

Cognitive Behavior Therapy After Acquired Brain Injury: Maintenance of Therapeutic Benefits at 6 Months Posttreatment

April Arundine, MSc; Cheryl L. Bradbury, PsyD; Kate Dupuis, MA;
Deirdre R. Dawson, PhD; Lesley A. Ruttan, PhD; Robin E. A. Green, PhD

Objectives: To examine whether 6-month posttreatment acquired brain injury (ABI) patients receiving cognitive behavior therapy (CBT) adapted for ABI would demonstrate (1) maintenance of psychological benefits, (2) better community integration, and (3) commensurate benefits for both teletherapy and face-to-face group therapy. A secondary objective was to examine the relationship between coping strategies and mood and community integration. **Participants:** Seventeen chronic ABI patients with elevated psychological distress. **Outcome Measures:** Symptom Checklist-90-Revised (SCL-90-R), Depression Anxiety Stress Scales-21 (DASS-21), Community Integration Questionnaire, and the Ways of Coping questionnaire, revised. **Procedures:** Eleven CBT sessions provided either in a face-to-face group format or individually by telephone with outcomes measured pretreatment, posttreatment, and at 6-month follow-up. **Results:** At 6-month follow-up, full-group scores were significantly better than pretreatment for psychological distress ($t_{16} = 6.22, P < .01$, SCL-90-R; $t_{16} = 7.32, P < .01$, DASS-21) and for community integration ($t_{16} = -6.15, P < .01$), with negligible decrements from immediately posttreatment. Subgroup scores were comparable. Coping also improved but was uncorrelated with mood or community integration. **Conclusion:** The CBT adapted for ABI shows enduring benefits for mood and community integration. The efficacy of teletherapy obviates service access problems related to geographical remoteness and mobility restrictions. A larger, randomized, control trial that examines underlying mechanisms of efficacy is needed. **Key words:** brain injury, community integration, cognitive behavior therapy, teletherapy

ACQUIRED BRAIN INJURY (ABI) refers to injuries to the brain such as stroke or traumatic brain injury (TBI) that are neither developmental nor classically neurodegenerative (eg, Alzheimer or Huntington disease). It is widely known that ABI gives rise to a range of cognitive and physical consequences.^{1,2} However, while numerous studies have also revealed that psychological distresses, in particular, depression

and anxiety, are highly prevalent in this population, these findings are less appreciated as a public health concern.^{3–5} Psychological symptoms often persist unabated for years postinjury^{6–8} and are associated with poorer recovery, community integration, psychosocial adjustment, quality of life, independent living skills, and employability.^{9–11}

Despite the prevalence and negative consequences of psychological symptoms, the availability of psychological care for people with ABI is notoriously limited, both acutely and subacutely.⁴ In the early stages of recovery, traditional rehabilitation typically focuses predominantly on cognitive and physical symptoms.¹² In the later stages, when emotional symptoms can sometimes dominate other symptoms, geographic remoteness from clinical centers, financial and safety restrictions around travel, and mobility limitations of patients often impede access to psychological treatment.^{13,14} Moreover, there has been very limited validation of psychological treatments for brain-injured patients.¹⁵

Bradbury and colleagues¹⁶ recently administered cognitive behavior therapy (CBT) to ABI patients. CBT is

Author Affiliations: Peel Halton Dufferin Acquired Brain Injury Services, Mississauga, Canada (Ms Arundine); Toronto Rehabilitation Institute, Toronto, Canada (Ms Arundine and Dupuis and Drs Bradbury, Ruttan, and Green); Kunitz-Lunenfeld Applied Research Unit, Baycrest, Toronto, Canada (Dr Dawson); and Department of Psychiatry, University of Toronto, Toronto, Canada (Drs Bradbury and Green).

The authors thank all of the participants and the administrative and clinical staff from the Peel Halton Dufferin Acquired Brain Injury Services. This research program was made possible by a grant from the Ontario Neurotrauma Foundation to R. G., C. B., L. R., and their coinvestigators.

The authors declare no conflicts of interest.

Corresponding Author: April Arundine, MSc, Peel Halton Dufferin Acquired Brain Injury Services, 176 Robert Speck, Mississauga, ON, Canada, L4Z 3G1 (april@phabis.com).

DOI: 10.1097/HTR.0b013e3182125591

a widely used clinical intervention with demonstrated efficacy in a number of clinical populations, including patients with neurological disorders.^{17,18} When incorporated within a holistic rehabilitation program, CBT has been shown to enhance outcome after brain injury, including community integration.¹⁹ The functional components of CBT enable the therapist to accommodate for individual differences across patients, including variations in cognitive functioning.^{4,15} Moreover, the combination of a structured format that is also flexible and adaptable make it particularly appropriate for ABI.

Bradbury and colleagues¹⁶ examined the efficacy of CBT for improving mood, coping, and community integration in a group of 10 survivors of ABI with significantly elevated emotional distress compared with a wait-list of 10 ABI control participants also endorsing elevations in emotional distress, who took part in education sessions. Employing a conventional CBT protocol adapted to meet the cognitive and psychological needs of this population, all ABI participants were administered 10 treatment sessions (ie, CBT or education) either via conventional face-to-face group delivery modality or individually, via telephone. The groups were assessed pretreatment, immediately posttreatment, and at a follow-up session held 1 month after treatment cessation. The authors observed significant improvements in mood for both CBT delivery modalities compared to the educational control group, and benefits persisted at the 1-month follow-up. Trends toward improvement for community integration and coping were observed. However, these authors did not assess whether improvements persisted beyond the 1-month posttreatment follow-up.

