

Effects of Assistive Technology on Functional Decline in People Aging With a Disability

**Dorothy J. Wilson, OTR/L,
FAOTA,¹ Judith M. Mitchell,
PhD,¹ Bryan J. Kemp, PhD,¹
Rodney H. Adkins, PhD,¹ and
William Mann, PhD²**

¹Rancho Los Amigos National
Rehabilitation Center, Downey,
California

²Rehabilitation Engineering
Center on Aging, University
of Florida, Gainesville, Florida

ABSTRACT This study used a randomized control group design to investigate the impact of an assistive technology and home modification intervention on function for individuals who are aging with a disability. There were 91 participants with polio, rheumatoid arthritis, cerebral palsy, spinal cord injury, stroke, and other impairments. Outcome data were collected at 12 and 24 months through in-home interviews using the Older Americans Resources and Services Instrument (OARS) and the Functional Independence Measure (FIM), and through monthly telephone contact on the hours of in-home care, hospitalizations, and acquisition of AT. The treatment group received an in-home evaluation of their equipment and home modification needs. All recommended AT and home modifications were provided and paid for in full or in part by the study. The control group received the standard community-available health care. A significant “group by time” interaction for the FIM suggested a slower decline in function for the treatment group over 2 years. Further analyses found that the treatment group was more likely to use equipment to maintain independence vs. personal assistance. This study supports the value of assistive technology for adults aging with a disability and suggests that it be provided earlier in the aging process.

KEYWORDS aging with disability, assistive technology, functional decline

INTRODUCTION

Compared to the general population, people with physical and intellectual impairments have historically lagged in terms of their life expectancy. However, that trend appears to be changing, and people with an impairment such as spinal cord injury, cerebral palsy, or Down syndrome are now aging into their 50s, 60s, and 70s and beyond in increasing numbers. For example, over the last 40 years, life expectancy for individuals with a spinal cord injury who survived the first 3 months has increased 39 or more years (Samsa, Patrick, & Feussner, 1993), and people with Down syndrome now have a life expectancy of approximately 60 years (Bittles, Bower, Hussain, & Glasson, 2007).

Address correspondence to
Dorothy J. Wilson, LAREI,
P.O. Box 3500, Downey, CA 90242.
E-mail: djwilson2@ca.rr.com

Recent research also indicates that people with severe physical impairments do not age in a typical manner. Instead, they appear to show signs of what some people have called “premature aging” (Kemp & Mosqueda, 2004). This atypical aging leading to significant declines in functional and physical abilities begins as early as the fifth decade and leads to increased needs for assistance (Federal Interagency Forum on Aging Related Statistics, 2006). One avenue of assistance may be through assistive technology (AT), including identification and appropriate use of assistive devices, behavioral changes, and environmental modifications. These techniques have been shown to be effective in both a gerontology population and in people newly disabled. However, there has been relatively little research on these approaches to help people aging with a disability acquired early in life. Two recent studies have demonstrated that the proper use of assistive technology, in conjunction with other clinical interventions, can keep frail elderly people functioning in their homes and that devices can be made acceptable to the overall population (Gitlin et al., 2006; Mann, Ottenbacher, Fraas, Tomita, & Granger, 1999).

Also, studies and clinical practice have shown that assistive technology for newly disabled individuals is highly effective (e.g., powered wheelchairs, communication devices, modified motor vehicles). Because people with early-onset disabilities (e.g., before age 30) are now aging, there is reason to believe that similar approaches may help them. Some of the most commonly reported functional problems of people aging with a disability include increased difficulty with activities of daily living (ADLs) such as ambulation and transfers, as well as increased difficulty with instrumental activities of daily living (IADLs) such as shopping and meal preparation. These problems are often considered to be due to issues commonly associated with aging such as physical organ failure, advancing loss of sensation, and increased medical problems (e.g., hypertension, osteoarthritis). However, underlying issues such as long-term effects of overuse of muscles, strain on joints, increasing weakness, and increased incidence of pain and fatigue play an increasingly important role among individuals aging with a disability (Thompson, 2004). Many people who are aging with a disability change status from being independent or semi-independent to needing more assistance from others or from equipment over a relatively short

period of time (Federal Interagency Forum on Aging Related Statistics, 2006).

