Incidence of traumatic brain injury (TBI) is estimated to be 100 per 100,000 persons per year, with half not surviving (NIH Consensus Development Panel on Rehabilitation of Persons With Traumatic Brain Injury [NIH], 1999). For the estimated 2.5 to 6.5 million survivors, TBI results in life-long disability and handicap requiring the care of others and is, therefore, a major public health problem. Rehabilitation appears to reduce this burden (Cope, 1995; Malec & Basford, 1996; NIH, 1999). The effectiveness of the various components of rehabilitation has not been differentiated. To avoid payer decisions made on the basis of inadequate information, the value of occupational therapy to effect positive changes on disability and handicap for persons with TBI needs to be demonstrated.

Literature about the effectiveness of occupational therapy to restore activity and participation for adults with TBI is limited to case reports, a low level of evidence on the evidence-based practice hierarchy (Center for Evidence-Based Medicine, 2001). Schwartz (1995) presented three case studies of occupational therapy administered to adults with memory deficits secondary to TBI. Treatment, individualized and administered in the home, consisted of retraining routines,
training in use of compensatory strategies, and environmental adaptations to recover basic activities of daily living (BADL) skills. Therapy was reported to improve memory, but the effect was not tested statistically. Using a repeated single-case design, Giles, Ridley, Dill, and Frye (1997) found that a given protocol for retraining washing and dressing routines was effective for 3 of the 4 carefully selected young adult participants with severe BADL deficits secondary to brain injury. The results were not tested statistically. Nelson and Lenhart (1996) reported a successful outcome for a young woman 5 years post–brain injury who was treated once a week for 5 months. Her goal was to become more organized in her approach to daily living in order to resume her education. Treatment consisted of training in the use of compensatory strategies, practice in problem solving, and environmental adaptation. Standardized testing of component abilities indicated improved attention to detail and an organized approach to completion of tasks, both of which were lacking at initial evaluation. At 6-month follow-up, the woman was still using the strategies she had learned and had resumed her student role. Gutman (1999) reported on the effects of therapy to rebuild self-identified gender social roles and activities for 4 persons who were classified 7 or above on the Rancho Los Amigos Functional Level Scale (Rancho Los Amigos Hospital, 1985) and who lived in a residential center. Therapy aimed at alleviating postinjury gender role strain consisted of 1-hr to 2-hr sessions per week for 4 months. Qualitative findings indicated that therapy was effective in helping the participants to rebuild the roles and activities that enhanced their postinjury gender role satisfaction.

Studies of occupational therapy for adults with TBI that offer higher levels of evidence focus on remediation of impairments (Dirette & Hinojosa, 1999; Neistadt, 1994; Sietsema, Nelson, Mulder, Mervau-Scheidel, & White, 1993) but do not relate the gains in components of performance to improvements in activity or participation. These studies do not contribute the evidence needed for practice in light of a changed health care system. The traditional paradigm of rehabilitation was one of caring—the process of developing a person with a disability to fullest potential without reference to cost (Banja & Johnston, 1994). Under this paradigm, therapy to remediate impairments was the norm, with the expectation that with this approach, activity and participation would improve more than if particular activities were practiced. This paradigm is in eclipse, being replaced by a new paradigm—the process of attaining maximum improvement in quality of daily life of the person with a disability within financial constraints (Banja & Johnston, 1994). Under this new paradigm, therapy is goal-specific, aimed at achieving independence in activities and participation in roles of importance to the individual. The new paradigm requires that the person with disability (or proxy) be involved with the planning and decision making of rehabilitation and that effectiveness be measured in terms of client-desired outcomes (Banja & Johnston, 1994; Johnston & Hall, 1994).

