COGNITIVE BEHAVIOUR THERAPY AFTER ACQUIRED BRAIN INJURY:
AN INVESTIGATION OF THE BENEFITS FOR EMOTIONAL WELL-BEING,
COPING STRATEGY USE, AND COMMUNITY INTEGRATION
AT 6-MONTHS POST-TREATMENT

by

April Arundine

A thesis submitted in conformity with the requirements
for the degree of Masters of Science
Graduate Department of Rehabilitation Science
University of Toronto

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Abstract

Objectives: To demonstrate that at 6-months post-cessation of cognitive behaviour therapy (CBT) adapted for acquired brain injury (ABI), (1) patients maintain psychological benefits, (2) coping strategy selection improves, (3) community integration is enhanced, and (4) benefits are observed in both face-to-face and telephone administrations. Methods: Participants. Seventeen ABI patients with elevated psychological distress. Outcome Measures. Pre-treatment, post-treatment and 6-month follow-up performance on the Symptom Checklist-90-revised (SCL-90-R), Depression, Anxiety Stress Scales (DASS-21), Community Integration Questionnaire (CIQ) and the Ways of Coping-Revised Questionnaire (WOC-R). Procedures. Eleven CBT sessions provided in group, face-to-face format or individually by telephone. Results: For face-to-face
and telephone groups, psychological distress was significantly reduced from pre-treatment to 6-months follow-up: DASS-21 ($t_{16}=7.32$, $p<.000$); SCL-90-R ($t_{16}=6.22$, $p<.000$). Community integration ($t_{16}=-6.15$, $p<.000$) and problem-focused coping ($t_{16}=-3.67$, $p<.01$) were also significantly enhanced. **Conclusion:** CBT adapted for patients with ABI carries robust benefits even 6-months after treatment.
Acknowledgments

I am indebted to Robin Green and Cheryl Bradbury for providing me with the opportunity to do my Masters thesis under their supervision. I would like to thank you both for your continued support, advice and “therapy” throughout this project. I have learned a lot over the past two years and have developed my skills both professionally and academically. Perhaps most importantly, I will carry these skills forward and continue to work towards improving the lives of acquired brain injury survivors. I will make you both proud!

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CHAPTER 1
INTRODUCTION AND RATIONALE

Acquired brain injury (ABI) is a significant public health problem that enduringly impacts the lives of many, posing a significant emotional and financial burden to the injured individual and their families\(^1\). These effects are largely due to the chronic physical, cognitive, behavioural and emotional consequences that ABI can cause\(^1\). While rehabilitation treats the physical and cognitive aspects of brain injury, psychological care is typically limited\(^2\)\(^-\)\(^4\). However, over the longer term, it is the psychological impact of ABI that can become more debilitating than the cognitive or physical disability\(^5\)\(^,\)\(^6\), having a profound and negative impact on recovery\(^7\)\(^-\)\(^9\), community integration, psychosocial adjustment\(^10\)\(^-\)\(^12\) and quality of life after injury\(^13\). Moreover, numerous studies have shown that psychological distress is not only highly prevalent after ABI, but also that the severity of psychological symptoms do not remit over time\(^14\)\(^15\)\(^,\)\(^16\).

Despite these observations, there has been limited research into the development of treatments tailored to meet the cognitive and emotional needs of ABI survivors, which may explain in part why psychological problems after brain injury remain undertreated in primary health care settings. In the later stages of recovery, psychological services are often inaccessible to survivors due to mobility limitations, geographic remoteness and financial restrictions\(^17\)\(^,\)\(^18\).

Recently, the efficacy of a cognitive behavioural therapy (CBT) protocol designed to improve mood and coping and, adapted to meet the unique cognitive and emotional needs of ABI survivors was demonstrated by Bradbury and colleagues (2008)\(^19\). This intervention, administrable by telephone, was also designed to address these challenges of inaccessibility.
Bradbury et al (2008) examined the efficacy of the intervention for mood as well as coping and community integration immediately after treatment; they also examined mood (but not coping and community integration) at one month post-treatment\textsuperscript{19}. They found continued benefits for mood at one month post-treatment. However, the study failed to demonstrate post-treatment effects on coping and community integration measures. It is plausible, though, that changes in coping and particularly community integration would occur more gradually over the longer-term. Changes on coping measures may require the passage of time for new, significant events in a patient’s life to take place for which they are able to utilize their newly developed coping strategies. In turn, coping has been demonstrated to not only influence emotional adjustment\textsuperscript{20, 21}, but is also a factor influencing community integration outcomes after injury\textsuperscript{22, 23}. Therefore, it would be of clinical and scientific interest to examine the long-term effects of this treatment in order to assess whether these speculations are true. Moreover, it would be of clinical utility to examine whether improvements in mood endured with the passage of time or whether booster sessions, for example, are needed for retention of benefits.

In light of the above, the objectives of the current thesis were to examine: (1) longer-term (i.e., 6-months post-cessation of treatment) maintenance of benefits of the adapted CBT protocol of Bradbury et al (2008)\textsuperscript{19} and (2) the long-term effects of treatment on community integration and coping.
CHAPTER 2: LITERATURE REVIEW

Introduction

This chapter examines the literature concerning psychological distress and its treatment after brain injury. The main topics reviewed were selected based on their relevance to the larger thesis. Topics include: (1) definition and epidemiology of ABI, (2) prevalence of depression and anxiety after ABI, (3) the impact of psychological distress on community integration outcomes, (4) the relationship between coping strategy selection and psychological adjustment, (5) the relationship between coping and community integration outcomes, and (6) the efficacy of CBT for improving both mood and coping in people with brain injury. Each topic is discussed in detail below.

Definition and Epidemiology of Acquired Brain Injury

An acquired brain injury (ABI) is an umbrella term used to capture brain injuries resulting from either traumatic or non-traumatic causes. A traumatic brain injury (TBI) is broadly defined as brain injury resulting from an external force causing diminished consciousness or coma. Although the causes of TBI vary, falls, motor vehicle accidents (MVAs) and assaults are the three most predominant causes of injury. Canadian Institutes of Health Information (CIHI; 2006) reported that falls represent approximately 50% of all TBI hospital admissions, while MVAs and assaults account for 36% and 10%, respectively. Non-traumatic brain injury is defined as an injury that occurs after birth and is not related to an externally inflicted trauma to the brain. This type of injury can be triggered by a number of causes such as tumor, cerebrovascular accidents, toxic or metabolic insults (e.g., severe hypoglycemia), infections (e.g., meningitis or encephalitis) or cerebral anoxia (e.g., a lack of oxygen to the brain).

