Outcomes of an Assistive Technology Intervention Among Wheeled Mobility Users

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ABSTRACT

This paper reports the outcomes of an assistive technology (AT) intervention among seating and mobility clients at an acute rehabilitation hospital between 2002 and 2004. Three instruments, OTFACT, PIADS, and the ATOM, were administered during baseline and assessments made at 1 and 12 months post-intervention. Results showed that the measures were not significantly correlated at baseline, post 1 and post 12 months, indicating the intervention had a dissimilar impact on their respective constructs. Results are discussed in terms of methodological implications for future outcomes studies.

KEYWORDS: outcomes; assistive technology; seating and mobility; wheelchair

BACKGROUND

The importance of assistive technology (AT) outcomes research is well documented [1-5], especially among people who use mobility devices. A key aspect of outcomes research is the device acquisition process [1] . However, to date, few studies have been published for wheeled mobility users. The inseparability of AT outcomes from their service provision contexts has been noted by many [2, 3, 6, 7]. Outcomes data can help AT providers and program managers better meet client needs by documenting the effectiveness, efficiency, and costs of AT service delivery and using them to improve services. In addition, they also provide insurers, social policy experts, AT users and other stakeholders with evidence-based data to assist in decision-making regarding appropriate treatments for specific clinical needs.

One challenge in assessing the effects of AT interventions is the limited number of instruments that isolate the impact of AT provision and service within those domains. Outcome measures vary by inclusion or exclusion of AT and their scoring procedures for AT assessment [8]. The choice of outcome measures reflects both researcher-clinician objectives and service delivery priorities. Lenker et al. [9] summarized the range of outcome domains most common to AT measurement as device usability, user satisfaction, quality of life, social role performance, functional level, and cost .

The objective of this study was twofold: to collect outcomes data related to the service delivery provision of assistive devices and to develop methodological procedures that could be incorporated easily into busy AT service delivery practices. This study collected outcomes information from seating and mobility clients at the Center for Rehabilitation Technology (CRT), Helen Hayes Hospital, an acute rehabilitation hospital. Three hypotheses were defined: 1) The three outcomes measures are significantly related at each measurement period; 2) The score of each instrument is correlated over time; and 3) The score of each instrument measured at 3 and 12 months after intervention is higher than the score taken prior to the intervention

METHODOLOGY

This project used a repeated measures cohort design to track the outcomes of an assistive technology intervention. One baseline and two post assessments were done at 1-month and 12-months post-intervention.

The ATOM, OT FACT and PIADS were selected for this study because they were designed to reflect outcomes of AT use and were able to be administered via in-person and telephone interview. They also were selected because each measures complementary yet different constructs which together represent a comprehensive assessment of AT outcomes.

Assistive Technology Outcome Measure (ATOM)

The ATOM is a device-specific measure developed to meet the need for a practical clinical tool to assess AT usability and service in a short, easy-to-administer format, and which could be integrated into a busy practice or administered by support staff. It consists of 19 questions to measure seven constructs: 1) *use and community* (how often an AT device is used within and outside the home); 2) *comfort* in using a device); 3) *hassle* (difficulty in setting up, using, and maintaining a device); 4) *self perceived assessment of function*; 5) *assistance and burden of care* (assistance required with device set-up and use, and assistance with those functional activities the AT device targets); 6) *service satisfaction* (promptness, communication, courtesy, accessibility, professionalism) and 7) *user's knowledge of AT resources*.

OTFACT

The OTFACT is a software-based data collection system constructed upon Trichotomous Tailored Sub-branching Scoring [10, 11]. Its taxonomy consists of 950 categories organized hierarchically in five domains that reflect occupational therapy's approach to functional performance: 1) *role integration,* 2) *activities of performance,* 3) *integrated skills of performance,* 4) *components of performance,* and 5) *environment*. This system offers the unique capability to probe a category with a general question, then subsequently branch into more detailed questions when responses indicate the need for greater sensitivity. For this study, questions for Activities of Performance (AOP) and environment domains were adapted for a telephone interview.