Our previous study (Trombly, Radomski, & Davis, 1998) examined therapy in tune with the new paradigm: The participants actively set the goals; treatment was directed toward those goals; and the outcomes were measured in terms of those goals. In a repeated-measures design, we determined that achievement of occupational performance goals improved significantly, $t(15) = −10.04, p < .001, d = 2.51, r = .93$ for 16 persons with mild to moderate acquired brain injury who participated in goal-specific outpatient occupational therapy. Treatment consisted of retraining instrumental activities of daily living (IADL) routines and teaching compensatory strategies for cognitive impairments. The participants rated themselves as performing their chosen goal activities significantly better, $t(14) = −7.23, p < .001$, and were significantly more satisfied, $t(14) = −9.41, p = .001$, with their performance of these activities after therapy than before. Effect sizes were large ($d = 1.93$ to $2.52; r = .69$ to $.78$). By self-report, performance on non-targeted but related skills (Independent Living Skills Evaluation [ILSE; Johnson, Vinnicombe, & Merrill, 1980] and Reintegration to Normal Living Scale [RNL; Wood-Dauphinee, Opzoomer, Williams, Marchand, & Spitzer, 1988]) also improved significantly [ILSE: $t(14 ) = −4.47, p < .05$; RNL: Newman-Keuls $q = 5.58, p < .05$], and the effect sizes were large ($d ≥ 1.19, r ≥ .51$). No significant changes were found in performance during the no-treatment period as measured on any of the scales. Spontaneous recovery was ruled out as the primary explanation for the improvements by comparing the 5 participants who were 12 months or more postinjury (a period when spontaneous recovery is no longer thought to account for improvement [Saghal & Heinemann, 1989; Tuel, Presty, Meythaler, Heinemann, & Katz, 1992]) with 3 participants who were 3 months or less postinjury (a period when spontaneous recovery is believed to be high). No significant difference was found in goal attainment scale scores between these groups, $t(6) = .068, p = .948$, and the effect size ($d = .05, r = .02$) was negligible (Giles, 1999; Trombly, Radomski, & Davis, 1999).

The purpose of the current study was to replicate the Trombly et al. (1998) study at two other centers and with a

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1In the Phase I study, effect sizes were reported as $d$; here they also are reported as $r$ to match the choice of effect size for the Phase II study.
new cohort of participants from the original center to provide robust evidence that goal-specific outpatient occupational therapy is strongly and significantly associated with restoration of valued occupational performance goals and reduction of disability in young adults with mild to moderate acquired brain injury. The hypotheses were as follows:

1. Adults with acquired brain injury who participate in goal-specific outpatient occupational therapy will improve significantly in self-identified goals related to activities and tasks of daily life.
2. Adults with acquired brain injury will rate their performance and their satisfaction with performance of targetted activities significantly higher after a period of goal-specific outpatient occupational therapy compared with a no-treatment period.
3. Adults with acquired brain injury will rate their performance on a measure of handicap (participation) significantly higher after a period of outpatient occupational therapy compared with a no-treatment period.

Method

Design

A repeated-measures design in which each participant acted as his or her own control under treatment and no-treatment conditions was used. The results from three sites were synthesized using meta-analytic techniques.

Participants

All participants at three sites located in the Southwest, Northwest, and Midwest regions of the United States who met the following criteria were recruited for the study: documented TBI, ability to follow directions, classified at Level VI or higher on the Rancho Cognitive Scale (Malkmus, Booth, & Kodimer, 1980), and competent to give informed consent. Exclusion criteria were severe behavioral problems; current drug or alcohol abuse; a previous head injury; concurrent neurological condition or psychiatric disorder; or lack of self-awareness, defined as being unaware of problems related to occupational performance tasks. Forty-one participants were enrolled as they entered outpatient occupational therapy. Thirty-one participated. Ten were dropped from the study because they self-discharged from therapy after less than 1 week and without warning (n = 8) or because of errors in research procedures (n = 2). All participants were independent in BADL at the time of entry into the study. One notable difference among the sites was chronicity: Clients at Site 3 were significantly less chronic (≤ 3 months postinjury) than those at the other two sites (Kruskal-Wallis one-way analysis of variance [ANOVA] H = 13.81, p = .001) (see Table 1).

Instruments

The Canadian Occupational Performance Measure (COPM) uses a semi-structured interview to detect what tasks in self-maintenance, productivity, and leisure roles a client wants to do, needs to do, or is expected to do (Law et al., 1990, 1994; Pollock, 1993). After all problems are identified, the participant rates each for importance on a scale of 1 to 10 (10 = most important). The COPM Performance subscale (COPM-P) measures the client’s perception of his or her ability to do the five most important identified tasks, and the COPM Satisfaction subscale (COPM-S) measures the client’s satisfaction with performance of those tasks. The COPM has construct and criterion validity (McColl, Paterson, Davies, Doubt, & Law, 2000) and test–retest reliability (COPM-S: ICC = .63; COPM-P: ICC = .84) (Law et al., 1994).

Goal attainment scaling (GAS) is an individualized criterion-referenced measure of progress in achieving targeted performance and their satisfaction with performance of targetted activities significantly higher after a period of outpatient occupational therapy compared with a no-treatment period.