In Canada, an estimated 50,000 people sustain a traumatic brain injury (TBI) annually. The
direct health care costs associated with TBI alone are estimated to be over 150 million dollars\(^29\). The Heart and Stroke Foundation of Canada estimates that there are over 300,000 stroke survivors living in Canada and an estimated 50,000 strokes annually\(^30\). The Brain Tumor Foundation of Canada reports that there are approximately 55,000 brain tumor survivors and 10,000 people diagnosed with a brain tumor each year\(^31\). Recently, Colantonio and colleagues (2009) published pilot data on the occurrence of ABI including both traumatic and non-traumatic causes of brain injury\(^32\). Based on emergency department, acute care and inpatient rehabilitation hospital data, there was an estimated 146,817 ABI admissions from 2003 to 2007 in Ontario, Canada alone\(^32\). Collectively, these data sets clearly illustrate that ABI is a major epidemiological concern in Canada.

The economic burden associated with disability after brain injury is also significant, with annual combined costs estimated to be in the billions\(^29\). Accordingly, it is important to identify variables that not only influence rehabilitation outcomes, but also that are amenable to intervention. Depression and anxiety are treatable psychological disorders that are highly prevalent in people with brain injury\(^6, 15\). Although the direct costs attributed to disability secondary to the psychological sequelae of ABI are unknown, the costs associated with mental illness are substantial. A Health Canada report published in 2002 reported that the costs associated with mental illness approximated 7 billion dollars due to lost productivity and increased use of the health care system\(^33\).

**The Nature and Prevalence of Psychological Distress after Acquired Brain Injury**

It has been well documented in the literature that ABI survivors are at increased risk for a number of psychiatric disorders. Many of these patients suffer from depression\(^6, 15, 16\). The
Diagnostic and Statistical Manual of Mental Disorders- Revised 4th Edition (DSM-IV)\textsuperscript{34} broadly classifies depression into major depressive disorder (MDD) and dysthymia. The former DSM-IV criteria includes depressed mood and/or loss of interest or pleasure for a period of at least two weeks, accompanied by four or more of the following symptoms: significant weight loss or gain, loss of appetite, insomnia or hypersomnia, psychomotor retardation, fatigue or loss of energy, feelings of worthlessness and guilt, diminished concentration, and recurrent thoughts of death or suicidal ideation\textsuperscript{34}. The latter, is a milder form of depression that is characterized by chronic depressed mood for a period of at least 2 years\textsuperscript{34}. Studies examining the prevalence of depression following ABI (discussed below) focus primarily upon MDD.

Acquired brain injury patients have also been shown to suffer from a number of anxiety disorders. These include generalized anxiety disorder (GAD), obsessive-compulsive disorder (OCD), panic disorder (PD), and post-traumatic stress disorder (PTSD)\textsuperscript{6, 14, 35, 36}. According to the DSM-IV, GAD is characterized by uncontrollable excessive anxiety and worry for a period of at least 6-months. Other symptom criteria include restlessness, fatigue, concentration difficulties, irritability, muscle tension and or sleep disturbances\textsuperscript{34}. Obsessive compulsive disorder is characterized by obsessions causing considerable anxiety or distress and/or by compulsions, which is the individual’s behavioural response used to reduce anxiety or distress\textsuperscript{34}. According to the DSM-IV, panic disorder (PD) is defined as the experience of recurrent and unexpected panic attacks. Panic disorder frequently co-occurs with agoraphobia defined by anxiety and/or avoidance of places and situations from which the individual fears is not easily escapable in the event they have a panic attack\textsuperscript{34}. Finally, PTSD is a psychological disorder that develops in response to a life threatening and traumatic event, such as an MVA. The DSM-IV defines PTSD as the re-experiencing of a traumatic event coinciding with symptoms of arousal and avoidance of stimuli associated with the trauma\textsuperscript{34}. 
**Etiology of Depression following Acquired Brain Injury**

Given that ABI survivors are at increased risk\(^6\)\(^{15}\) relative to the general population\(^33\) for developing depression and anxiety, the etiology of psychiatric disorders has garnered substantial attention. The literature is not only abundant, but has also brought forth both contradictory and controversial findings regarding hemispheric lateralization and distinct neuroanatomical divisions associated with emotional sequelae. Recently, Shenal et al (2003) proposed a model of depression based on a review of studies investigating the neuropsychology of depression\(^37\). Their model is comprised of three broad neuroanatomical divisions that have been found to be related to depression; the right frontal, left frontal and right posterior lobes. The authors indicated that the latter two regions are more frequently associated with depression, although lesions sustained in any of the three areas may produce depressive symptomatology\(^37\).

Other investigators have suggested that depression may be reactionary in nature, developing in response to the cognitive, physical and psychosocial consequences of their injury\(^38\). This interpretation is bolstered by the finding that depression that develops over the longer-term has been shown to be associated with increased insight and recognition of one’s losses\(^38, 39\). One proposed mechanism for reactionary depression is that it develops in response to environmental demands and the repeated failure to meet these demands that were once considered effortless\(^40\).

Recent research has broadly conceptualized the development of psychological distress after ABI as the result of a complex interaction of both organic and non-organic factors, with the latter comprising pre-injury psychiatric status, personality, social support network, awareness and coping\(^41\).
Prevalence of Emotional Distress after Traumatic Brain Injury

Within the TBI literature, there has been an extensive amount of research examining the prevalence of psychiatric disorders. These findings often lack consistency and vary dramatically in their estimates of prevalence. For example, depression prevalence rates have been found to vary from as low as 6%\textsuperscript{42} to as high as 77%\textsuperscript{43}. Sources of variability include differences in the operationalized definition of depression, differences in diagnostic measures and the interchangeable use of clinically diagnosed disorders versus the presence of affective symptomatology associated with depression. Other sources of variability arise from sample size, different types of methodology employed in the studies such as variation within diagnostic measures, different clinical populations (e.g. inpatient groups versus community dwelling groups), and groups differing in time post-injury and varying levels of injury severity\textsuperscript{44}. Therefore this section is intended to provide the key illustrative findings relevant to the current thesis rather than a full review of the literature.