Additional research is needed to determine if the use of assistive technology can help solve functional problems for individuals aging with an early-onset long-term disability as it has with frail elderly and elderly individuals aging with chronic medical conditions. The purpose of this research was to determine whether the appropriate use of an AT intervention program including AT devices, home modifications, and environmental and behavioral changes for people aging with an early-onset disability improves function and reduces the rate of functional decline. To test this concept, we conducted a randomized controlled trial giving both groups an assessment of their current function. For one group, we added the provision of an assistive technology intervention program that included AT devices, task modification, and environmental changes. Our hypothesis was that the group that received assessment and intervention would maintain their independence longer and better than the group without intervention.

METHODS

Recruitment

Candidates for this study were recruited from a larger nonintervention research study about adults aging with a physical disability (AWD study). This study took place between 1999 and 2002 at the Rancho Los Amigos National Rehabilitation Center (RLANRC). Recruitment for the larger AWD study was done by way of flyers, disability support group presentations, and newspaper advertising in order to obtain a community-based sample. All interested individuals contacted RLANRC, received an in-depth explanation of the study, and were invited to participate. If interested, the individuals signed consent forms certified by the federally approved institutional review board (IRB). The larger AWD study examined the effects of aging on people with physical impairments such as spinal cord injury, polio, rheumatoid arthritis, and cerebral palsy. Everyone in the larger study was cognitively intact as determined by a clinical psychologist, was between the ages of 23 and 94, and had a disability duration of 3 or more years.

In order to identify the most appropriate candidates for the current study, an inclusion criterion was

created that would select people that could benefit from receiving first-time or additional assistive technology. Two major strategies were used. First, people were included if they reported a need for equipment in one or more areas of mobility, splints or braces, durable medical equipment, low-technology devices, or home accommodations. Second, people were included if they were determined by a physical therapist to have major muscle weakness, mobility problems, upper extremity pain, or if they reported that pain, or fatigue interfered with their ability to do home responsibilities, complete self-care tasks, or perform their job. The rationale for the second strategy was that people with pain, fatigue, or muscle weakness are likely to benefit from using equipment as documented in the occupational and physical therapy literature (Gilbert, 1965; Kohlmeyer, 1993; Prior, 1960; Smith, 1991). Interested participants in the larger AWD study had signed additional consent forms that gave permission for investigators from other affiliated studies to review their information and to contact them. This provided the investigators with a list of possible participants that met our inclusion criteria.

Participants

One hundred twenty people qualified to be in this study; 91 participants completed the study, 16 did not (an attrition rate of 15%), and 13 declined. Of the 16 participants who were lost to attrition, 5 died prior to study completion, 4 became too ill to continue, 3 were lost to contact but not deceased as per the Social Security Death Index, and 4 had incomplete data.

There were no demographic differences between the participants who completed the study and those who did not. The 13 people who declined differed from the final participants in that they were more likely to be men ($\chi^2[1, N = 104] = 10.3, p < .001$), younger ($t = 3.3, p < .001$), have either a spinal cord injury or "other" impairment ($\chi^2[3, N = 104] = 10.7, p < .01$), and have a disability of shorter duration ($t = 2.6, p < .01$).

The final group of 91 participants included 68 women and 23 men with an average age of 62 ($SD = 14.3$); 39 participants (44%) were under the age of 60, and the average educational level was 15 years ($SD = 2.6$). The ethnic breakdown was 74 White, 9 Hispanic, 6 Asian, and 2 African American. Breakdown by impairment was 59 polio, 13 spinal cord injury, 9 rheumatoid arthritis, and 10 people with impairments classified as "other," which consisted of cerebral palsy, stroke, and peripheral neuropathy. The average disability duration was 45.4 years ($SD = 19.2$).

Forty-seven participants were randomly assigned to the treatment group and 44 to the comparison group. The demographic and descriptive data for the treatment and control groups are shown in Table 1. There were no significant differences in demographics between the two groups.