Table 1. Characteristics of Participants by Site

<table>
<thead>
<tr>
<th>Site</th>
<th>N</th>
<th>Age M (SD)</th>
<th>Gender M/F</th>
<th>Onset ≥ 12 Months</th>
<th>Onset ≤ 3 Months</th>
<th>Education</th>
<th>Rancho Scale</th>
<th>Severity at Time of Injury</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>12</td>
<td>40.5 (14.53)</td>
<td>7/5</td>
<td>8</td>
<td>0</td>
<td>College or trade school = 9</td>
<td>9 at VIII</td>
<td>PTA ≥ 1 week for 4/7; LOC &lt; 15 min for 9/10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>High school = 3</td>
<td>3 at VII</td>
<td>LOC &gt; 1 mo for 4</td>
</tr>
<tr>
<td>2</td>
<td>9</td>
<td>34.9 (12.66)</td>
<td>7/2</td>
<td>8</td>
<td>0</td>
<td>College or trade school = 3</td>
<td>9 at VIII</td>
<td>LOC &gt; 1 mo for 4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>High school = 6</td>
<td>3 at VII</td>
<td>LOC &gt; 1 mo for 4</td>
</tr>
<tr>
<td>3</td>
<td>10</td>
<td>34.8 (8.15)</td>
<td>8/2</td>
<td>1</td>
<td>6</td>
<td>College or trade school = 5</td>
<td>5 at VIII</td>
<td>LOC &gt; 1 mo for 4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>High school = 5</td>
<td>4 at VII</td>
<td>LOC &gt; 1 mo for 4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 at VI</td>
<td>LOC &gt; 1 mo for 4</td>
</tr>
<tr>
<td>All</td>
<td>31</td>
<td>37.03 (12.16)</td>
<td>71% M</td>
<td>55%</td>
<td>19%</td>
<td>55% attended or graduated college/trade school</td>
<td>74% VIII</td>
<td>LOC &gt; 1 mo for 4</td>
</tr>
</tbody>
</table>

Note. Information about severity at the time of the accident was not available for all participants, a common problem in studies of late treatment in this population (Cope, Cole, Hall, & Barkan, 1991) and inconsistently recorded for the others. PTA = post traumatic amnesia, the period following brain injury when patients are disoriented and impaired in the acquisition of new knowledge (Forrester, Encel, & Geffen, 1994), is the best single indicator of the severity of closed head injury (McMillan, Jongen, & Greenwood, 1996); GCS = Glasgow Coma Scale (Asikainen, Kaste, & Sarna, 1998); a GCS score of 3 to 8 defines severe injury, 9 to 12 moderate, and 13 to 15 mild brain injury (Hall & Johnston, 1994). LOC = loss of consciousness, the least reliable indicator of severity of injury (Lovell, Iverson, Collins, McKeag, & Maroon, 1999).
goals (Clark & Caudrey, 1983; Kiresuk & Sherman, 1968; Ottenbacher & Cusick, 1990, 1993). Goal attainment scales are indices of an individual client's progress that can be used to quantify summary outcomes across clients who have different, individual goals. GAS has been used to evaluate effectiveness of post–acute brain injury rehabilitation (Malec, Smigielski, & DePompolo, 1991; Rockwood, Joyce, & Stolee, 1997; Zweber & Malec, 1990).

In GAS, a plausible range of five outcomes of treatment for one particular problem is developed. Each outcome is described in nonoverlapping, sequential, behavioral, and measurable terms (Kiresuk & Sherman, 1968; Ottenbacher & Cusick, 1990). Each outcome is assigned a score from −2 to +2, with −1 being the status at entry to therapy and 0 being the acceptable discharge outcome (Zweber & Malec, 1990). Plus 1 and +2 represent better-than-expected and much-better-than-expected outcomes, respectively, whereas −2 represents regression (worse-than-expected outcomes). After GAS scales are developed for each problem, they are weighted according to importance, or difficulty. In this study, they were weighted 1 to 5, from least to most important, on the basis of the participant's ranking of the problem in the COPM. The weighted scores are transformed into standard T scores (Kiresuk & Sherman, 1968).