To date, one of the most comprehensive studies examining the prevalence of post-TBI depression was conducted by Kruetzer and colleagues (2001)\textsuperscript{15}. Their study incorporated a large heterogeneous sample of 722 TBI survivors who were, on average, 2.5 years post-injury. Symptom profiles were established for each patient using the Neurobehavioral Functional Inventory (NFI), a tool specifically designed for the brain injury population. Symptoms of depression were then identified from the NFI using DSM-IV criteria. Based on the methodology employed, the findings revealed that 42% of TBI survivors met the DSM-IV criteria for major depressive disorder (MDD) in the post-acute phase of TBI (3-months to 9-years post-injury). The methodological strengths of the study include its large sample size and the utilization of DSM-IV diagnostic criteria. However, the authors also acknowledged that the generalizability of their findings may have been limited by participant recruitment from a single
outpatient setting. The findings reported by Kruetzer et al (2001) parallel and may be substantiated by findings of Hoffien and colleagues (2001). They found that within a group of 76 participants diagnosed with TBI, 45% had elevated scores of depression on the Symptom Checklist-90-Revised (SCL-90-R). Participants in this study averaged 14.1 years post-injury, indicating that depression rates were as high as those observed by Kreutzer et al at 2.5 years after injury.

A large number of studies have also examined the prevalence rates of anxiety following TBI. Hibbard et al (1998) examined the prevalence of psychiatric disorders, including anxiety, in a group of 100 mild to severe TBI survivors (7.6 years post-injury on average). Psychiatric diagnoses were made using the Structured Clinical Interview (SCID) for DSM-IV disorders. The results of their analyses revealed that PTSD (19%) and OCD (15%) were among the two most prevalent types of anxiety disorders followed by PD (14%) and GAD (9%). Moreover, 48% of their TBI sample met the DSM-IV criteria for major depression and 25% were diagnosed with co-morbid depression and anxiety.

In another study, Epstein & Ursano (1994) conducted a meta-analysis of 12 studies examining the prevalence anxiety following TBI. Their analysis included studies examining patients of varying ages and injury severity from mild to severe TBI. Their findings revealed that 29% of participants (N=1199) in these studies were diagnosed with clinical anxiety. Considerably higher rates of anxiety were reported by VanReekum and colleagues (1996). In this study, structured psychiatric interviews were also used to measure the number of DSM-III-revised disorders in a mixed group of 18 mild to severe TBI patients. Participants in this study were living in the community and were, on average, 4.9 years post-injury. The data revealed that 39% of their sample met the criteria for an anxiety disorder, 61% met the criteria for major
depressive disorder and 56% had co-morbid Axis 1 disorders\textsuperscript{36}. However, the authors acknowledged that the generalizability of their findings is limited by selection bias and the study’s very small sample size.

**Prevalence of Emotional Distress after Stroke**

The prevalence of depression and anxiety in the stroke literature parallels the rates found in the TBI population. To provide an accurate estimate of the prevalence of post-stroke depression, Hackett and colleagues (2005) completed a systematic review of 51 prospective studies conducted between 1977 and 2002\textsuperscript{46}. The results of their meta-analysis revealed that 33\% of all stroke survivors experience depression within the first 6-months of having a stroke. Over the longer-term (i.e., greater than 6-months post-stroke), the pooled estimate of depressive symptoms marginally increased to 34\%\textsuperscript{46}. Astrom and colleagues (1993) examined the prevalence and longitudinal course of depression in a group of older stroke patients\textsuperscript{47}. Diagnosis of major depression was made using the DSM III-revised criteria. Patients were assessed for depression during the acute stages of their recovery at 3-months, and at 12-months, 2-years and 3-years post-stroke. Seventy-six participants were initially assessed, but by the 3-year follow-up only 49 participants remained in the study. Attrition rates were largely due to patient mortality, patient inaccessibility, patient refusal or recurrent stroke. The findings of the study revealed that at 3-months, 31\% of participants were depressed\textsuperscript{47}. At 12-months, depression rates had decreased to 16\%. However, at the 2- and 3-year follow-up, the depression rates had again increased to 19\% and 29\%, respectively\textsuperscript{47}. Thus, by year 3, patients had returned to acute levels of depression. Within the same cohort of stroke patients, Astrom (1996) examined the development and longitudinal course of generalized anxiety disorder and co-morbidity with depression\textsuperscript{48}. At the 3-month follow-up, the prevalence of anxiety was 31\%. The course and prevalence of anxiety remained stable at each consecutive time point with no
significant differences between follow-up assessments: 24% at 1-year follow-up, 25% at 2-year follow-up and 19% at the 3-year follow-up\textsuperscript{48}. The findings also revealed a high co-morbidity with depression across all time points. De Wit and colleagues (2008) conducted a similar experiment, but at an earlier stage in the recovery process following stroke injury\textsuperscript{49}. In their multicentre longitudinal study, the time course of both depression and anxiety at 2-, 4- and 6– months post-stroke was examined in 505 patients. The prevalence rates for depression and anxiety ranged between 24% to 30%, and between 22% to 25%, respectively. In this study, the prevalence of depression and anxiety, albeit high, remained stable and did not significantly differ over time\textsuperscript{49}. Although the aforementioned findings shed light on the prevalence of post-stroke depression at different stages in the recovery process, the findings of cannot be directly compared due to varying timelines and patient populations. Thus, replication of these studies with a single longitudinal timeline from early to late recovery would be of value to examine the chronicity and longitudinal coarse of depression and anxiety subsequent to stroke injury.

\textit{Prevalence of Emotional Distress in Tumor Survivors}

Although there is much less known about the prevalence of depression and anxiety in other forms of ABI, the brain tumor literature suggests that similar to TBI and stroke, depression is highly prevalent. In a study conducted by Wellisch et al (2002), the DSM-IV criteria were used to diagnose depression in a group of 89 adult brain tumor survivors\textsuperscript{50}. Their analysis revealed that 28% of the sample met the criteria for major depressive disorder. However, higher rates of depression were found by Pelletier and Colleagues (2002)\textsuperscript{51}. They examined the contributions of neuropsychiatric symptoms on quality of life in a sample of 60 brain tumor patients. The analysis revealed that 38% of patients scored within clinically depressed range using the Beck Depression Inventory, second edition (BDI-II)\textsuperscript{51}. Interestingly, depression has also been shown to negatively correlate with survival. Mainio and colleagues (2005) conducted a 5-year follow-
up study investigating depression in a patients diagnosed with low-grade glioma. The findings of their study revealed that depression was a significant predictor for survival time\(^5\).

Compared to the TBI and stroke populations, the development of depression over time remains unclear for tumor patients, and is clouded by lack of longitudinal data resulting from poor prognosis and low survival rates associated with the disease. In addition, there is little research focused on depression following ABI secondary to non-progressive tumor resection. As such, the long-term emotional sequelae experienced by ABI survivors after tumor resection requires further investigation.