The current study was designed to extend the work of Bradbury et al¹⁶ by examining the longer-term impact of CBT treatment on mood and community integration as well as the relationship between coping and any treatment effects observed. In the current study, all 10 participants originally treated in the study of Bradbury et al¹⁶ were reassessed in a follow-up session held 6 months after treatment cessation. In addition, 7 participants from the wait-list control group in that study subsequently completed the 10-week intervention and 6-month follow-up session, leading to a total of 17 participants.

We first hypothesized that the benefits of CBT for mood found by Bradbury et al¹⁶ would be maintained at 6-month posttreatment. We expected that the benefits of therapy might require time to be translated into functional changes, such as improved community reintegration, and thus, second, we hypothesized that improvements might be observed at 6-month posttreatment even though significant improvements were not observed at the 1-month follow-up by Bradbury et al.¹⁶ Third, given the previous findings of our group and those of others using tele-CBT,^{20,21} we predicted that commensurate improvements to mood and community integration

would be observed in the face-to-face and teletherapy modalities.

We also examined the role of coping more comprehensively in the present study. CBT can be used to improve adaptive coping behaviors such as problem-focused coping and to reduce maladaptive coping approaches such as escape-avoidance coping.²² Lastly, we speculated that coping might serve as a mechanism for functional benefits²³ and as such predicted that improvements in mood and community integration would be correlated with improvements in coping.

METHODS

Participants

This study was conducted in accordance with the human ethics standards and received approval from the ethics committee of the Toronto Rehabilitation Institute. All 17 participants in the current study were drawn from the Bradbury et al¹⁶ study sample of 20 participants. Ten were the members of the original treatment group and 7 were wait-list (education group) control participants who were subsequently administered the CBT intervention. Of the remaining 3 wait-list control subjects from the study of Bradbury et al,¹⁶ 2 declined CBT and long-term follow-up due to the time commitment involved and the third was ineligible for the current study due to participation in an individual psychotherapy program. The 7 wait-list control participants from the study of Bradbury et al¹⁶ were readministered the baseline measures of mood before commencing treatment to ensure that they still met the mood criteria for the current study. All participants were recruited from a community-based ABI service provider just outside of metropolitan Toronto, Canada.

Inclusion criteria comprised medically diagnosed ABI sustained at least 1 year before recruitment; elevated psychological distress, operationally defined as 1 standard deviation or more above the mean on the Global Severity Index (GSI) of the Symptom Checklist-90-Revised (SCL-90-R); aged between 18 and 65 years; for participants on psychoactive medication, dosage stable and actively monitored; for traumatic patients ($N = 9$), initial Glasgow Coma Scale score of 12 or less and/or positive neuroimaging and/or current moderate to severe cognitive impairments in at least 1 cognitive domain as measured by Repeatable Battery of Adult Neuropsychological Status (RBANS); for nontraumatic patients ($N = 8$), moderate to severe impairments in at least 1 cognitive domain on the RBANS and/or an inpatient rehabilitation stay at least double the provincial average (which was 27 days).

Exclusion criteria comprised significant suicidal ideation at the time of recruitment, currently receiving psychological treatment from another source (not

TABLE 1 Demographic and injury variables for the participants in the current experiment (means and SDs)

	All participants, N = 17	G-CBT, N = 10	T-CBT, N = 7	G-CBT vs T-CBT		
				t_{15}/χ^2	P	ES (Cohen d)
Age, y; mean (SD)	42.94 (11.23)	45.40 (12.41)	39.43 (9.00)	1.08	.29	0.55
Sex N (% male)	9 (53)	6 (60)	3 (43)	0.01	.65	
Years of education, mean (SD)	12.71 (1.57)	12.60 (1.58)	12.86 (1.67)	-0.32	.75	-0.16
Years postinjury, mean (SD)	9.65 (8.35)	11.00 (9.04)	7.71 (7.47)	0.70	.44	0.36
Injury type, N (%)						
Trauma	9 (53)	5 (50)	4 (57)	0.08	.58	
Nontrauma	8 (47)	5 (50)	3 (43)			
RBANS, mean (SD)	70.65 (15.18)	72.1 (16.63)	68.57 (13.82)	0.79	.44	0.4
WTAR, mean (SD)	97.82 (12.7)	96.2 (14.42)	100.14 (12.26)	-0.62	.58	0.32
SCL-90-R-GSI, mean (SD)	70.71 (7.59)	71.6 (8.22)	69.43 (7)	0.57	.58	0.29

Abbreviations: G-CBT, group cognitive behavior therapy; ES, effect size; RBANS, Repeatable Battery of Adult Neuropsychological Status; SCL-90-R-GSI, Symptom Checklist-90-revised-Global Severity Index; T-CBT, telephone-administered cognitive behavior therapy; WTAR, Wechsler Test of Adult Reading.

including case management support, noncounseling social work support, or monthly neuropsychiatry follow-up for monitoring of medications), another neurological disorder or active psychotic disorder, and a communication disorder that would preclude treatment participation. See Table 1 for participant demographic and injury characteristic information.