Malec et al. (1991) found that GAS had discriminant validity in relation to work outcomes: Those clients with unsatisfactory work outcomes had significantly lower (p < .05) GAS scores than those with satisfactory work outcomes. GAS scores done at 2 months of therapy strongly (r = .66) and significantly predicted GAS scores at discharge. Concurrent validity with the Portland Adaptability Inventory (Lezak, 1987) was moderately strong (r = .62). GAS was more sensitive and more responsive to changes in health status than other standardized measures used to evaluate outcomes of a program of cognitive rehabilitation (Rockwood et al., 1997) or used in an antidepressant drug trial (Rockwood, Stolee, Howard, & Mallery, 1996). GAS has strong (r ≥ .91) interrater reliability (Rockwood, Stolee, & Fox, 1990; Joyce, Rockwood, & Mate-Kole, 1994). Achievement of interrater reliability requires training (Clark & Caudrey, 1983). For this study, therapists underwent a full day of training primarily devoted to practice in goal specification and development of GAS scales.

The Community Integration Questionnaire (CIQ; Willer, Ottenbacher, & Coad, 1994; Willer, Rosenthal, Kreutzer, Gordon, & Rempel, 1993) is a measure of handicap (participation), specifically for persons with TBI (Johnston & Hall, 1994). The CIQ measures status of home and social integration and productive activity (Sander et al., 1999; Willer et al., 1994). The questionnaire has discriminative validity; it discriminates between persons with brain injury and persons without (Willer et al., 1994) and between preinjury functioning and 3-month postinjury functioning (Corrigan & Deming, 1995). Test–retest reliability for client and family versions were found to be .91 and .97, respectively (Willer et al., 1993).

Because some researchers (Ben-Yishay & Diller, 1993; Krefting, 1989) found clients with brain injury to be unreliable reporters, whereas others did not (Cusick, Gerhart, & Mellick, 2000; Sander et al., 1997; Seel, Kreutzer, & Sander, 1997; Tepper, Beary, & DeJong, 1996), we administered the COPM-P (for the five problems the participant had identified) and the CIQ to the significant other identified by the participant. Two-way ANOVAs with one between factor (group) and one repeated factor (time) indicated no significant differences between reporters at any of the data collection points (admission, discharge, follow-up) in the scores for the CIQ, F(2, 47) = 1.12, p = .33, but there was a difference among data collection points for both groups for the COPM-P. However, no significant difference between groups, F(1, 45) = 1.01, p = .32, was found. In line with the newer research and this finding, the participants' scores were accepted as valid data for this study.

Procedure

The protocol was approved by the Review Boards of all concerned institutions. At admission to outpatient occupational therapy, the participant was informed about the study and gave consent. The therapist assigned to the participant administered (a) the interview portion of the COPM, (b) the COPM-P, (c) the COPM-S, and (d) the CIQ. The same therapist prepared a GAS scale for each of the five most important problems or goals identified during the participant's COPM interview.

The participants identified problems of priority and their goals during administration of the COPM, with input from the therapists to clarify, to probe for more detail, and to break large goals into component parts. That is, participants never offered just one sentence in describing problems. Instead, the discussion was lengthy of what they could not do relative to what they used to be able to do and would like to be able to do in the future. As the therapists established the GAS scales, they used their professional expertise to synthesize evaluation results and other information with the participants' identified goals to project realistic outcomes for the available treatment period. In treatment, GAS was used periodically to revisit with the participant how well therapy was going toward getting him or her moving in the direction he or she wanted to go.

The participants received the usual treatment offered to clients with the identified problems and goals at each site. Amount of treatment varied significantly among centers:

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participants at Site 1 experienced significantly fewer hours of treatment than those at the other two sites (Kruskal-Wallis one-way ANOVA $H = 18.208$, $p < .001$) (see Table 2). The nature of the treatment was similar among the sites: Emphasis was on training in the use of compensatory strategies and environmental adaptation.

Specifically, at Site 1, a rehabilitation institute in the Midwest, occupational therapy included training in compensatory skills for deficits in IADL and cognition and meta-cognition, described as follows:

- **IADL**: tasks such as laundry, meal preparation, leisure activities, child care, self-medication, phone use, money management, scheduling of events and appointments, study strategies, and home or work-site visits
- **Cognitive**: activities directed at improving attention, memory, problem solving, selecting and setting up a memory notebook system, and simulated work tasks to rehearse compensatory cognitive strategies

At Site 2, a 2-year college in the Southwest, participants were students who participated in a program of classes to facilitate assimilation into the college and the community. Occupational therapists directed classes in adapted computer technology, problem solving, and independent living skills. In the adapted computer technology class, students learned to use common productivity software at their own pace, using computer adaptations for their particular disability. The problem-solving class had a psychosocial emphasis in which common problems for persons with TBI were identified and discussed, and strategies for addressing those problems were explored. The independent living skills class emphasized organizational strategies to enable independence in IADL, such as budgeting, assertiveness, and advocacy; how to use campus resources; how to find one’s way using a map; use of bus transportation; and time management. For this study, treatment lasted one semester.