**Summary of the Prevalence of Emotional Distress after Brain Injury**

In view of the extensive literature on the emotional sequelae of ABI, researchers have developed a consensus that ABI survivors are vulnerable to the development of psychiatric disorders, and in particular depression and anxiety\(^6, 15, 36, 47, 48, 50\). These studies collectively illustrate that compared to base rates of the Canadian population, where the lifetime prevalence of major depression is 8% and the prevalence of all anxiety disorders combined is 12%\(^33\), depression and anxiety is significantly higher for individuals who have sustained an ABI and often co-occur\(^36\). Depression and anxiety not only represent a long-term consequence of brain injury, but have also been shown to have widespread impact on community integration and psychosocial outcomes as discussed below.
Correlates of Emotional Distress after Acquired Brain Injury

Emotional distress is associated with a variety of psychosocial and adjustment difficulties after brain injury including increased functional disability\textsuperscript{7, 8, 11}, reduced life satisfaction\textsuperscript{13}, poorer quality of life\textsuperscript{5}, increased suicide rates\textsuperscript{53}, and increased caregiver burden\textsuperscript{54}. Moreover, emotional distress after brain injury has been shown to have an adverse and negative effect on community integration\textsuperscript{10}, which is described as the “ultimate goal of individuals with traumatic brain injury and their health care professionals” (p. 426)\textsuperscript{55}.

The Relationship between Emotional Distress and Community Integration after Brain Injury

Community integration has been broadly defined as “…returning to the mainstream of family and community life by persons with impairments and disabilities due to injury, chronic illness or old age” (p. 74)\textsuperscript{56}. It is a multifaceted construct that is defined by a set of variables across multiple rehabilitation domains including: integration into a social network, engagement in vocational, productive or meaningful activities, and participation in home-based and community activities. Collectively, these variables are commonly used to measure how well someone integrates back into community life after injury\textsuperscript{56}.

In a study incorporating 53 TBI patients, Draper and colleagues (2007) demonstrated the association between psychological distress and community integration outcomes 10 years after injury\textsuperscript{11}. Community integration was measured using the Sydney Psychosocial Reintegration Scales (SPRS), a tool that has also been identified as a psychometrically valid measure of community integration\textsuperscript{57}. Levels of depression and anxiety, as measured by the Hospital Anxiety and Depression Scale (HADS) were significantly correlated with the SPRS. Specifically, their analyses revealed that higher levels of depression and anxiety were associated
with lower levels of integration such as poorer occupational outcomes, poorer interpersonal relationships and reduced independent living skills\textsuperscript{11}. In addition, depression and anxiety were found to negatively correlate with overall level of community integration. Interestingly, anxiety was found to be the strongest predictor of outcome\textsuperscript{11}. These findings coincide with Stalnacke (2007), who examined longitudinal data on community integration outcomes in a group of 163 TBI patients\textsuperscript{10}. The findings showed a significant relationship between symptoms of emotional distress and community integration, life satisfaction and social support. Specifically, higher levels of distress were associated with lower levels of community integration, life satisfaction and social support\textsuperscript{10}. In another study, Corrigan and colleagues (2001) measured life satisfaction at 1-year and 2-years post-injury in a large group of 218 TBI patients\textsuperscript{58}. The authors found that life satisfaction was significantly correlated with productivity and gainful employment (an indicator of community integration) at 1- and 2-years post-injury.

Consistent with these data, studies examining the relationship between community integration outcomes and post-stroke emotional distress have revealed similar findings. For example, Shimoda and Robinson (1998) showed that at long-term follow-up, co-morbid depression and anxiety in a group of stroke survivors contributed to greater impairment in community integration domains such as activities of daily living and social functioning\textsuperscript{8}. Astrom and colleagues (1992) also demonstrated an association between depression, life satisfaction and psychosocial functioning\textsuperscript{59}. In this study 98 long-term survivors of stroke were repeatedly assessed and compared to a control group comprised of older adults from the general population. Compared to the control group, stroke survivors reported a significantly higher frequency of psychiatric symptoms and significantly lower levels of psychosocial functioning such as reduced leisure and social contact - important markers of community integration. The findings also showed that the subgroup of stroke survivors\textquoteright, who had clinically elevated levels
of depression, also reported lower life satisfaction. Interestingly, when the authors examined the temporal relationship and changes over time among these variables, the findings revealed that an improvement in mood was associated with an improvement in life satisfaction and an increase in social contact\textsuperscript{59}. Conversely, a decline in mood was associated with deterioration in life satisfaction, and a reduction in leisure and social engagement. Unfortunately, the interpretation and generalizability of their findings may be affected by high attrition rates in the study sample, whereby the number of participants was reduced by almost 50% at the 3-year follow-up (largely due to participant mortality).

**Summary of Community Integration**

Collectively, these findings illustrate that the presence of post-ABI psychological distress is associated with poorer community integration outcomes. It is also evident from the literature that lower levels of community integration are widely associated with reduced life satisfaction and poorer quality of life after injury. However, Astrom et al (1992)\textsuperscript{59} have provided clinically promising results because their findings suggest that community integration may be amenable to change via mood enhancement. Although, many factors have been shown to predict community integration after injury, including injury severity, cognition and demographic variables, such as age\textsuperscript{60, 61}, psychological variables such as coping and emotional distress are unique in their putative amenability to intervention.

**Coping after Brain Injury**

Coping is a psychological variable that has begun to receive increased attention in the literature as a factor influencing both emotional adjustment\textsuperscript{20, 21} and community integration \textsuperscript{22, 23} outcomes after brain injury. Lazarus (1993) broadly defined coping as a person’s cognitive and behavioural efforts used to manage psychological stress\textsuperscript{62}. From a theoretical perspective,
coping is viewed as a constantly changing, dynamic process between the person and their environment\textsuperscript{63}. Environmental demands are subjectively evaluated as stressful when the stressor exceeds the individual’s capacity to manage the demands placed upon them. Subsequent to this appraisal, the individual determines what actions or coping strategies they will employ to reduce stress associated with situation\textsuperscript{64}. Based on the literature, coping strategies can be broadly classified as adaptive (problem-focused) or maladaptive (emotion-focused)\textsuperscript{20, 21, 65}. Problem-focused coping is characterized by strategies that actively seek a solution to a problem or stressful event. Problem-focused coping includes strategies such as defining the problem and, weighing and generating alternative solutions; these strategies are generally considered more analytic and cognitive in nature\textsuperscript{62, 63}. In contrast, emotion-focused coping is broadly considered a more maladaptive form of coping, whereby the individual manages stress through emotional reactions. Emotion-focused coping may be characterized by escape-avoidance behaviour, denial, wishful thinking, self-blame and substance abuse\textsuperscript{62, 63}.