Measures

Screening

Cognitive status of the group was characterized by the RBANS and by the Wechsler Test of Adult Reading (WTAR). The RBANS is a brief neuropsychological assessment tool that is used to evaluate performance across a range of cognitive variables (eg, attention, speed of processing, and visuospatial/constructional abilities)²⁴ and has been shown to be a reliable and valid measure of cognitive abilities for TBI.²⁵ The WTAR is a 50-item, single-word reading test that provides an estimate of premorbid intelligence on the basis of an individual's reading pronunciation level²⁶ and has demonstrated reliability for estimating premorbid intelligence after TBI.²⁷

Primary outcome measures

The *Symptom Checklist-90-Revised* (SCL-90-R) is a 90-item self-report questionnaire, with 9 subscales used to assess a range of psychological symptoms. Results are coded as T-scores. The questionnaire also provides a GSI, which reflects the overall severity of emotional symptoms and has been widely employed to examine psychotherapeutic effects and has demonstrated validity for brain injury.²⁸

The *Depression Anxiety Stress Scales-21* (DASS-21) is a 21-item questionnaire that is composed of 3 subscales: depression, anxiety, and stress, with demonstrated validity and reliability.²⁹

The *Community Integration Questionnaire* (CIQ) was designed to measure an individual's level of community integration after brain injury and consisted of 3 separate subscales measuring home integration, social integration, and productivity.³⁰

Secondary outcome measure

The *Ways of Coping Questionnaire, Revised* (WOC-R) includes 8 subscales designed to measure practical cognitive and behavioral coping strategies and has previously been used with brain-injured populations.³¹ The current investigation restricted analysis to the planful problem-focused and escape-avoidance coping subscales.

Cognitive behavior therapy intervention protocol

The protocol adhered to proven and standardized CBT procedures and incorporated specific adaptations recommended in the literature to meet the unique cognitive, emotional, and rehabilitative needs of ABI survivors.¹⁵ Completion of a brief neuropsychological screen using the WTAR and RBANS allowed for the identification of individual cognitive strengths and weaknesses and further individualized adaptations based on cognitive profile and subscale scores.

The CBT treatment was provided by a combination of 2 licensed Psychologists: 1 clinical psychology PhD student and 1 master's student who had received extensive training in CBT. Both students were closely

monitored and supervised by the primary study psychologist to ensure adherence to and competence with CBT delivery.

Procedures

Participants were assigned to 1 of the 2 CBT treatment groups, group CBT (G-CBT; $N = 10$) or telephone-administered CBT (T-CBT; $N = 7$) on the basis of logistical considerations such as geographical proximity to the treatment center or access to reliable transportation. Before treatment, all participants completed the SCL-90-R, DASS-21, CIQ, WOC-R, RBANS, and the WTAR. Participants then received 11 sessions of CBT. The first session for all participants was conducted individually in person by their treating therapist. The purpose of this session was to educate the participant to the CBT model, distribute materials, and discuss confidentiality. The initial session also provided the treating therapist with an opportunity to build rapport and develop a collaborative working relationship with their participants. The remaining 10 sessions took place weekly in their respective administration modalities (either a face-to-face group format or individually over the telephone). The teletherapy sessions typically lasted between 45 and 60 minutes, while the group sessions typically lasted between 60 and 90 minutes. Posttreatment, participants completed the SCL-90-R, DASS-21, CIQ, and WOC-R. Finally, all participants completed the same battery of tests during a 6-month follow-up assessment to assess the retention of treatment benefits.

Statistical analyses

Repeated measures analyses of variance (ANOVAs) were used to compare the 2 treatment groups over time (eg, pretreatment vs 6-month follow-up). Within each of the treatment groups, paired-samples t tests were used to compare scores on the outcome measures between specific time points (eg, pretreatment and 6-month follow-up, posttreatment and 6-month follow-up). The normality of the data was confirmed by using tests of skewness and kurtosis. No outliers were identified, and all participant data were included in the analyses.

RESULTS

Maintenance of psychological benefits and community integration: full group and treatment groups

Figures 1 to 3 illustrate the mood and community integration findings across all 3 time points (pretreatment, posttreatment, and 6-month follow-up) for all 17 participants (see Table 2 for breakdowns of scores by treatment group). A repeated-measures group (G-CBT vs T-CBT) by time (pretreatment vs 6-month follow-up) ANOVA for each of the 3 primary outcome measures was undertaken to assess the primary hypotheses of the study. Consistent with our first 2 predictions, for each measure, there was a main effect of time, with significantly decreased emotional distress on the SCL-90-R-GSI ($F_{[1,15]} = 36.34, P < .01$) and the DASS-21 ($F_{[1,15]} = 18.56, P < .01$) and increased community integration on the CIQ ($F_{[1,15]} = 38.85, P < .01$).