The outpatient program at Site 3 was an extension of the inpatient program for persons with brain injury at a rehabilitation facility in the Northwest. Transdisciplinary treatment was conducted in multiple environments, including clinic, home, community, work, and school. Occupational therapy was responsible for independent living skills (teaching compensatory skills for homemaking; money management; self-care and nutrition; and community locomotion as a pedestrian, a bus user, or a driver), compensatory planning (teaching use of a daily planner, how to effectively plan and organize daily activities, and how to apply self-pacing to a particular situation), and vision (teaching compensatory strategies for deficits of vision or visual information processing). Occupational therapy and speech–language pathology shared responsibility for problem solving and prevocational therapy.

At discharge, the participating therapist readministered the COPM-P, COPM-S, and CIQ and scored the GAS. After the no-treatment period, the weeks immediately following discharge from outpatient occupational therapy, the therapist repeated the COPM-P, COPM-S, and CIQ with the participant over the phone. Therapists were asked to time the final data collection so that the no-treatment period equaled the length of the treatment period. However, exigencies of the clinic interfered so that the average no-treatment period was 9.9 weeks (range = 1–18 weeks) compared with the average treatment period of 15.3 weeks (range = 5–32 weeks).

**Data Analysis**

Data were analyzed using Sigmastat 2.03. Significance level was set at $\alpha = .05$. Because each site had its own mission, used its own treatment protocol, differed significantly in treatment hours, and treated clients who differed significantly in chronicity, data from each site were analyzed separately. Dependent $t$ tests were used to test the GAS scores before and after treatment and to compare gain scores of COPM-P, COPM-S, and CIQ between the treatment (admission to discharge) and no-treatment (discharge to follow-up) periods. Effect sizes, $r$, were calculated according to the method of Rosnow and Rosenthal (1988). According to Cohen (1988), in the context of behavioral sciences, an $r$ effect size of .1 is considered a small effect, an $r$ of .3 a medium effect, and an $r$ of .5 a large effect. The data from the sites were combined, after testing for statistical homogeneity, using meta-analytic procedures described by Rosenthal (1984).

Table 2. Treatment by Site

<table>
<thead>
<tr>
<th>Site</th>
<th>Treatment Weeks</th>
<th>Hours of Treatment</th>
<th>Number of Treatments</th>
<th>IADL Treatments</th>
<th>Cognitive Treatments</th>
<th>Other Treatments</th>
<th>No-Treatment Weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$M$</td>
<td>$SD$</td>
<td>$M$</td>
<td>$SD$</td>
<td>$M$</td>
<td>$SD$</td>
<td>$M$</td>
</tr>
<tr>
<td>1</td>
<td>13.7</td>
<td>7.86</td>
<td>12.9</td>
<td>9.76</td>
<td>24.5</td>
<td>16.41</td>
<td>10.7</td>
</tr>
<tr>
<td>2</td>
<td>20.9</td>
<td>3.73</td>
<td>84.2</td>
<td>45.4</td>
<td>63.0</td>
<td>37.18</td>
<td>27.9</td>
</tr>
<tr>
<td>3</td>
<td>12.3</td>
<td>4.73</td>
<td>53.1</td>
<td>31.70</td>
<td>49.9</td>
<td>24.95</td>
<td>15.6</td>
</tr>
<tr>
<td>All</td>
<td>15.3</td>
<td>6.84</td>
<td>46.6</td>
<td>42.16</td>
<td>43.9</td>
<td>30.43</td>
<td>17.3</td>
</tr>
</tbody>
</table>

Note. IADL = instrumental activities of daily living.
Results

See Table 3 for the means and standard deviations of assessment scores for each individual site. Participants at Site 1 achieved 83% of their goals (scored 0 or above on the GAS). GAS scores improved significantly, \( t(11) = 7.587, p < .001, r = .91 \). The participants demonstrated a significantly greater gain on the COPM-P, \( t(10) = 5.029, p < .001, r = .84 \), and the COPM-S, \( t(10) = 6.325, p < .001, r = .89 \), but not on the CIQ, \( t(11) = .019, p = .985, r = .005 \), during the treatment versus no-treatment periods.

