospital for new or exacerbated medical conditions.

## Discussion

In this study, subjects declined rapidly in function after moving from an AWP to a traditional day care program.

Observed scores on both the MMSE and the CPT were significantly lower than expected four months after the move. Dressing, grooming, and showering abilities were rated by spouses as having declined in the majority of the subjects. Although some spouses reported that happiness declined, depression was not found to account for the decline in ADL function demonstrated by GDS scores.

The CPT provided an objective measure of subjects' change in function. Previous research followed patients (N = 77) with initially mild to moderate AD in a longitudinal study. This study found that CPT scores significantly correlated with MMSE scores and two measures of caregiver-rated ADL. Significant declines in CPT scores were seen on follow-ups at one, two, and three years. An initial CPT score of 4.2 or less predicted the risk of institutionalization over the four-year follow-up period.<sup>11</sup> In the present study, we found a more rapid rate of decline, and five of nine subjects were institutionalized within one year after the AWP closed. Of the seven subjects who had longitudinal scores for comparison, three remain in the ADHC and four reside in long-term care.

Allen cognitive levels emphasize how information-processing deficits interfere with function and prevent effective performance. Cognitive level scores are derived from the CPT and are determined by evaluating

**Table 1. Response frequencies for items on the caregiver questionnaire**

Item	Decline				Same	Improve
	# 1	# 2	# 3	# 4	# 5	#6 – 10
Overall function	0	3	2	2	2	0
Orientation to schedule	0	5	1	0	3	0
Dressing	0	1	4	1	3	0
Grooming	0	2	2	3	2	0
Showering	0	1	3	1	4	0
Appetite	0	1	1	3	4	0
Ability to eat	0	0	1	2	6	0
Happiness	1	1	3	1	3	0
Energy	0	2	3	2	2	0
Physical abilities	0	2	1	3	3	0

Spouses (N = 9) who rated items from same (#5) to much decline (#1) four months after the work program closed. No ratings for improvement or above 5 were recorded.

sensorimotor behavior, including the types of sensory cues that are processed and the resulting task behavior. Sensory cues are ordered from internal cues (proprioception), to external concrete cues (tactile, visual, verbal), to increasingly abstract cues (related visual cues, verbal hypotheticals, symbols, and ideas). Motor performance is also ordinal, from reflexive actions that appear in response to internal cues to planned actions that reflect processing of tactile, visual, and then abstract cues. At each higher cognitive level, the sensory cues used in performance are more complex, resulting in behavior that is more organized and complex.

In the AWP, jobs were adapted by controlling for the types of cues involved according to the worker's cognitive level. This allowed workers to perform their jobs with relative ease or with repetitive, continuous performance. Continuous repetition of several task steps, within a variety of activities, allowed for the practice of sequencing skills; practice may have translated into abilities in sequencing self-care activities at home.

In this study, the expected mean in CPT four months after moving from the AWP was 4.7, based on the subjects' rate of decline during their participation in the program. An ADL disability at 4.7 is associated with the initiation and organization of tasks (for example, not knowing

when to bathe or when or what clothes to change) as opposed to the inability to sequence the main components or steps of the task. Basic self-care activities are mildly impaired at 4.7, as sequencing skills for concrete familiar activity are intact.

The observed CPT mean after the move was 4.0. At this cognitive level, ADL performance shows not only the problems with initiation and organization, but also the additional problems with attending to and sequencing the steps of these tasks. As a result, caregivers need to directly assist the person during the task. Thus, the difference in ADL ability between 4.7 and 4.0 ranges from a decline in performance frequency (necessitating reminders or prior set-up) to the need for one-to-one care.

Repetitive work activities adapted to individual capabilities may have an effect on maintaining function in AD, and the amount of time spent repeating the activity may be an important factor. Traditional day care programs typically offer large-group leisure and verbal activities, and participation is often passive with respect to motor engagement in the task. Cognitive engagement may also be passive, for example, with activities or discussions that require memory and other complex cognitive skills. Adapted work activities may be easier for individuals with AD to engage in, thereby offering the

opportunity to practice sequencing skills and attention to a motor task. In addition, work may offer more purpose to some individuals than leisure or verbal activities.

Meaningful activity has been shown to affect overall health in elderly who are well,<sup>17</sup> as well as in participants with dementia who attended adult day care.<sup>1</sup> However, no studies show that adult day care participation maintains ADL or delays the rate of decline in AD. A work program with matched cognitive-motor activity that has meaning to the person may offer important benefits in overall function and health. Ultimately, adapted work programs may help to delay institutional long-term care better than traditional programs.

This study suggests that a behavioral intervention of repetitive work can delay decline in AD. Although the environment changed with the transition between programs, as did the schedule with respect to the number of days, the programs had existed side-by-side and the former workers were familiar with the ADHC staff and space. Weekly attendance hours and the staff-to-patient ratio remained the same. Therefore, the type of activity, as opposed to the environment, appears to be the primary change. Other limitations to this study include the small sample size of men, who were mostly Caucasian and from the Midwest. Longitudinal, randomized controlled studies with larger, more diverse populations are needed to further investigate these effects.

Future research could lead to the development, within large institutions, of new adult day care centers that can offer repetitive work. Employees and adult children or other family members caring for a person with AD could benefit from employer-provided adult day care. Further investigation of the effects of specific activities on function in AD are needed in order to identify best-practice models for the growing population of individuals who use adult day care.

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