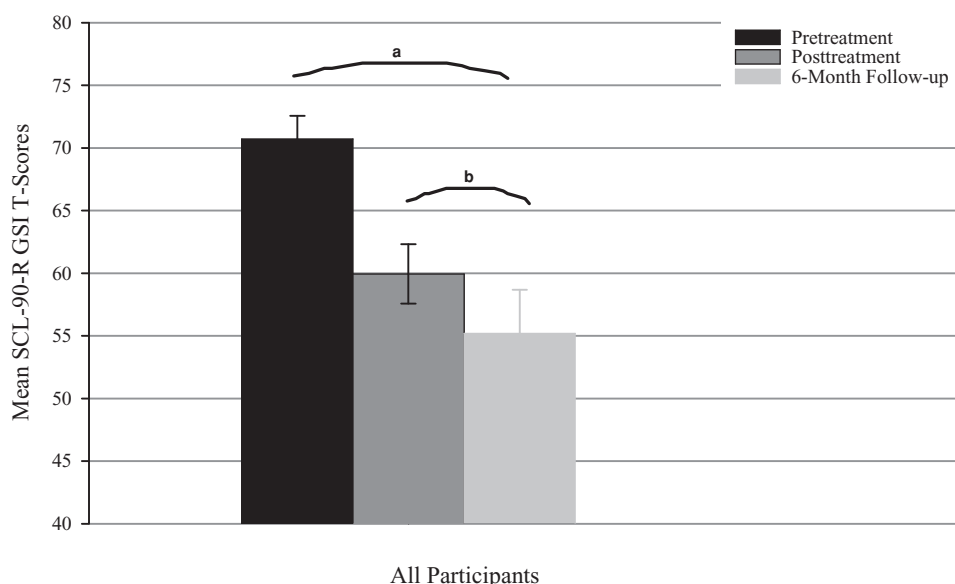


Figure 1. Mean SCL-90-R-GSI total scores (\pm SE) for all participants ($N = 17$) ($P: {}^aP < .05; {}^bP < .005$). Note that comparisons of interest are between (a) pretreatment and 6-month follow-up and (b) posttreatment and 6-month follow-up.

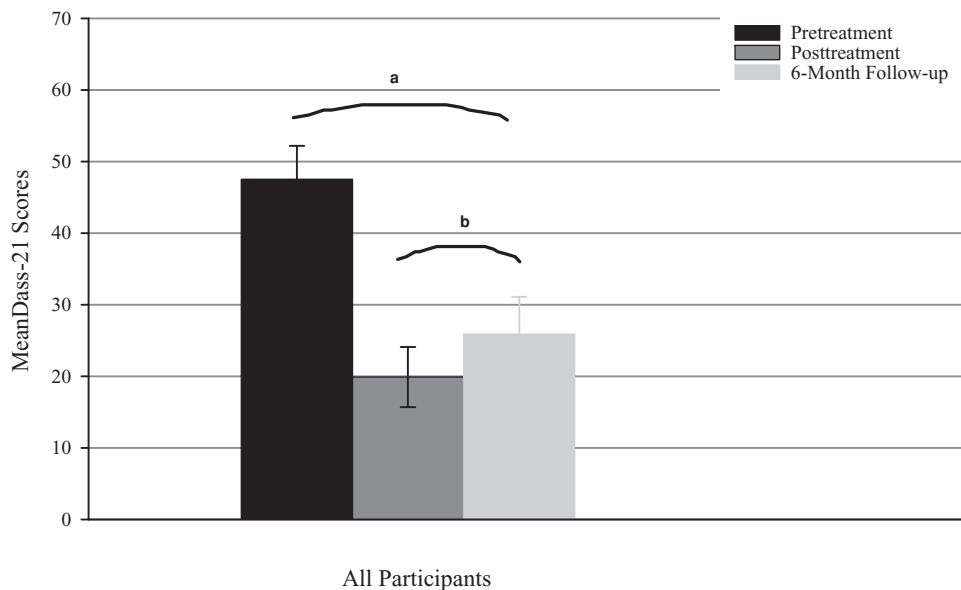


Figure 2. Mean DASS-21 scores (\pm SE) for all participants ($N = 17$) (P : ^a $P < .05$; ^b $P < .005$). Note that comparisons of interest are between (a) pretreatment and 6-month follow-up and (b) posttreatment and 6-month follow-up.

As Figures 1 to 3 indicate, the changes in the 2 treatment groups were commensurate. There was no main effect of group on any of the measures (SCL-90-R-GSI: $F_{[1,15]} = 0.38$, $P = .55$; DASS-21: $F_{[1,15]} = 0.03$, $P = .87$; CIQ: $F_{[1,15]} = 1.27$, $P = .28$) nor group by time interaction (SCL-90-R: $F_{[1,15]} = 0.15$, $P = .71$; DASS-21: $F_{[1,15]} = 0.19$, $P = .67$; CIQ: $F_{[1,15]} = 1.01$, $P = .33$). Moreover, the improvements in each of the treatment groups mirrored those of the 2 groups when combined. Within-groups, planned comparisons for pretreatment to 6-month follow-up showed a significant decrease in

psychological distress with large effect sizes for each of the 2 groups on the SCL-90-R-GSI (G-CBT, $t_9 = 4.71$, $P < .01$, Cohen $d = 2.87$; T-CBT, $t_6 = 3.83$, $P < .01$, Cohen $d = 2.4$) and the DASS-21 (G-CBT, $t_9 = 4.12$, $P < .01$, Cohen $d = 1.85$; T-CBT, $t_6 = 2.22$, $P = .05$, Cohen $d = 1.27$) as well as significant improvements on the CIQ with large effect sizes (G-CBT, $t_9 = -3.41$, $P < .01$, Cohen $d = -1.69$; T-CBT, $t_6 = -7.86$, $P < .01$, Cohen $d = -4.17$). These results provide support for our third hypothesis that treatment effects would not differ across groups.