Psychosocial Impact of Assistive Devices Scale (PIADS)

The PIADS measures the impact of AT on quality of life [12, 13]. Twenty-six items fall into one of three sub-scales: competence, adaptability, and self-esteem. The *competence* subscale assesses subjects' feelings about the impact of AT on their sense of competence, productivity, usefulness, performance, and independence. The a*daptability* subscale examines a subject's willingness to try new things and queries self-perceived ability to participate, a willingness to take chances, eagerness to try new things, and the ability to take advantage of opportunities. The *self esteem* subscale looks at the perceived impact of AT on overall emotional well being and queries an individual's sense of self-esteem, security, power, control, and self-confidence.

In addition, field notes were recorded for all subjects. Field notes are a methodologically formalized written record of observations, interactions, conversations, situational details, and thoughts kept during the research period. In this study, they captured the everyday and informal context surrounding subject-clinician-researcher interactions; for example, after conversations with a clinician who might relate a change in a subject's health condition, problems with an insurance company, or change in the subject's living or marital situation.

ANALYSIS

Outcome scores were calculated according to the respective instructions. The ATOM returned a single score. The three domains of the PIADS were summed and entered as a single variable. For the OTFACT, separate scores for the Activities of Performance (AOP) and Environment measures were entered into analysis. Therefore, analysis included four outcome scores.

Correlations were calculated to determine the relationships between measures and the relationships of a single measure over time. Correlations were judged using significance values as well as clinical significance as reported by Currier [14] with <.69 regarded as poor; 0.7-0.79 as fair; 0.80-0.89 as good and 0.90-0.99 as excellent. A General Linear Model was used (Minitab v14) to determine if instrument scores were different over the 3 measurement periods and a Tukey Pairwise comparison was

used to identify where differences in measures occurred. The results of tests whose significance was <=0.10 will be discussed.

RESULTS

A convenience sample of subjects was enrolled between June and December 2002. Inclusion criteria consisted of both outpatients and inpatients 14 years or older undergoing a seating and mobility evaluation by CRT staff. Clients with cognitive impairments or dementia were also consented if there was a full-time primary caregiver who could act as proxy. Excluded were clients with rapidly progressing diseases such ALS and Duchene's muscular dystrophy and those with proxies who had multiple caregivers.

Sixty-six seating and mobility subjects were approached to participate in this study; 44 consented and 31 completed the study. Subjects' primary diagnoses included spinal cord injury (10); multiple sclerosis (8); cerebral palsy (2), stroke (2), osteoporosis (2). Other diagnoses included osteomyelitis, Guillian Barre syndrome, Parkinson's disease, neurofibromatosis, chronic paraparesis, dystonia, SMA type 2, traumatic brain injury, and arthritis. All seating and mobility subjects who completed this study were experienced, full-time, wheelchair users. The minimum time a subject had been using a wheelchair before this intervention was 2 years.

Subjects' ages ranged between 27 and 95 with nearly a third (32%) over 65 years of age. Most subjects were male (70%) and white (77%) and 45% were unemployed as of 2002. Twenty (65%) subjects lived with family members. The average (mean) number of years subjects had lived with a disability was 21 years.

Seating and mobility interventions took between 3 and 16 months (with an average of 8 months) between initial consultation and delivery of AT device. The timeframe from consent to 12-month post-intervention assessment ranged from 13-30 months. Delays in completing an intervention were attributed to delays in submitting information, payor review and approval and acquisition of the prescribed equipment.

Outcome Instrument analysis

Correlations between the different outcome measures were generally low but increased over time.

Table 1 Goes Here

ATOM and AOP exhibited the greatest relationship ranging from 0.475 ($p=0.014$) at baseline to 0.679 ($p=0.001$) at the 12 month post-intervention. The two domains of the OT FACT- AOP and ENV- exhibited a low correlation at all three time periods.

The ATOM is significantly correlated over time ($p<0.001$) meaning people with a high ATOM score pre-intervention also scored high at Post1 and Post12. In addition, scores of ATOM differed over time ($p=0.001$) with significant evidence that Post1 ($p=0.0017$) and Post12 ($p=0.0023$) values were higher than Pre values. Post 1 and Post 12 were not significantly different.

Table 2 Goes Here

AOP was also significantly correlated over time ($r>0.88$, $p<0.001$) with the scores being different over time ($p=0.007$). AOP values decreased over time with Pre scores greater than Post 1 and 12 scores (0.0050). Pre1 scores were not significantly different than Pre or Post 1 or 12 values.