Design and Procedures

The study used a randomized control group design. All potential candidates were called to explain the purpose and procedures of the AT study and determine if they were interested in participating. Those participants

TABLE 1 Demographic and descriptive data for the treatment and control groups

Variables	Treatment group	Control group	Total	<i>p</i>
Gender, % female	68	81	75	<i>ns</i>
Ethnic, % White	83	80	81	<i>ns</i>
Age, mean (<i>SD</i>)	62 (14.1)	62 (14.6)	62 (14.3)	<i>ns</i>
Education, mean (<i>SD</i>)	15 (2.8)	15 (2.4)	15 (2.6)	<i>ns</i>
Impairment, no.				<i>ns</i>
Polio	28	31	59	
Spinal cord injury	7	6	13	
Rheumatoid arthritis	6	3	9	
Other	6	4	10	
Duration, mean (<i>SD</i>)	43.7 (21.1)	47.3 (17.0)	45.4 (19.2)	<i>ns</i>
Equipment at start, mean (<i>SD</i>)	6.6 (3.7)	7.2 (3.7)	6.9 (3.7)	<i>ns</i>

who agreed to be part of the study were then assigned to either the treatment or control group using simple randomization techniques and a random number table. Participants then signed an additional IRB-approved consent form specifically for this study. Outcome data were collected in two different formats: (a) yearly blinded in-person home interviews covering functional outcomes collected at baseline, 12 months, and 24 months and (b) monthly blinded contacts through telephone or e-mail covering information on the number of overnight stays in a health care facility and the number of hours of in-home care. Information from these calls was used to calculate the average monthly outcomes for the 12- and 24-month periods. Data were collected by graduate students in an allied health field under the supervision of an occupational therapist.

Intervention

The major intent of the intervention was to provide the treatment participants with customized in-home evaluations of their assistive technology, home modification and task performance problem needs, and then to help each participant receive what was needed. This was done either by giving the participants the AT or helping them locate and purchase items on their own. When home modification needs were identified, a contractor's services were provided or recommendations were made to the participants. When changes in task performance were identified as a need, an experienced occupational therapist or physical therapist instructed the participants in alternative methods. Most participants did not need financial assistance for these services. For those who did, negotiations resulted in either the project sharing the costs with the participants or completely paying for the AT and/or modifications. Individuals in the control group received no equipment or intensive AT services; however, they did have access to general AT information from the AWD Study.

Treatment Group

A functional evaluation and an AT needs assessment were conducted in participants' homes by an occupational therapist and equipment specialist within the first year of the study. Survey of the home for potential safety hazards as well as observation of the participant in performance of tasks perceived to be problematic was conducted. Based on the findings

and discussions with the participants, recommendations for specific home modifications, assistive technology, or behavior modifications were made. Details on the types of AT, home modification, and adaptive behavior recommendations made are provided in the "Assistive Technology" measures section. For the majority of the participants, the devices were provided and, when necessary, participants were trained in their use. If new functional problems occurred after the baseline assessment or participants experienced problems with the provided AT, they were asked to contact the evaluators. New AT or assistance with provided AT was available to the treatment group throughout the 24 months of the study.

Control Group

Like the treatment group, participants in the control group were seen in their own homes for a functional assessment and follow-up at 12 and 24 months. These participants received no AT devices, home modifications, or any assistance from the project staff. However, participants might have learned about AT devices through other sources such as doctor's appointments, Area Agencies on Aging services, community programs, support groups, and general AT manuals from the AWD study. Also, for those control participants where staff determined that safety was a serious concern, project staff recommended that they seek medical help from their physician, which might have led to knowledge of AT devices available.

Outcome Measures

Two types of outcomes were collected from all participants. First were functional outcomes collected yearly through in-person interviews using the Older Americans Resources and Services Instrument (OARS) (Fillenbaum, 1988) and the Functional Independence Measure (FIM) (Keith, Granger, Hamilton, & Sherwin, 1987). Second were monthly outcomes collected through calls and e-mails focusing on nights spent in health facilities and hours of in-home care received.

Function

The Functional Assessment section of the OARS has 14 items that measure level of independence in

ADLs and IADLs. Individual items were scored as 4 (independent), 3 (independent with equipment), 2 (help from human), 1 (help from both human and equipment), or 0 (unable to do). The final score for ADLs and IADLS was the count of the total number of tasks done independently or independently with equipment. Scored in this manner, the OARS does not have a penalty for use of AT. The items assessed were ADL tasks of eating, grooming, dressing, mobility, bed transfers, showering, and toilet care and IADL tasks of telephone use, community mobility, shopping, meal preparation, housework, medication management, and finances. This scale has been reported to be reliable and valid (Fillenbaum & Smeyer, 1981).