Psychological disturbances such as depression and anxiety have been widely associated with maladaptive coping after brain injury\textsuperscript{20, 21, 65}. Avoidance behaviour, in particular, has not only been linked to depression and anxiety\textsuperscript{66}, but has also been denoted as the common underlying mechanism for maintaining psychological disturbances\textsuperscript{67}. Avoidance behaviour often leads to reduced activity levels, social isolation and a restricted lifestyle, which are the behavioral hallmarks of depression and anxiety\textsuperscript{68}.

**The Relationship between Coping and Emotional Distress after Brain Injury**

The relationship between maladaptive coping and emotional distress has been well documented in the literature. Finset and Andersson (2000) examined coping and symptoms of depression and apathy in a group of 70 ABI patients and compared them to a control group\textsuperscript{65}. The ABI group
consisted of brain injuries resulting from TBI, cerebrovascular accident (CVA) and hypoxia. In this study the COPE questionnaire was used to assess approach orientated (adaptive) versus avoidance orientated (maladaptive) styles of coping. The findings revealed a positive relationship between depression and avoidance coping. However, there were no significant differences found between coping and lesion location among the three subgroups. Based on these findings, the authors concluded that coping strategies were less dependent on the neuroanatomical aspects of brain injury and more dependent on psychological factors such as pre-morbid personality and repertoire of coping skills, although these results - null findings - must be interpreted with caution.

Curran and colleagues (2000) also examined coping strategy use and level of emotional distress in a group of severe TBI patients, comparing them to a group of patients with orthopedic injuries. In this study, coping was assessed using the Coping Scale for Adults (CSA) and depression and anxiety were measured with the Beck Depression Inventory (BDI) and the State-Trait Anxiety Inventory (STAI), respectively. The same pattern was observed within both the TBI and orthopedic injury groups: that patients with maladaptive coping styles reported significantly higher levels of depression and anxiety. To examine the influence of coping on emotional outcome, hierarchical regression models were performed. After controlling for age, injury type and level of handicap, these analyses revealed that coping strategies independently accounted for 38% of the variance in depression scores and 54% of the variance in anxiety scores. The two most influential coping strategies were non-productive coping (characterized by escape-avoidance behaviour and wishful thinking) and dealing with the problem (adaptive coping). Interestingly, the non-productive coping was found to be the most important contributor for predicting depression in their model. These data also mirror those of other studies illustrating that patients who engage in maladaptive coping behaviours are more likely to
suffer from depression and anxiety compared to those who employ more adaptive coping strategies\textsuperscript{2, 20, 21}.

\textit{Coping Strategy Selection and Executive Function after Brain Injury}

The literature illustrates that in people with and without brain injuries, there is a relationship between maladaptive coping and higher levels of emotional distress\textsuperscript{21}. However, brain injury survivors in particular may be more vulnerable to adopting a maladaptive style of coping due to impaired executive functioning\textsuperscript{69}. Recently, Krpan and colleagues (2007) examined the relationship between executive performance and coping in a group of TBI patients compared to a group of healthy controls\textsuperscript{69}. The results of their study revealed that poorer executive performance was associated with increased use of emotion-focused coping strategies in TBI patients. Conversely, higher executive performance was related to greater use of problem-focused coping\textsuperscript{69}. In the control group, no relationship between coping and executive performance was found. Although causality cannot be inferred conclusively from these correlations, these findings suggest that brain injury survivors could be more vulnerable to depression and anxiety because of their inability to cope, secondary to deficits in executive functioning. Thus, it is plausible that maladaptive coping may play a role in the development of depression and anxiety after brain injury. At the same time, greater use of adaptive coping strategies may buffer individuals from psychological distress, resulting in better adjustment and outcomes after injury. The implications of this study further suggest that ABI survivors may benefit from being taught better coping strategies, including actively engaging in the process of problem solving\textsuperscript{69}. 
Coping and Community Integration Outcomes after Brain Injury

Maladaptive coping is not only associated with higher levels of depression and anxiety, but has also been associated with community integration difficulties after brain injury. Dawson and colleagues (2006) found that brain injury survivors relying more heavily on maladaptive coping behaviours were less likely to return to productive activity, an important component of community integration. In this study, coping and community integration data was collected from 73 close friends and/or relatives of TBI survivors. Baseline and 6-month data were collected using the Coping with Health Injuries and Problems Scale (CHIP) and the productivity sub-score from the Community Integration Questionnaire (CIQ). Their findings showed that TBI survivors who increased their use of distraction and emotional preoccupation coping behaviours in the initial 6-months following their injury exhibited lower productivity scores, indicating that they were less likely to return to vocational activities. Somewhat surprisingly, there was no relationship between pre-injury coping behaviours and productivity status at 6-months post-injury. Planned hierarchical regression analyses were undertaken to identify the main contributors to outcome variance. While age and injury severity accounted for 10.5% of the outcome variance in productivity status at 6-months post-injury, maladaptive coping accounted for a substantially larger portion (22.3%).

In a similar study, Dawson and colleagues (2006) examined variables that influence return to productivity (RTP) following TBI. In this study, 46 people with TBI (on average 4.3 years post-injury) were examined and compared to 14 controls. Data on demographic variables, severity of injury, psychological variables (including coping and depression) and productivity status were collected. The authors reported that injury severity, coping, depression, as well as pain all contributed to productivity outcome variance. Among these variables, higher levels of depression and maladaptive coping were observed in the subgroup of participants identified as...
having “no return to productivity”\textsuperscript{23}. Overall, these findings suggest that maladaptive coping is negatively associated with community integration, at least within the productivity domain.

**Summary of Coping and Brain Injury**

Taken together, the aforementioned findings not only illustrate that maladaptive coping is associated with higher levels of emotional distress after ABI, but they also suggest that brain injury survivors may be at an increased risk for adopting a maladaptive style of coping due to executive dysfunction\textsuperscript{69}. Moreover, coping is an important correlate of outcome after brain injury and has been shown to be associated with an individual’s productivity status\textsuperscript{22, 23}. The relationship between coping on other community integration domains such as social engagement and participation in activities of daily living have yet to be investigated in the literature.

Based on the findings in the literature, it is evident that the relationships between emotional adjustment, coping and community integration are complex and multifaceted. Moore and Stambrook (1995) have presented a conceptual model for understanding how these variables may interact and affect one another in a directional and reciprocal manner\textsuperscript{40}.