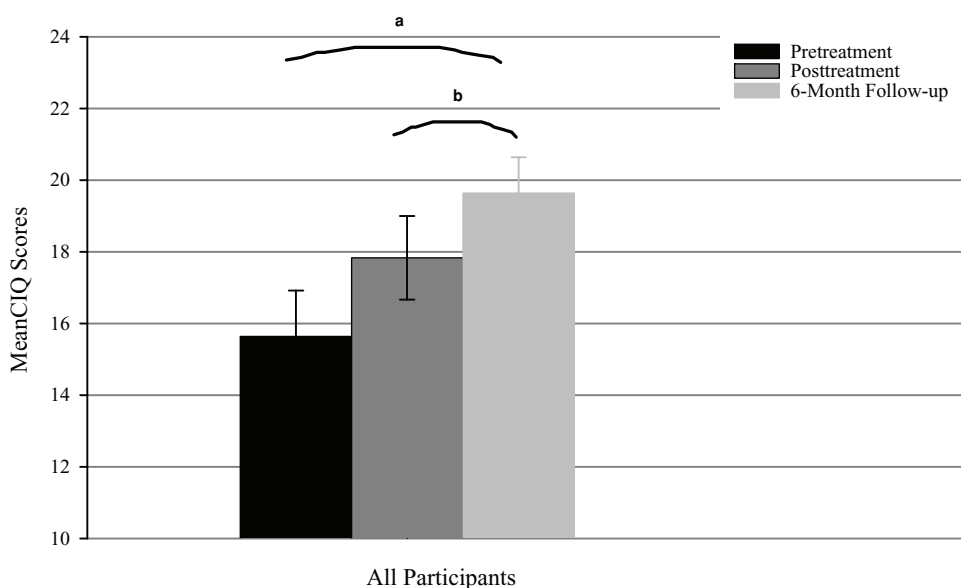


Figure 3. Mean CIQ scores (\pm SE) for participants ($N = 17$) (P : ^a $P < .05$; ^b $P < .005$). Note that comparisons of interest are between (a) pretreatment and 6-month follow-up and (b) posttreatment and 6-month follow-up.

TABLE 2 Means and standard deviations for each of the primary outcome measures

Outcome measure	All participants, <i>N</i> = 17	G-CBT, <i>N</i> = 10	T-CBT, <i>N</i> = 7
SCL-90-R-GSI			
Pretreatment	70.71 (7.59)	71.60 (8.22)	69.43 (6.99)
Immediately posttreatment	59.94 (9.78)	61.10 (9.66)	58.29 (10.47)
6-month follow-up	55.18 (14.41)	56.90 (4.83)	52.71 (13.85)
DASS-21			
Pretreatment	47.53 (19.14)	47.80 (22.73)	47.14 (14.18)
Immediately posttreatment	19.88 (17.33)	20.40 (17.28)	19.14 (18.86)
6-month follow-up	25.88 (12.48)	24.40 (20.58)	28.00 (24.19)
CIQ			
Pretreatment	15.64 (5.25)	16.95 (5.55)	13.79 (4.51)
Immediately posttreatment	17.83 (4.82)	18.30 (5.54)	17.18 (4.27)
6-month follow-up	19.64 (4.12)	20.40 (4.13)	18.57 (4.17)

Abbreviations: CIQ, Community Integration Questionnaire; DASS-21, Depression Anxiety Stress Scales-21; G-CBT, group cognitive behavior therapy; SCL-90-R-GSI, Symptom Checklist-90-revised-Global Severity Index; T-CBT, telephone-administered cognitive behavior therapy.

We also examined the stability of effects and were interested in whether the benefits observed at 6-month posttreatment were as robust as those observed immediately after treatment. Using paired-sample *t* tests for each outcome measure, we compared performance immediately posttreatment with 6-month follow-up. For the full group, there was no significant difference or trends toward significance on the SCL-90-R-GSI, ($t_{16} = 1.63$, $P = .12$, Cohen $d = 0.55$), but absolute scores were lower at 6 months, and the effect size of the difference was medium, suggesting better psychological functioning with the passage of time. This was true for both the G-CBT group (Mean_{posttreatment} = 61.1, SD = 9.66; Mean_{6months} = 56.9, SD = 15.27; $t_9 = 1.21$, $P = .26$, Cohen = 0.33) and the T-CBT group (Mean_{posttreatment} = 58.29, SD = 10.47; Mean_{6months} = 52.71, SD = 13.85; $t_6 = 1.03$, $P = .34$, Cohen $d = 0.45$).

Contrary to these findings, scores on the DASS-21 showed a significant increase in psychological distress from posttreatment to the 6-month follow-up ($t_{16} = -2.83$, $P < .05$, Cohen $d = -0.30$), with a small-to-medium effect size. To identify the source of this increase in distress, we examined subscale changes. While all 3 subscales were significantly lower at 6-month follow-up than at pretreatment testing (Depression: $t_{16} = 3.88$, $P < .05$; Anxiety: $t_{16} = 2.41$, $P = .03$; Stress: $t_{16} = 3.96$, $P < .01$), only the depression subscale showed benefits as robust at 6 months as immediately posttreatment, with very similar means (Mean_{posttreatment} = 8.24, SD = 7.45; Mean_{6months} = 8.47, SD = 8.53) and no significant difference ($t_{16} = .15$, $P = .88$, Cohen $d = -0.03$). In contrast, reduced functioning was observed on the anxiety (Mean_{posttreatment} = 3.41, SD = 3.37; Mean_{6months} = 6.35, SD = 6.17; $t_{16} = 3.07$, $P < .01$, Cohen $d = -0.59$) and stress subscales (Mean_{posttreatment} = 8.24, SD = 9.16;

Mean_{6months} = 10.94, SD = 9.3; $t_{16} = -2.23$, $P = .04$, Cohen $d = -0.29$). When DASS-21 subscale scores were analyzed separately for the 2 CBT groups, there were no significant differences for any of the subscales between posttreatment and 6-month follow-up (Depression: G-CBT $P = .68$, T-CBT $P = .36$; Anxiety: G-CBT $P = .08$, T-CBT $P = .06$; Stress: G-CBT $P = .10$, T-CBT $P = .27$).