The FIM (Hamilton, Granger, Sherwin, Zielezny, & Tashman, 1987) is an 18-item instrument that uses a 7-point scale ranging from 1 (dependent) to 7 (independent). While this instrument is designed to measure burden of care, it is commonly used in rehabilitation settings to measure functional change (Granger, Cotter, Hamilton, & Fiedler, 1993; Granger, Cotter, Hamilton, Fiedler, & Hens, 1990). This study used the 13-item motor subscale of the FIM to assess functional levels of independence. The items assessed were in the areas of self-care, bowel and bladder management, transfers, and locomotion either by walking or using a wheelchair. A final score on this subscale could range from 13 to 91. The instrument has satisfactory reliability data (Ottenbacher et al., 1994).

Facility Visits and In-Home Health Care Hours

Efforts were made to contact participants monthly by telephone or e-mail to collect information on the number of nights spent at a health care facility and the number of hours of in-home health care received that month. It was not possible to reach all participants every month, and the actual number of calls was approximately 9 during the first year and 8 during the second year. A health care facility was defined as a hospital, rehabilitation setting, or nursing home. In-home health care included visits from nurses, home health aides, or attendant help with self-care. For each 12-month period of the study, the monthly call data were averaged across all

completed calls to provide a monthly figure for number of overnight facility visits and hours of in-home care.

Assistive Technology

For this study, the AT intervention program included (a) a wide variety of AT devices such as grab bars, bath benches, and so forth that can be used to assist with task performance and enhance safety; (b) home or environmental modifications such as ramps, lighting/electrical changes, or widening of doorways to make it easier and safer to move around in the home and to control the home environment; and (c) adaptive behavior or changing the way a task is performed to enhance safety and reduce energy expenditures. The number of assistive devices or home modifications that each participant had at baseline and received or acquired during the study was reported. At baseline, participants identified their current equipment from a list of 41 different devices in five areas: mobility, braces, medical equipment, low-technology devices, and home accommodations. During the monthly calls, participants were asked if they received or acquired additional equipment, and what type. The monthly call data were then used to provide a total of additional equipment obtained for each year of the study.

Data Analysis

A series of *t* tests and chi-square analyses tested for group differences in demographics and use of assistive technology; *t* tests also examined preliminary differences between the two groups for the three functional outcome measures, with a significant finding for ADLs. This difference was adjusted for by using covariate analyses when testing ADL results. For the functional measures of FIM and IADLS, between-group repeated measures analyses examined patterns over time for the baseline, 12-month, and 24-month periods, and for ADLs, a covariate between-group analysis of variance was done. For the monthly data of caregiver hours and facility visits, between-group repeated measures analyses and chi-square tests were used to assess differences between the 12- and 24-month periods.

RESULTS

Participant Characteristics and Assistive Technology

There were no significant differences between the treatment and control group in demographics, years of duration of disability, or type of impairment.

There were no differences in the number of AT devices being used by the treatment and control group at baseline. For the treatment group, 94% received new equipment at 12 months and 50% at 24 months. While the control group never received equipment from the study, 50% obtained new equipment on their own at 12 months, and 36% at 24 months (group difference at 12 months, $\chi^2[1, N = 91] = 21.7, p < .001$; 24 months, $\chi^2[1, N = 91] = 4.1, p < .05$). At both the 12-month ($t = 5.8, p < .001$) and 24-month ($t = 2.04, p < .05$) periods, the treatment group had significantly more pieces of equipment than the control group. The final number of equipment pieces (i.e., the number of pieces at the start of study added to the equipment received or obtained at each follow-up period) for the treatment group was 9.0 ($SD = 4.1$) at 12 months and 10.0 ($SD = 4.5$) at 24 months; for the control group, it was 8.0 ($SD = 3.8$) at 12 months and 8.6 ($SD = 4.1$) at 24 months. Table 2 lists the most common types of equipment provided during the intervention for the treatment participants, and Table 3 reports the number of equipment pieces by group.

Comparisons Between the Treatment and Control Groups

Means and standard deviations for the average monthly call data and the yearly functional evaluation data at the different follow-up time periods are reported in Table 3.