**Moore and Stambrook’s Conceptual Framework (1995)**

Moore and Stambrook (1995) suggest that community integration and quality of life outcomes after brain injury are moderated by psychological variables\textsuperscript{40}. Specifically, their model suggests that the behavioural, cognitive, emotional and interpersonal consequences of brain injury contribute to higher levels of psychological distress and a poor selection of coping strategies, which in turn, adversely affect outcome\textsuperscript{40}. The pathway leading to outcomes is moderated by a group of psychological variables, including attribution style, locus of control and coping behaviours. Coping is not only a central component of their model, but is also identified as the
conduit leading to outcomes. Collectively, these variables are said to influence each other in a reciprocal manner.

Moore and Stambrook (1995) suggest that brain injury survivors are at increased risk for developing a self-limiting belief system, which causes the individual to over-generalize the effects of their injury. Specifically, dysfunctional thinking contributes to a pattern of learned helplessness and an external locus of control (i.e., feelings of low personal control over the environment), leading to higher levels of emotional distress, and a poor selection of coping strategies. Feedback loops are then generated back into the individual’s cognitive belief system and a ‘negative cycle’ is created between cognitive beliefs, coping and outcomes. Factors within the model such as cognitive beliefs and automatic thoughts are based upon the cognitive behaviour therapy framework (described below). Moore and Stambrook (1995) state that this interaction is also influenced by the cognitive, behavioural and emotional consequences of brain injury and pre-morbid variables such as personality, psychological status, education and vocational status. Their conceptual model not only explains the development and maintenance of emotional distress after ABI, but also explains the interaction between cognitive beliefs, coping and outcomes after injury. The clinical utility of their model is grounded in the identification of target variables such as cognitive beliefs and coping for research and clinical intervention. Moore and Stambrook (1995) propose that if improvements in mood and coping strategy selection can be facilitated, then higher levels of community integration and quality of life can be attained. Their model was designed to be applied within neuropsychological rehabilitation incorporating a cognitive behavioural treatment approach.
Cognitive Behaviour Therapy

Cognitive Behaviour Therapy (CBT) is a structured, time limited and collaborative form of psychological treatment that is based on Beck’s (1976) cognitive theory of depression⁷⁰. The CBT treatment model consists of thoughts (i.e. automatic thoughts), feelings and behaviours, which interact with each other in a reciprocal, causal and bi-directional manner. Beck (1976) defined thoughts as ‘automatic’ because they are said to occur automatically and without intention or conscious effort⁷⁰. Underlying the concept of automatic thoughts are schema or beliefs. A schema is defined as deep cognitive structure which is often developed in childhood and allows an individual to interpret their experiences in a meaningful way⁷¹. However, the schemas that we develop over time can be both adaptive and maladaptive, and sometimes a schema that had assisted us at one point in our lives, is no longer adaptive, especially after an injury or illness has occurred. Inherent to the CBT model is the idea that dysfunctional or distorted thinking is common to all psychological disturbances⁷². The basic premise of CBT is that changes in any one of these elements will subsequently produce changes in the other elements. The overall goal of therapy is to improve mood and functioning by modifying dysfunctional thoughts and behaviours using variety of therapeutic techniques. Interventions designed to modify dysfunctional behaviour and thoughts include, but are not limited to, activity scheduling (e.g. behavioural activation via the scheduling of pleasant and productive activities) and cognitive restructuring by means of using thought records (a tool used for identifying and evaluating the accuracy of automatic thoughts). Cognitive behaviour therapy also incorporates a variety other techniques including problem-solving skills training, exposure therapy, modeling and relaxation skills training among many more⁷¹-⁷³.

Cognitive behaviour therapy is the most empirically validated form of psychotherapy. Findings derived from randomized control trials provide support for the empirical validity of CBT,
demonstrating that CBT is as effective for the treatment of depression compared to pharmacotherapy\textsuperscript{74}. Cognitive behaviour therapy has been shown to be efficacious for the treatment of a variety of other psychiatric disorders. Butler and colleagues (2006) conducted a review of meta-analyses of CBT studies for sixteen different disorders\textsuperscript{75}. Their study employed stringent inclusion criteria limiting their review solely to randomized control trials. Results of their analysis revealed that CBT was highly effective for the treatment of depression, generalized anxiety disorder, post-traumatic stress disorder, panic disorder, and social phobia\textsuperscript{75}.

Importantly, meta-analytic evidence also demonstrated the \textit{long-term} effectiveness of CBT for a number of disorders including depression and anxiety. Specifically, there was robust and convergent evidence indicating that CBT was superior to pharmacotherapy for the maintenance of gains with relapse rates half those of medication for the treatment of depression and panic disorder\textsuperscript{75}.

In addition to being the empirically validated treatment of choice for a range of psychiatric disorders, there is an increasing amount of literature illustrating that CBT can be successfully adapted and applied to a diverse set of neurological and medical populations. For example, CBT interventions were found to be beneficial in the treatment of depression for Alzheimer’s\textsuperscript{76} and Multiple Sclerosis patients\textsuperscript{77, 78}, for improving coping skills and quality of life in breast cancer survivors\textsuperscript{79}, and for reducing pain and anxiety in orthopedic patients\textsuperscript{80}.

Although CBT is traditionally administered in an individual or group format, studies have shown promising findings for technology-based interventions, such as internet and telephone administered therapy\textsuperscript{77, 78, 81}. CBT administered remotely has recently received increased attention in the literature as a means of promoting greater accessibility to psychological interventions\textsuperscript{77}. Collectively, these studies demonstrate that CBT is a robust form of
psychotherapy that can be adapted for remote administration and to meet the unique needs of many diverse clinical groups. These findings are especially promising for ABI survivors who may otherwise be precluded from treatment due to their unique cognitive and emotional needs and/or due to accessibility barriers such as transportation and mobility\textsuperscript{17, 18}.

Finally, CBT has been shown to be a cost effective therapeutic intervention. In their review, Myhr and Payne (2006) showed that CBT is more cost effective than pharmacotherapy for the treatment of depression and anxiety\textsuperscript{82}. Despite these findings, pharmacological interventions continue to remain the standard for the treatment of mental health disorders in Canada\textsuperscript{82}.

\textit{Cognitive Behaviour Therapy for Acquired Brain Injury}

Despite the vast literature demonstrating the empirical validity of CBT, relatively few studies have focused on the development of a specific CBT intervention for improving mood and coping after brain injury\textsuperscript{19, 83-85}, and even fewer have investigated the generalization of treatment effects for broader rehabilitation outcomes such as community integration\textsuperscript{19}. Holistic therapeutic milieu programs incorporating a psychotherapy component to rehabilitation have been shown to be effective for improving functional outcomes after brain injury\textsuperscript{86-88}. However, the confounding effects of psychological treatment with additional rehabilitation therapies prevent us from drawing any firm conclusions regarding the effectiveness of the psychotherapeutic and/or CBT-based component of their programs. Among the studies that have examined the effectiveness of CBT as a stand-alone treatment for improving mood and coping, there have been mixed, albeit promising, findings.