Finally, like the SCL-90-R-GSI, the CIQ scores also improved from posttreatment to 6-month follow-up for the full-scale scores ($t_{16} = 3.59$, $P < .01$, Cohen $d = -1.28$) and on all subscales: home ($t_{16} = -3.07$, $P < .01$, Cohen $d = -1.02$), social ($t_{16} = -3.93$, $P < .01$, Cohen $d = -1.40$), and productivity ($t_{16} = -2.30$, $P < .05$, Cohen $d = 0.78$). When CIQ subscale scores were analyzed separately for the 2 CBT groups, there was a significant difference between posttreatment and 6-month follow-up on the full scale for the G-CBT group ($t_{16} = -2.61$, $P = .03$, Cohen $d = -0.44$) and on the home and full scales for the T-CBT group (home: $t_{16} = -2.46$, $P = .05$, Cohen $d = -0.35$; full: $t_{16} = -3.01$, $P = .02$, Cohen $d = -0.33$).

Clinical significance of mood changes

The magnitude of improvements to mood that were sustained 6-month posttreatment may be considered clinically significant. On the SCL-90-R-GSI, participants demonstrated an average reduction of 1.5 standard deviations (from > 84th to 55th percentiles) from pretreatment to 6-month follow-up, with 65% ($N = 11$) showing reductions of 1 standard deviation or more. On the DASS-21, participants scored within the moderate range of distress pretreatment (mean = 47.53, range = 16–76) and dropped to the borderline normal-to-mild

range at 6-month follow-up (mean = 25.88, range = 0–62), with 65% ($N = 11$) of the participants scoring in the normal range at 6-month follow-up compared with only 18% ($N = 3$) before treatment.

Clinical benefits were comparable for the 2 treatment groups on both measures, with the G-CBT group showing reductions of 20.53% on the SCL-90-R-GSI and 48.95% on the DASS-21 and the T-CBT group showing reductions of 24.08% on the SCL-90-R-GSI and 40.61% on the DASS-21.

Coping

A repeated-measures ANOVA was conducted to examine WOC-R planful problem-focused subscale versus escape-avoidance subscale from pretreatment to posttreatment. The analysis failed to reveal a main effect of subscale ($F_{[1,16]} = 3.22, P = .09$), or time ($F_{[1,16]} = .348, P = .08$), or a scale by time interaction ($F_{[1,16]} = 1.16, P = .07$). Planned comparisons on the full group revealed a significant increase on the planful problem-focused subscale across time ($t_{16} = -2.79, P = .01$, Cohen $d = 0.46$). These improvements were comparable to those immediately posttreatment, with no significant difference between posttreatment and 6-month follow-up ($t_{16} = -1.71, P = .11$, Cohen $d = 0.60$). In contrast, there was no significant change on the escape-avoidance subscale from pretreatment to 6-month follow-up ($t_{16} < 0.01, P = .58$, Cohen $d = -0.11$).

Contrary to our hypothesis, there were no significant correlations or trends toward significance between changes in either planful problem-focused or escape-avoidance coping and changes in mood or community integration.

DISCUSSION

Previous researchers have examined retention of CBT treatment benefits in brain-injured populations for social anxiety³² and emotional distress¹⁶ up to 1-month posttreatment. To our knowledge, this is the first examination of the longer-term (6 months) retention of clinical benefits of CBT for ABI. At the 6-month follow-up, our participants were generally scoring within the normative functional range on both emotional outcome measures, consistent with the large body of literature in other populations demonstrating the enduring effects of CBT treatment for depression and anxiety.³³ In addition, the diminution of distress was as robust at 6-month posttreatment as it was immediately after treatment on the SCL-90-R. While scores at the 6-month follow-up remained below pretreatment levels on the DASS-21, there was a significant increase in distress from posttreatment to 6-month follow-up on the total DASS-21 score that appeared driven by the anxiety and stress subscales (but not depression). Research published after the start

of our study suggests that the DASS-21 anxiety subscale lacks internal consistency for TBI patients and thus may not be a reliable measure for assessing anxiety in this population; this may explain our findings.³⁴ The presence of physical symptoms of anxiety are highly variable, often based on situational factors, and may fluctuate over time. Given that the DASS-21 and SCL-90-R differ in the content of their items, particularly for cognitive and physiological aspects of anxiety (with the DASS-21 consisting of proportionately more physiological symptoms), this may account for the inconsistencies noted between psychometric scores over time. It is interesting to note that the benefits for stress reduction were not fully maintained over time, and it may be that maintenance sessions that specifically target stress are needed to maximize the enduring benefits of CBT.

Results from this investigation indicate that CBT can be used to enhance community integration, even among adults who sustained their ABI many years before treatment. In our study, the benefits of CBT treatment appeared to positively impact community reintegration as time elapsed posttreatment. It is possible that CBT benefits may require time to translate into effects on integration into the community. Research is needed to better understand the mechanisms of these benefits to community integration. Depression and anxiety may result in reduced or restricted activity levels after head injury,³⁵ with patients isolating themselves and no longer engaging in activities that they previously enjoyed. Components of CBT such as behavioral activation (eg, activity scheduling) and cognitive restructuring can help to enhance mood by promoting more adaptive thinking and reengagement in activity.^{36,37} Accordingly, a dynamic cycle of positive change may account for gradual improvements in both mood and community integration (from pre- to posttreatment and from posttreatment to 6-month follow-up), with increases in one leading to increases in the other and then vice versa. In addition, the negative influence of depression on cognition is well documented in the literature,^{38,39} as is the influence of cognitive abilities on community integration.⁴⁰ Thus, it may be that by alleviating depressive symptoms in these participants, we concomitantly improved their cognitive functioning, leading to enhanced community integration. Unfortunately, we were not able to reassess cognitive function posttreatment to assess this speculation. Future research is needed to determine which components of CBT are of greatest benefit to ABI survivors.