The practical significance of effect sizes can be appreciated when graphically presented in the binomial effect size display (BESD; Rosnow & Rosenthal, 1988). A BESD is a 2 x 2 contingency table that displays an effect size as a dichotomous (binomial) outcome. The two rows of the table correspond to the independent variables (treatment, no-treatment), and the two columns correspond to the dependent variables (improved, not improved) (Rosenthal, 1984) (see Table 4). The percentage of cases “improved” in the treatment condition is calculated using the formula .50 + \( r/2 \times 100 \); for example, .50 + .84/2 x 100 = 92%. Percentage of cases improved in the no-treatment condition is calculated by .50 – \( r/2 \times 100 \), or 8%. Because all rows and all columns must add to 100%, the other cells can be calculated easily. The difference between these two values, 92% and 8%, is equivalent to an 84% increase in improvement rate due to treatment (Rosnow & Rosenthal, 1988).

Participants at Site 2 achieved 66% of their goals, which was reflected in the improved GAS scores, \( t(8) = 6.338, p < .00025, r = .91 \). However, the scores of the other assessments did not demonstrate significantly greater gains during the treatment versus no-treatment periods: COPM-P, \( t(7) = .352, p = .73, r = .13 \); COPM-S, \( t(7) = 1.214, p = .26, r = .42 \); and CIQ, \( t(7) = .828, p = .43, r = .30 \). The effect sizes indicated small to medium effects, however, and with a larger sample, a significant outcome could be expected.

Site 3 participants achieved 94% of their goals. The GAS scores improved significantly, \( t(9) = 12.33, p < .0000005, r = .97 \). There was a significantly greater gain for the COPM-P, \( t(9) = 5.348, p < .001, r = .87 \), and the COPM-S, \( t(9) = 4.22, p = .002, r = .81 \), during the treatment versus no-treatment periods. The gains for the CIQ during treatment versus no-treatment were not significantly different, \( t(9) = 1.884, p = .09, r = .53 \). All effect sizes were large.

Effect sizes were compared across sites for each dependent variable to determine whether the results were consistent enough to legitimately combine into one analysis (Rosenthal, 1984). Heterogeneity was not a factor; therefore, results from the three sites were combined. The first hypothesis predicted that adults with acquired brain injury who participated in a goal-specific program of occupational therapy would achieve a significant level of self-identified goals related to activities and tasks of daily life. This hypothesis was supported. The total number of goals identified by all participants was 149, 81% of which were achieved. All participants, except 1, achieved at least one goal. Fifteen participants achieved 100% of goals; 11 achieved 80%; and 2 achieved 60%. The improvement in GAS scores from admission to discharge for combined sites was significant.

### Table 3. Assessment Scores by Site

<table>
<thead>
<tr>
<th>Measure</th>
<th>Site 1 Admission Scores</th>
<th>Site 1 Discharge Scores</th>
<th>Site 1 Follow-Up Scores</th>
<th>Site 2 Admission Scores</th>
<th>Site 2 Discharge Scores</th>
<th>Site 2 Follow-Up Scores</th>
<th>Site 3 Admission Scores</th>
<th>Site 3 Discharge Scores</th>
<th>Site 3 Follow-Up Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>GAS</td>
<td>35.4 0</td>
<td>60.4 11.42</td>
<td>17.60 1.16</td>
<td>35.4 0</td>
<td>57.3 10.37</td>
<td>16.47 4.25</td>
<td>35.4 0</td>
<td>58.1 5.83</td>
<td>19.27 6.02</td>
</tr>
<tr>
<td>COPM-P</td>
<td>3.97 1.73</td>
<td>7.11 1.49</td>
<td>6.75 1.27</td>
<td>5.42 1.47</td>
<td>6.31 1.73</td>
<td>6.46 1.73</td>
<td>4.76 1.72</td>
<td>7.46 1.51</td>
<td>7.70 1.96</td>
</tr>
<tr>
<td>COPM-S</td>
<td>3.13 1.42</td>
<td>7.38 1.31</td>
<td>7.74 1.14</td>
<td>4.60 2.22</td>
<td>6.24 1.76</td>
<td>6.46 1.73</td>
<td>3.84 1.76</td>
<td>7.14 1.75</td>
<td>7.54 1.72</td>
</tr>
<tr>
<td>CIQ</td>
<td>17.21 3.35</td>
<td>17.39 2.98</td>
<td>17.60 4.08</td>
<td>14.44 3.59</td>
<td>14.16 5.62</td>
<td>16.47 4.25</td>
<td>13.92 3.84</td>
<td>18.70 4.97</td>
<td>19.27 6.02</td>
</tr>
</tbody>
</table>