Medd & Tate (2000) demonstrated the efficacy of a brief CBT program designed to improve anger management skills in a group of 16 ABI survivors\textsuperscript{83}. Participants in this study were
randomly allocated to either a waitlist control (N=8) group or CBT treatment group (N=8). The State and Trait Anger Expression Inventory (STAXI) was used to compare pre- to post-treatment changes in anger. In addition, the authors employed subsidiary measures to examine changes in depression and anxiety using the Hospital Anxiety and Depression scales (HADS), as well as measures for self-esteem and self-awareness. Participants in the CBT program demonstrated a significant improvement on the STAXI compared to the waitlist control group. Retention of benefits was observed at the 2-month follow-up. Unfortunately, treatment effects did not generalize to measures of depression, anxiety, self-esteem or awareness. Although this study provides support for the use of CBT to improve anger management after brain injury, the durability of effects was not examined beyond 2 months post-treatment. Thus, we are unable to determine if ABI survivors are able to retain the benefits of treatment over the longer-term.

In another study, Anson & Ponsford (2006) evaluated the effectiveness of a CBT-based coping skills intervention for 31 individuals with TBI. The intervention was designed to improve both coping strategy selection and emotional adjustment. Following treatment, participants demonstrated a significant improvement in adaptive coping. However, these treatment effects were not sustained at a 5-week follow-up assessment. Interestingly, participants exhibited improvements in adaptive coping at long-term follow-up (6- to 24-months). However, this may have been a consequence of the natural recovery process rather than intervention (as more than half the sample were less than a year post-injury at the time of intervention). On the other hand, the findings may also reflect the need for the passage of time for the full benefits of treatment to manifest. Additionally, no significant changes in mood or non-productive (maladaptive) coping were observed subsequent to the treatment. The failure to demonstrate treatment effects on mood measures may be attributed, in part, to the study’s inclusion criteria, whereby clinically elevated levels of depression and anxiety were not considered a pre-requisite
for study participation. Despite this weakness, this study lends support for using CBT to enhance adaptive coping skills after brain injury.

In an investigation conducted by Hodgson et al. (2006), the efficacy of CBT for treating social anxiety following ABI was examined. In this study, 12 ABI subjects (including patient with injuries resulting from TBI, anoxia and cerebral edema) were randomly assigned to either a CBT treatment group (N=6) or a wait list control condition (N=6). Compared to the waitlist control group, the participants in the treatment group demonstrated a significant improvement in general anxiety, depression and transient anxiety (i.e. feelings of tension and restlessness). Interestingly, the authors failed to demonstrate treatment effects for social anxiety and self-esteem, although trends toward improvement were observed over time for the treatment group. Despite the latter observation, this study did suggest that CBT designed to target social anxiety after ABI results in global improvements in mood. Treatment benefits were also maintained at 1-month follow-up. Unfortunately, long-term maintenance of gains was not examined and generalizability of the findings were limited by the small sample size.

Recently, Bradbury and colleagues (2008) examined the efficacy of an adapted CBT protocol designed to improve mood and coping in a group of 20 moderate to severe ABI survivors. Participants in this study were assigned to either a CBT treatment group or an ABI educational control group (i.e. waitlist group). In the treatment group, participants received 11 weeks of CBT delivered in either a face-to-face group format (G-CBT; N=5) or delivered individually over the telephone (T-CBT; N=5). Similarly, in the waitlist education control groups, 11 weeks of general brain injury education was delivered in either a group format (G-Ctrl; N=5) or over the telephone (T-Ctrl; N=5). The study design not only enabled the authors to compare the overall efficacy of CBT, but also allowed for the determination of the effectiveness of CBT delivered in a group versus telephone format. Post-treatment and follow-up performances on
the Global Severity index (GSI) of the Symptom Checklist-90-revised (SCL-90-R), the Depression, Anxiety Stress Scales-21 (DASS-21), the Community Integration Questionnaire (CIQ) and the Ways of Coping Questionnaire revised (WOC-R) were examined. The results revealed a significant reduction in emotional distress (in both group and telephone formats) from pre- to post- treatment on both DASS-21 and SCL-90-R measures\(^1\). Treatment effects on the DASS-21 and SCL-90-R were sustained at the 1-month follow-up. No significant improvements were observed in the control groups (T-Ctrl and G-Ctrl). On the other hand, no significant changes in the treatment groups were observed for community integration or maladaptive coping (escape-avoidance coping), although trends were observed in the expected directions. While there were no differences between the treatment and control group for problem-focused coping, surprisingly, both groups demonstrated post-treatment improvements\(^1\). Follow-up assessments were not conducted for community integration and coping, and thus, provide the foundation for the studies conducted within the current thesis.

Although the generalizability of these findings are limited by the study’s small sample size, the results are nonetheless compelling and provide support for the efficacy of CBT for treating emotional distress after brain injury. The failure to yield treatment effects on coping and community integration outcomes may be attributed to the fact that these variables require a longer period of time to exhibit change. For example, it may be unreasonable to expect participants to change their coping repertoire, find a job or to increase their level of social engagement within the limited timeframe between their pre- and post- treatment assessments. These changes would logically occur more gradually over time, as supported by the findings of Anson and Ponsford\(^8\).

Collectively, these studies demonstrate the short-term effectiveness of CBT for improving mood and coping after brain injury. However, these studies have also highlighted the importance of
longitudinal follow-up within experimental designs. To date, the maintenance of gains and stability of treatment effects have largely been an uninvestigated area for ABI\textsuperscript{85}. Moreover, the generalization of treatment effects on community integration outcomes over the longer term have yet to be elucidated.

**Summary of Literature Review**

This chapter has synthesized findings from a variety of published research studies enabling us to draw an overall picture of how emotional sequelae and coping strategy selection can impact recovery and community integration after brain injury. Moore and Stambrook (1995) have provided us with a model for understanding the complexity of how these variables may interact with one another, and in particular, the putative impact of coping and cognitive beliefs on adjustment and community integration after injury\textsuperscript{40}. Critically, the literature highlights the need to develop more effective treatments for managing psychological distress and improving coping after brain injury in order to maximize community integration outcomes.