The magnitude of the longer-term benefits of our intervention was similar across therapy administration modalities (ie, group- and teletherapy). The duration of intervention time differed between modalities, with group sessions typically lasting between 60 and 90 minutes and teletherapy sessions typically lasting between

45 and 60 minutes. A central purpose of the study was to illustrate commensurate benefits of teletherapy relative to conventional treatment. This finding was demonstrated despite the slightly shorter sessions in the teletherapy group. Future research should empirically examine whether the length of treatment session has an influence on treatment outcome. Critically, this is the first investigation of the longer-term mood and community integration benefits of tele-CBT with a brain-injured population, and these findings may have an important influence on treatment delivery and accessibility for this population. Recent research by Fann and colleagues⁴¹ indicates that patients who have experienced a head injury are very open to speaking with a clinician over the telephone as a form of treatment for depression, which supports our work with this treatment modality.

Finally, contrary to our hypothesis, while planful problem-focused coping did improve in response to treatment, neither planful nor avoidant coping showed a significant relationship with mood or community integration. It may be that our participants had already developed and used individual coping styles for such an extensive period of time (on average, almost 10 years) that our 11-week program was not sufficient to evoke sufficient change in coping strategies to influence mood or day-to-day behavior.

Limitations

All participants were recruited from a community organization dedicated to people living with ABI. It is unclear to what extent current findings will generalize to ABI survivors who are not members of such organizations or who do not have an alternative type of com-

munity support. In addition to this limitation, outcome measures were self-report and thus are limited by subjectivity and perception-based responding. Assignment to group (G-CBT vs T-CBT) was not randomized, and the sample size was quite small. Nonetheless, it should be noted that effect sizes were high, and significance testing revealed robust findings despite a sample of only 17 participants. As the study design did not involve randomized assignment to group nor did it include a control group, this raises the question of whether improvement was associated with the treatment provided or to spontaneous improvement of mood. We suggest that the latter explanation is unlikely, given that patients were many years from injury, on average, and had most probably long-since reached a plateau of recovery.⁴² Spontaneous improvements to the brain and/or behavior, which might directly or indirectly support improved mood, were not expected.

CONCLUSIONS

Our findings support the longer-term benefits of an 11-week cognitive behavior therapy program on the psychological well-being of patients who have suffered brain injuries. In addition to improvements in emotional distress, this intervention also showed improvements in community integration 6 months after the cessation of treatment. The findings are promising as they suggest that a brief intervention provided a decade after initial injury can have lasting effects. Finally, the results from this study support the delivery of therapeutic intervention services via telephone, potentially increasing accessibility to and reducing costs of psychotherapy for this vulnerable population.

REFERENCES

1. Malojcic B, Mubrin Z, Coric B, et al. Consequences of mild traumatic brain injury on information processing assessed with attention and short-term memory tasks. *J Neurotrauma*. 2008;25:30–37.
2. Gronwall D. Assessment during the acute stages of traumatic brain injury. In: Lezak MD, ed. *Assessment of the Behavioral Consequences of Head Trauma*. New York, NY: Alan R. Liss Inc; 1989.
3. Mathias JL, Coats JL. Emotional and cognitive sequelae to mild traumatic brain injury. *J Clin Exp Neuropsychol*. 1999;21:200–215.
4. Mateer C, Sira CS. Cognitive and emotional consequences of TBI: intervention strategies for vocational rehabilitation. *Neuro Rehabil*. 2006;21:315–326.
5. Moldover JE, Goldber KB, Prout MF. Depression after traumatic brain injury: a review of evidence for clinical heterogeneity. *Neuropsychol Rev*. 2004;14:143–154.
6. Koponen S, Taiminen T, Portin R, et al. Axis I and II psychiatric disorders after traumatic brain injury: a 30-year follow-up study. *Am J Psychiatry*. 2002;159:1315–1321.
7. Kreutzer J, Seel RT, Gourley E. The prevalence and symptom rates of depression after traumatic brain injury: a comprehensive review. *Brain Inj*. 2001;15:563–576.
8. Hoofien D, Gilboa A, Vakil E, et al. Traumatic brain injury (TBI) 10-20 years later: a comprehensive outcome study of psychiatric symptomatology, cognitive abilities and psychosocial functioning. *Brain Inj*. 2001;15:189–209.
9. Stalnacke BM. Community integration, social support and life satisfaction in relation to symptoms 3 years after mild traumatic brain injury. *Brain Inj*. 2007;21:933–942.
10. Draper K, Ponsford J, Schonberger M. Psychosocial and emotional outcomes 10 years following traumatic brain injury. *J Head Trauma Rehabil*. 2007;22:278–287.
11. Franulic A, Carbonell CG, Pinto P, et al. Psychosocial adjustment and employment outcome 2, 5 and 10 years after TBI. *Brain Inj*. 2004;18:119–129.
12. Ponsford JL. Psychological sequelae of closed head injury: time to redress the imbalance. *Brain Inj*. 1990;4:111–114.
13. Schopp LH, Johnstone BR, Merveille OC. Multidimensional telecare strategies for rural residents with brain injury. *J Telemed Telecare*. 2000;6:S1146–S1149.
14. Pickelsimer EE, Selassie AW, Sample PI, et al. Unmet service needs of persons with traumatic brain injury. *J Head Trauma Rehabil*. 2007;22:1–13.