Monthly Outcome Measures

For the monthly average of caregiver hours, the between-group repeated measures analyses found a significant “time” main effect for caregiver hours, $F(1, 89) = 3.80, p < .05$, with hours increasing over time for both groups. The control group reported more caregiver hours than the treatment group at both the 12- and 24-month follow-up period, although the differences were not statistically significant. For the number of facility visits, there was no significant

TABLE 2 Assistive technology and environmental interventions provided to treatment participants

Technology	Description (if needed)	No. of devices	%
Assistive technology (AT)			
Grab bars		20	16.7
ADL adaptations	Dressing tools, positioning devices, hygiene tools	17	14.2
Bath/shower benches		14	11.7
IADL adaptations	Kitchen aids, cleaning aids, gardening aids	13	10.8
Toilet equipment	Toilet frames, raised seats, bidet	11	9.2
Hand-held showers		7	5.8
Transfer equipment	Floor to ceiling bars, raised furniture, bed rails	7	5.8
Telephone equipment	Large numbers, volume enhanced	4	3.3
Arm supports	Designed for easier access	2	1.7
Wheelchair cushions	Back or seat cushions	2	1.7
Environmental interventions (EI)			
Recommendations made and followed by participants	AT, EI, changing residence	18	35.3
Equipment justifications		12	23.5
Community resource referrals	Orthotist, physical therapist, psychologist, city/county agencies	12	23.5
Behavior modification instruction		9	17.6
Ramps	Outdoor and threshold	8	6.7
Outside railings		8	6.7
Home modification	Work surfaces, kitchen installations, thermostat changes, door hinges	7	5.8

change from 12 to 24 months. However, the pattern of the mean scores shows that treatment group facility visits doubled from 12 months to 24 months, from 0.12 to 0.21 ($t = 0.87, ns$), while the control group means remained approximately the same. Overall, the average monthly caregiver hours for all participants

TABLE 3 Equipment, caregiver hours, facility visits, and functional outcomes for the treatment and control groups

Variables	Treatment group	Control group	Total
Total pieces of equipment			
Baseline	6.6 (3.7)	7.2 (3.7)	6.9 (3.7)
12 months	9.0 (4.1)	8.0 (3.8)	8.6 (4.0)
24 months	10.0 (4.5)	8.6 (4.1)	9.3 (4.4)
Monthly average of caregiver hours			
12 months	6.8 (33.1)	15.5 (42.0)	11.0 (37.8)
24 months	7.9 (36.4)	18.8 (48.0)	13.2 (42.5)
Monthly average of facility visits			
12 months	.12 (.29)	.11 (.27)	.12 (.28)
24 months	.21 (.59)	.12 (.37)	.16 (.50)
FIM motor score			
Baseline	78.5 (13.0)	74.1 (18.3)	76.4 (15.8)
12 months	79.2 (12.1)	71.8 (20.8)	75.6 (17.2)
24 months	77.1 (13.4)	71.3 (20.8)	74.2 (17.5)
IADLs			
Baseline	5.3 (1.2)	4.9 (1.7)	5.1 (1.4)
12 months	5.4 (1.4)	4.6 (2.0)	5.0 (1.7)
24 months	4.9 (1.6)	4.3 (1.9)	4.6 (1.8)
ADLs			
Baseline	6.3 (1.5)	5.5 (2.2)	5.9 (1.9)
12 months	5.9 (1.7)	5.2 (2.4)	5.6 (2.1)
24 months	6.0 (1.7)	5.3 (2.5)	5.7 (2.1)

Note. Data are reported as means (*SD*).

tended to be modest (12-month $M = 11.0$, $SD = 37.8$; 24-month $M = 13.2$, $SD = 42.5$), as was the average number of monthly facility visits (12-month $M = 0.12$, $SD = 0.28$; 24-month $M = 0.19$, $SD = .50$).

Functional Outcome Measures

Comparisons (t tests) between the treatment and control groups at baseline for the FIM motor score, IADLs, and ADLs were done to determine if both groups were similar in functional ability at the beginning of the study. Nonsignificant results were found for the FIM and IADLs; a significant result was found for ADLs, with the control group scoring significantly lower ($t = 2.05$, $p < .05$). To control for ADL baseline differences, the repeated measures analysis for ADLs was performed covarying for baseline scores.

Three separate between-group repeated measures analyses were done. A significant time main effect was found for two of the three measures, those of the FIM, $F(1, 89) = 5.30$, $p < .05$, and IADLs, $F(1, 89) = 9.35$, $p < .001$, indicating that regardless of group, participants

were declining over time in function as measured by the FIM and IADLs. A significant group by time interaction was found for the FIM, $F(1, 89) = 6.6$, $p < .01$. Examination of the FIM scores suggests a slower decline in function for the treatment compared to the control group. For the treatment group, function was maintained from baseline to 12 months and then declined at 24 months, whereas for the control group decline occurred by the 12-month period and then leveled off at 24 months. Results from the between-group repeated measures covariate analysis for ADLs were nonsignificant for both the main effect of time and the group by time interaction.