Note: GAS = goal attainment scaling; COPM-P = Canadian Occupational Performance Measure–Performance subscale; COPM-S = Canadian Occupational Performance Measure–Satisfaction subscale; CIQ = Community Integration Questionnaire.

### Table 4. Binomial Effect Size Display for the Effects of Occupational Therapy on Canadian Occupational Performance Measure–Performance Subscale Scores for Site 1

<table>
<thead>
<tr>
<th>Condition</th>
<th>Improved</th>
<th>Not Improved</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>92%</td>
<td>8%</td>
<td>100%</td>
</tr>
<tr>
<td>No treatment</td>
<td>8%</td>
<td>92%</td>
<td>100%</td>
</tr>
</tbody>
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Note. \( r = .84 \).
(Z = 7.52, p < .001), indicating that the outcome is unlikely to be due to chance. The combined effect size was r = .94, a large effect, suggesting a strong relationship between goal-specific outpatient occupational therapy and achievement of goals.

The second hypothesis predicted that adults with acquired brain injury would rate their performance and their satisfaction with performance of targeted activities significantly higher after a period of goal-specific outpatient occupational therapy compared with a no-treatment period in which gain was not expected. Significant improvement was found in gain scores for the COPM-P (Z = 4.13, p < .001) and the COPM-S (Z = 4.25, p < .001) during treatment compared with the no-treatment period. The combined effect size estimates were .71 and .76, respectively, suggesting a strong relationship between outpatient occupational therapy and improvement of the participants’ perceptions of their performance and satisfaction with performance of the five targeted behaviors.

The third hypothesis predicted a significant improvement in a measure of handicap (participation) during a period of goal-specific outpatient occupational therapy aimed at different, though related, goals compared with the no-treatment period. This hypothesis was not supported. The gain scores of nontargeted community and home integration skills, measured by the CIQ, were not significantly different (Z = .75, p = .22) between the treatment and no-treatment periods. However, the moderate combined effect size (r = .29) suggests that with a larger sample, significance might have been achieved.

Discussion

We concluded that the major findings of the first study (Trombly et al., 1998) were confirmed; that is, participants in a goal-specific program of outpatient occupational therapy, as represented by these sites, significantly improved during the treatment period in (a) achievement of self-identified goals (Phase I: r = .93; Phase II: r = .91), (b) perception of ability to perform the targeted behaviors (Phase I: r = .69; Phase II: r = .84), and (c) satisfaction with performance of those tasks (Phase I: r = .78; Phase II: r = .89). As in the first study, the scores of perception of performance, satisfaction with performance, and community skills were sustained during the no-treatment period, but little further improvement occurred spontaneously after discharge from therapy. The lack of significant improvements during the no-treatment period suggests that occupational therapy effectively facilitated the improvements that occurred during the treatment period.

In Phase I of the study, the RNL scale (Wood-Dauphinee et al., 1988) was used to estimate handicap (participation), and the participants improved significantly (Newman-Keuls q = 5.58, p < .05). In Phase II, the newer CIQ was used to estimate handicap (participation) because it was designed specifically for use with persons with TBI. The CIQ scores showed improvement for participants at Site 3 but not for those at the other two sites (see Table 3). Possible explanations for this outcome are differences in (a) chronicity, (b) the nature of the program, and (c) sensitivity of the CIQ and the RNL in relation to severity of brain injury. The participants at Site 3 were less chronic than the other participants (see Table 1). They entered outpatient therapy immediately after inpatient rehabilitation, and 60% were still in the period of spontaneous recovery. They had no opportunity to engage in complex ADL in the community before outpatient therapy started, so what they learned in therapy may have helped them to solve new problems encountered at home and in the community. Participants at the other sites had been living in the community for months or years before entering outpatient occupational therapy and had developed particular routines that remained fairly stable, and, therefore, few if any changes were noted by the CIQ. The second possible explanation for the difference among sites is that treatment at Site 3 was conducted “in the field” (i.e., in the home and community rather than in the clinic) more often than the other two sites, a factor that may have facilitated transfer of training. A third possible explanation is that the CIQ measures achievement of performance rather than efficiency of performance in which persons with mild to moderate brain injury are more interested. From the fragmented information we have, it appears that more participants from Site 3 were classified as severe at the time of injury. All three explanations for improvement in nontargeted activities by some participants but not others should be researched further.