ENV scores were significantly correlated over time ($p < 0.02$) but were nearly equal at the three time periods ($p=0.924$). PIADS scores exhibited low and non-significant correlations and also exhibited no differences over time ($p=0.902$)

Table 3 Goes Here

DISCUSSION

The clinical significance of correlations between instruments was generally low. This means that each instrument measured different constructs. Results also indicated that the AOP and ATOM were most sensitive to the seating and mobility intervention and showed a change with the intervention. In addition, they exhibited the highest correlations with themselves over time as well as the highest correlations with each other. However, whereas ATOM scores rose after intervention, AOP scores decreased.

In order to account for this effect, both medical charts and field notes were reviewed. As reported elsewhere [15], the decrease in AOP scores reflected negative changes in both health (e.g., MS exacerbation, illness) and/or living situation (e.g., death, divorce, loss of job) during the one year follow-up assessment. This was true for all subjects whose AOP scores decreased over time. The AOP scales of the OTFACT appeared sensitive to those contextual variables that impacted both social role performance as well as functional outcomes over time. In contrast, the increase in ATOM scores reflected an increase in perceived usability of the wheelchair and satisfaction with the intervention. In other words, subjects whose total ATOM scores increased had, on average, a positive outcome across the 7 constructs measured by the ATOM.

The ENV domain of the OTFACT showed little change over time suggesting that the intervention had little impact on subjects' social and financial support system, mode of their transportation, overall accessibility indoors and outdoors, or air quality, safety, and lighting. It is possible that these outcomes reflected the "infrastructure" of subjects' lives and were less likely to be directly affected by a single intervention.

PIADS data showed no significant change between pre and post assessments. A possible explanation was subjects were already experienced, full-time, wheelchair users. The acquisition of a new wheelchair would not necessarily reflect changes in psychosocial impact within a population already well-adapted to wheelchair use. This suggests that although the PIADS might be sensitive to subjects' psychosocial adjustment in using a new or different device, it may be a less sensitive as a measure of change as the result of an intervention among populations already experienced in using a specific device.

This study's results reflect the myriad methodological challenges in effectively measuring outcomes that isolate the impact of an AT intervention on people with disabilities. The complexities of measuring an intervention's effect need to be framed in terms of specific research questions and in the choice of outcome instruments appropriate to the variables, research questions, subject population, and study design. The rationale for pre-post methodology presupposes the stability of a baseline score against which the effects of a treatment or intervention can be measured during post assessments. However - as this study suggests - changes in life situations, health status, aging, increasing functional limitations, over the course of an AT intervention can substantially impact outcome measurements. These complexities point to the need to control – either statistically or methodologically – for the range of variables that impact the outcome of an intervention.

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Table 1. Correlations between instruments

PRE	ATOM	PIADS	AOP
ATOM			
PIADS	0.281		
AOP	0.475	-0.047	
ENV	0.051	0.104	-0.201
POST- 1 mo	ATOM	PIADS	AOP
ATOM			
PIADS	0.349		
AOP	0.566	0.165	
ENV	-0.109	0.365	-0.225
POST- 12 mo	ATOM	PIADS	AOP
ATOM			
PIADS	0.697		
AOP	0.679	0.343	
ENV	0.397	0.352	0.185

Table 2. Correlations over time within instrument

	ATOM Pre	ATOM Post1
ATOM Pre		
ATOM Post1	0.62	
ATOM Post12	0.76	0.774
	PIADS Pre	PIADS Post1
PIADS Pre		
PIADS Post1	0.194	
PIADS Post12	0.057	0.711
	AOP Pre	AOP Post1
AOP Pre		
AOP Post1	0.947	
AOP Post12	0.882	0.907
	ENV Pre	ENV Post1
ENV Pre		
ENV Post1	0.585	
ENV Post12	0.518	0.518

Table 3. Average outcomes instrument scores over time

	Pre	Post1	Post12
ATOM*	0.7096	0.7838	0.7921
PIADS	2.784	2.900	3.011
AOP**	77.69	73.64	70.00
ENV	92.42	92.08	92.91

*significantly higher post-intervention

** significantly lower post-intervention

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