Since the average facility visit score for the treatment group at 24 months was high, this suggested the possibility that treatment participants may have experienced some specific health problems that might have affected their functional results between the 12- and 24-month follow-ups. To adjust for this possibility, repeated measures analyses were reanalyzed for the FIM and IADLs using facility visits as a covariant. No different findings were revealed.

Individual IADL and ADL Tasks

To provide a more detailed understanding of change in functional status, we examined the equipment use patterns of specific functional tasks. Four OARS tasks of community mobility, bed transfers, bathing, and toilet care were identified as those most likely to benefit and improve from use of equipment. For each participant, outcome status was established as “desired,” “undesired,” or “independent.” “Desired” status was defined as gaining or maintaining independence with the use of equipment and no assistance from another person in performing the activities. “Undesired” status was defined as either remaining in a situation where assistance from a person was needed or movement into such a situation. “Independent” meant that the individual began and remained completely independent without equipment or assistance from another person in performing the activity for the identified time period. It should be noted that an individual who began as independent could have had either a desired outcome by maintaining independence with the use of equipment and no assistance from another person in performing the activities or an undesired outcome by declining to a situation where assistance from a person was needed. However, if an individual began and

remained independent in a specific activity, his or her participation as a member of either the treatment or control group clearly had no impact on that activity. From this perspective, those classified as independent were excluded from the analysis.

Chi-square analyses were used to examine group differences in outcome status in these tasks at the 12-month and 24-month periods. All analyses were nonsignificant. However, the patterns of desired change were similar throughout. For all four tasks, the treatment group had a higher percentage of participants who experienced a desired change and a lower percentage who experienced an undesired change. The tasks that had the highest percentage of positive changes for both the 12- and 24-month follow-up periods were mobility and bathing. For mobility, 83% of the treatment group and 66% of the control group at 12 months, and 75% of the treatment group and 66% of the control group at 24 months, had desired outcomes. In contrast, 6% of the treatment group and 18% of the control group at 12 months, and 16% of the treatment group and 20% of the control group at 24 months, had undesired outcomes. For bathing, 60% of the treatment group and 50% of the control group at 12 months, and 64% of the treatment group and 55% of the control group at 24 months, had desired outcomes. In contrast, 24% of the treatment group and 29% of the control group at 12 months, and 25% of the treatment group and 29% of the control group at 24 months, had undesired outcomes. Since the same pattern was observed, the data were collapsed across tasks and examined for differences between the treatment and control groups. Collapsed across the four tasks, the treatment group had 102 desired outcomes and 27 undesired outcomes and the control group had 75 desired outcomes and 38 undesired outcomes at 12 months ($\chi^2 = 4.32, p < .05$). The pattern was the same at 24 months, but the differences were of smaller magnitudes and not significant.

DISCUSSION

The process of aging can pose significant safety, health, and functional decline problems; individuals aging with a disability may experience many of these problems at an earlier age than individuals without a disability. This study investigated the role that an AT intervention program plays in either reducing or slowing down functional and frailty problems associated with aging with a disability.

The study produced two main results. First, both groups had functional decline over time during the 2-year period as indicated by a significant time finding for the FIM and IADLs. When examining the FIM scores, the treatment group's functional decline was slower than that of the control group, as indicated by a significant FIM group by time interaction. The participants in the treatment group appeared to maintain their function during the first 12-month period and did not start declining until the beginning of year 2, whereas the control group showed functional decline for both the 12- and 24-month periods. It is interesting that out of the three functional measures used in this study, only the FIM demonstrated this difference over time between the treatment and control groups. We suspect this is because the FIM measures degree of functional change at a more sensitive level than that of ADLs and IADLs. Given its 7-point scale for each functional task, the FIM is able to capture varying degrees of change from independence to dependence over time. Since both groups acquired AT equipment during the study and had high functional scores at baseline, measuring change over time appeared to require this level of sensitivity provided by the FIM.