Three threats to internal validity of research on effectiveness of rehabilitation for persons with brain injury have been identified: spontaneous recovery, preinjury characteristics of the participants, and nature and locus of the injury (High, Boake, & Lehmkühl, 1995). The repeated-measures design controlled for individual differences and heterogeneity of injury. Spontaneous recovery was not controlled for; however, it seems unlikely in view of the general lack of improvement in the CIQ during the treatment period and in the COPM-P, COPM-S, and CIQ during the no-treatment period, that spontaneous recovery is the primary explanation for the outcome of this study.

Post hoc analyses of the GAS and COPM-P scores were done to determine whether spontaneous recovery could be a viable alternative explanation for the outcome. The 6 participants who were ≤ 3 months postinjury and the 17 who
were ≥ 12 months postinjury were compared using an independent *t* test. Those less than 3 months postinjury could be considered to be undergoing rapid spontaneous recovery, and those more than 12 months postinjury could be considered to be experiencing very little spontaneous recovery (Saghal & Heinemann, 1989; Tuel et al., 1992). Mean GAS gain scores (from admission to discharge) were 23.0 and 23.8 for the two groups, respectively, reflecting a nonsignificant difference, *t*(21) = -1.16, *p* = .875, *r* = .03. The mean COPM-P gain scores were 1.7 for the chronic group and 2.9 for the acute group. The acute group gained more during treatment, but this was not a statistically significant difference, *t*(21) = 1.69, *p* = .10. The effect size estimate, *r*, was .35, indicating a medium effect that may have shown a significant difference between groups had the sample size been larger. We tentatively conclude, therefore, that spontaneous recovery was probably not the explanation for the magnitude of change observed in this study.

**Limitations**

Several limitations existed for this study. First, the treating therapist scored the GAS because it was not practical to use external evaluators in these settings. This limitation introduced a potential bias in that therapists could have set goals for the GAS that they thought easy to achieve (Clark & Caudrey, 1983). However, because goals were set in conjunction with the participants and in response to problems identified by the participants, it is unlikely that this bias existed. However, future study should use an independent assessor. Second, because of an oversight in the research protocol, the GAS was not rescored after the no-treatment period. Future study should correct this. Third, the no-treatment period was shorter than the treatment period. In future studies, this difference needs to be better controlled in order to balance the passage of time under each condition. Finally, no valid determination of cost-effectiveness can be made from these data. In the present study, the number of hours recorded were the number of hours that the participant was in therapy from admission to discharge, but some or all of the five goals were achieved before the discharge date. In future studies, recording the number of treatment hours until each goal is achieved may help determine the cost-effectiveness of therapy.

**Implications for Occupational Therapy Practice**

The finding from this study that can be used to support practice is that occupational therapy directed at specific goals valued by the client and using training of compensatory strategies as intervention is likely to result in achievement of targeted goals. Therapists may need to help a client to identify manageable, achievable goals as did the therapists in this study. For example, if a participant identified a long-term goal, such as return to work, the therapist needed to help him or her figure out what more immediate goals had to be conquered before that long-term goal could be achieved. Given clarification of the situation, the participants in this study were able to identify interim, immediate, plausibly achievable goals.

**Conclusion**

Participation in outpatient occupational therapy by adults with acquired brain injury, as practiced at the three occupational therapy departments participating in this study, was significantly and strongly associated with achievement of self-identified goals and improvement in perception of performance and satisfaction with performance of targeted behaviors as demonstrated by large effect sizes (*r*) associated with the GAS (.94), COPM-P (.71), and COPM-S (.76). Scores did not improve significantly after discharge from occupational therapy. Spontaneous recovery alone does not appear to be a viable explanation for the improvement seen.

Taken together, this study and the previous study (Trombly et al., 1998) provide robust evidence that goal-specific outpatient occupational therapy contributes to reduction of disability for adults with acquired brain injury. The effect on handicap, as measured by the CIQ, is mixed and needs further study. ▲

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