15. Khan-Bourne N, Brown RG. Cognitive behaviour therapy for the treatment of depression in individuals with brain injury. *Neuropsychol Rehabil.* 2003;13:89-107.
16. Bradbury CL, Christensen BK, Lau MA, et al. The efficacy of cognitive behaviour therapy in the treatment of emotional distress after acquired brain injury. *Arch Phys Med Rehabil.* 2008;89:S61-S68.
17. Terri L, Logsdon RG, Uomoto J, et al. Behavioral treatment of depression in dementia patients: a controlled clinical trial. *J Gerontol B Psychol Sci Soc Sci.* 2003;17:759-774.
18. Mohr DC, Likosky W, Bertagnoli A, et al. Telephone-administered cognitive-behavioral therapy for treatment of depressive symptoms in Multiple Sclerosis. *J Consult Clin Psychol.* 2000;68:356-361.
19. Ben-Yishay Y, Silver SM, Piasetsky E, et al. Relationship between employability and vocational outcomes after intensive holistic cognitive rehabilitation. *J Head Trauma Rehabil.* 1987;2:35-48.
20. Mohr DC, Hart S, Julian L, et al. Telephone-administered psychotherapy for depression. *Arch Phys Med Rehabil.* 2005;62:1007-1014.
21. Lovell K, Cox D, Haddock G, et al. Telephone administered cognitive behaviour therapy for treatment of obsessive compulsive disorder: randomized controlled non-inferiority trial. *BMJ.* 2006;333:883-887.
22. Karlsen B, Idsoe T, Dirdal I, et al. Effects of a group-based counselling programme on diabetes-related stress, coping, psychological well-being and metabolic control in adults with type 1 or type 2 diabetes. *Patient Educ Couns.* 2004;53:299-308.
23. Curran CA, Ponsford JL, Crowe S. Coping strategies and emotional outcome following traumatic brain injury: a comparison with orthopedic patients. *J Head Trauma Rehabil.* 2000;15:1256-1274.
24. Randolph C. *RBANS Manual.* San Antonio, TX: The Psychological Corporation; 1998.
25. McKay C, Casey JE, Wertheimer J, et al. Reliability and validity of the RBANS in a traumatic brain injury sample. *Arch Clin Neuropsychol.* 2007;22:91-98.
26. Wechsler D. *Wechsler Test of Adult Reading (WTAR).* San Antonio, TX: The Psychological Corporation; 2001.
27. Green REA, Melo B, Christensen B. Measuring premorbid IQ in traumatic brain injury: an examination of the validity of the Wechsler Test of Adult Reading (WTAR). *J Clin Exp Neuropsychol.* 2008;30:163-172.
28. Hoofien D, Barak O, Vakil E, et al. Symptom Checklist-90 Revised scores in persons with traumatic brain injury: affective reactions or neurobehavioral outcomes of the injury. *Appl Neuropsychol.* 2005;12:30-39.
29. Henry J, Crawford JR. The short-form version of the Depression Anxiety Stress Scales (DASS-21): construct validity and normative data in a large non-clinical sample. *B J Clin Psychol.* 2005;44:227-239.
30. Willer B, Rosenthal M, Kreutzer JS, et al. Assessment of community integration following rehabilitation for traumatic brain injury. *J Head Trauma Rehabil.* 1993;8:75-87.
31. Anson K, Ponsford J. Evaluation of a coping skills group following traumatic brain injury. *Brain Inj.* 2006;20:167-178.
32. Hodgson J, McDonald S, Tate R, et al. A randomized controlled trial of cognitive-behavioural therapy program for managing social anxiety after acquired brain injury. *Brain Impair.* 2005;6:169-180.
33. Butler AC, Chapman JE, Forman AM, et al. The empirical status of cognitive-behavioral therapy: a review of meta-analyses. *Clin Psychol Rev.* 2006;26:17-31.
34. Ownsworth T, Little T, Turner B, et al. Assessing the emotional status following acquired brain injury: the clinical potential of the depression, anxiety stress scales. *Brain Inj.* 2008;22:858-869.
35. Garland A, Fox R, Williams C. Overcoming reduced activity and avoidance: a five areas approach. *Adv Psychiatr Treat.* 2002;8:453-462.
36. Persons JB, Davidson J, Tompkins MA. *Essential Components of Cognitive-Behavior Therapy for Depression.* Washington, DC: American Psychological Association; 2001.
37. Beck JS. *Cognitive Therapy: Basics and Beyond.* New York, NY: Guilford Press; 1995.
38. Austin M-P, Mitchell P, Goodwin G. Cognitive deficits in depression: possible implications for functional neuropathology. *Br J Psychiatry.* 2001;178:200-206.
39. Burt DB, Zembar MF, Niederehe G. Depression and memory impairment: a meta-analysis of the association, its pattern, and specificity. *Psychol Bull.* 1995;117:285-305.
40. Colantonio A, Ratcliff G, Chase S, et al. Is cognitive performance related to level of community integration many years after traumatic brain injury? [abstract]. *Brain Cogn.* 2000;44:P19-P20.
41. Fann JR, Jones AL, Dikmen SS, et al. Depression treatment preferences after traumatic brain injury. *J Head Trauma Rehabil.* 2009;24:272-278.
42. Christensen BK, Colella B, Inness E, et al. Recovery of cognitive function after traumatic brain injury: a multilevel modeling analysis of Canadian outcomes. *Arch Phys Med Rehabil.* 2008;89:S3-S15.