Two other studies using a randomized control group design investigated the effectiveness of AT and home modification interventions with a population of frail older adults living in the community. Their findings were very similar to ours. Mann et al. (1999) studied 104 older adults (average age of 73) and used the FIM, CHART, and IADLs as outcome measures. Only the FIM showed a significant difference by group, with the treatment group experiencing a slower decline in function over 18 months. Gitlin et al. (2006) studied 319 older adults (average age of 79) and found that at 6 months their treatment group had less difficulty than their control group with ADLs and IADLs. The largest reduction in difficulty was found for bathing and toileting. The difference between our study and these studies is that the other studies only included older and frail senior adults and resulted in functional decline in a shorter period of time. The participants in our study had a greater age range (e.g., 30 to 89 years old), and we believe the rate of functional decline was prolonged due to the number of younger people. No differences were found between the two groups in the present study for the monthly data on number of caregiver hours and number of facility visits. Both groups experienced an increase in caregiver

hours per month over time. The increase in caregiver hours may reflect the general functional decline both groups experienced, though at different rates.

The second main result came from the analysis of individual functional tasks at the 12- and 24-month follow-up periods. Specific tasks examined were mobility, bed transfers, bathing, and toilet care. Although not statistically significant when tasks were examined individually, when data were collapsed across the four tasks, the treatment group had significantly more desired functional changes than the control group. The desired change was the ability to gain or maintain independence with the given task through use of equipment only, thereby reducing the need for personal assistance.

Both groups started the study with statistically the same amount of assistive technology and, as expected, the treatment group obtained significantly more equipment than the control group over the duration of the study. Over half (56.8%) of the equipment provided or acquired by the treatment group was related to safety in the bathroom or safely getting around the home. This appears to have a direct relationship to the items discussed that had “desired” functional changes. The amount of equipment acquired by the control group during the 2-year period raises the issue of availability and accessibility of AT for consumers with and without a disability. It is possible that use of AT is facilitated by the proliferation of commercially available AT in department and home improvement stores. Both professional and consumer publications during the last 10 years have been instructive in what equipment and resources are available to consumers and where they can be obtained (El-Faizy & Reinsch, 1994; Mann et al., 1999; Mann, 2004; Matteliano et al., 2003). However, the appropriateness of AT acquired by the control group is not known. One advantage to the treatment group was the professional in-home evaluation provided by an occupational therapist and equipment specialist. This led to appropriate identification, installation, and training as needed on the assistive technology and task and home modifications.

Study Limitations

The present results cannot be generalized to all individuals aging with early-onset disabilities. The results were limited by the small size of the sample; however,

the information should prove useful to individuals in the impairment groups that participated. The outcome measures may have some limitations. The traditional scoring of the OARS penalizes individuals for use of equipment only to accomplish tasks. A ceiling effect among patients with traumatic brain injury or low back pain has been reported with the FIM, but this effect was not recorded with any of the impairments in this study (Hall et al., 1996).

Another main limitation of this study was that there was no way to control access to AT by the control group, given the general public’s awareness of and accessibility to AT. Although the treatment group obtained significantly more AT, the control group on their own also obtained AT throughout the study. Having to schedule an independent contractor when environmental modifications or AT installation was necessary was also a limitation of this study. This, and waiting for delivery of some of the more complicated AT items, proved to be a limiting factor to ensuring that participants received the recommended AT in the first 12 months of the study. Maintaining the blinding of the interviewers over the entire study period was not viable. The monthly and yearly contacts gave the interviewers clues as to who was in each group and potentially biased the reporting in spite of continuing and extensive training. These limitations point to the difficulty of conducting a controlled randomized trial in the real-world setting versus randomized controlled drug trials, the most common use of this design (Guihan et al., 2007).

Practical Implications

The heterogeneous sample used in this study sample gives credence to the validity of using AT, specifically for mobility and safety in the bathroom, for a generalized population of adults aging with early-onset disabilities. Clinicians need to be aware that regardless of an individual’s impairment, functional decline will occur earlier for individuals aging with a disability than for those experiencing normal age-related changes who do not have a disability. This will allow the clinician to make recommendations for AT, including environmental adaptation and behavioral strategies, earlier in the aging process to slow functional decline and support aging in place.

CONCLUSION

This study used a 2-year randomized control group design to look at the impact of AT and environmental intervention on the functional decline of adults aging with physical disabilities. Both groups acquired AT and environmental interventions (the control group on their own); however, the treatment group received more equipment and presumably more appropriate equipment due to the involvement of clinicians and long-term care planners experienced in evaluating functional and safety needs. Functional decline occurred in both groups, but the decline over time was significantly slower among participants in the treatment group.

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