Over the last decade, a small body of literature providing empirical support for using CBT to improve mood and coping after brain injury has emerged\textsuperscript{19, 83-85}. The findings have largely supported the short-term efficacy of these interventions. However, with the exception of Anson & Ponsford (2006)\textsuperscript{85}, these studies have failed to address the most important indicator of therapeutic success, the long-term retention of benefits. For these findings to be of maximal clinical value, long-term efficacy must be assessed in order to gain an understanding of whether treatment effects are maintained overtime without support or whether supports are needed to enable benefits to endure, and if so, what types. Moreover, in the absence of long-term outcome data, it may not be possible to determine whether CBT has an impact on coping and
community integration; as previously noted, changes in these variables may occur more gradually, over the longer term.

In view of these findings, the primary aims of this thesis were to examine the long-term efficacy of CBT for emotional distress, and to investigate longitudinal changes in coping and community integration subsequent to CBT intervention.
CHAPTER 3: MANUSCRIPT 1

Examining the Efficacy of a Cognitive Behaviour Therapy Protocol Adapted for Acquired Brain Injury at 6-Months Post-Treatment

ABSTRACT

Objectives: The primary objective of the current study was to evaluate the long-term benefits of cognitive behaviour therapy (CBT) for patients with acquired brain injury (ABI) at 6-months post-cessation of treatment. A secondary objective was to compare the long-term effectiveness of CBT administered in either a face-to-face group format (G-CBT) or individually over the telephone (T-CBT).

Design: The study design was longitudinal, with a within-subjects factor (time: pre-treatment vs. 6-month follow-up) and a between subjects factor (group: G-CBT vs. T-CBT).

Setting: Outpatient, community brain injury centre.

Participants: Seventeen participants with moderate to severe acquired brain injury.

Intervention: All participants received eleven sessions of CBT delivered in either a face-to-face group format (G-CBT: N=10) or individually over the telephone (T-CBT: N=7). For the current study, CBT was adapted (1) to accommodate individuals with cognitive impairments and (2) for telephone administration to increase service accessibility for participants with mobility restrictions and/or geographical remoteness.

Outcome Measures: The Symptom Checklist-90-Revised (SCL-90-R), Global Severity Index (GSI), and the Depression Anxiety Stress Scales-21 (DASS-21) were used to examine changes in psychological distress over time.
**Results:** A significant reduction in psychological distress with large effect sizes was observed at 6-months post-cessation of treatment relative to baseline on both the SCL-90-R ($t_{16}= 6.22$, $p<.000$, Cohen’s $d=1.35$) and DASS-21 ($t_{16}= 4.57$, $p<.000$, Cohen’s $d=1.06$). Subgroup analyses revealed that both G-CBT and T-CBT also showed significant benefits of treatment with large effect sizes at the 6-month follow-up on SCL-90-R ($t_9= 4.71$, $p<.000$, Cohen’s $d=2.87$) and ($t_6= 3.83$, $p<.01$, Cohen’s $d=2.40$), respectively. Similarly, on the DASS-21 measure, both subgroups demonstrated a significant reduction in distress from pre-treatment to 6-months follow-up with large effect sizes: G-CBT ($t_9= 4.12$, $p<.000$, Cohen’s $d=1.85$) and T-CBT ($t_6= 2.22$, $p=.05$, Cohen’s $d=1.27$).

**Conclusions:** The benefits of CBT adapted for ABI can be maintained up to at least 6-months post-cessation of treatment. Both face- to- face and telephone administered therapy produce lasting benefits.

**INTRODUCTION**

Acquired brain injury (ABI) is associated with long-term cognitive, physical, behavioural and emotional consequences\(^1\). Over time, it is the psychological impact of ABI that has been described as being more disabling than the cognitive or physical sequelae \(^5, 6\), having a profound and negative impact on recovery \(^7-9\) and quality of life \(^13\). Numerous studies have shown that psychological distress, and in particular depression and anxiety, are highly prevalent after ABI, and symptomatology often persists for many years post-injury \(^15, 16\).

While the focus of rehabilitation is traditionally centered on treating the physical and cognitive aspects of brain injury, psychological care is typically limited\(^2-4\). Moreover, there is a lack of empirical evidence demonstrating the long-term effectiveness of psychological treatment for
brain injury survivors. The slow progression of research may, in part, be attributed to the complex needs of people with brain injury, whereby the cognitive and behavioural sequelae are viewed as obstacles for engaging in traditional psychotherapy.

Cognitive behaviour therapy (CBT) has been proposed as an appropriate psychological treatment for ABI because of its structured format, flexibility and extensive range of therapeutic techniques. The functional components of CBT not only enable the therapist to accommodate for individual differences, but also allow for the adaptation of treatment for patients with cognitive impairment\(^89, 90\). CBT-based treatments have been incorporated within many holistic milieu rehabilitation programs such as those proposed by BenYishay et al\(^87, 91\), Prigatano\(^88\) and Tiersky et al\(^86\). While there is evidence that such holistic approaches can enhance rehabilitation outcomes, the confounding effects of CBT treatment with additional cognitive remediation and rehabilitation interventions prevent us from drawing any firm conclusions regarding the effectiveness of the CBT component of treatment.

To date, few studies have attempted to empirically evaluate the efficacy of a specific CBT intervention with mixed, albeit promising, findings for the short-term effectiveness of CBT treatment for ABI\(^19, 83-85\). However, the majority of these studies failed to incorporate longitudinal follow-up within their experimental designs, and thus, have not examined arguably the most important indicator of therapeutic success: the long-term retention of benefits\(^19, 83, 84\). Among these, Bradbury et al. (2008) demonstrated the short-term efficacy of a CBT protocol intended to reduce psychological distress and adapted to meet the unique cognitive and emotional needs of ABI\(^19\). This intervention, administrable by telephone, was also designed to
address the challenges of inaccessibility of psychological services for ABI survivors, such as geographical remoteness, mobility restrictions and transportation barriers\textsuperscript{17,18}. The efficacy of the intervention was demonstrated for a conventional face-to-face group modality as well as a teletherapy modality up to one month post-treatment. However, the study did not examine long-term retention of benefits. In the absence of long-term follow-up, we cannot determine whether the effects of this treatment were enduring. Accordingly, the objectives of the current study were to extend the findings of Bradbury and colleagues (2008) by examining the long-term maintenance of CBT treatment effects. We additionally sought to compare the long-term effectiveness of CBT administered in a group format (G-CBT) with CBT administered individually over the telephone (T-CBT). In the current study, the same population of patients examined in Bradbury et al, plus a further seven (education waitlist control patients) were administered CBT and followed longitudinally. It was hypothesized that the effects of CBT treatment would be enduring at 6-months post-cessation of treatment and that there would be stability of benefits, that is, no loss of improvement from immediately post-treatment to 6-month follow-up. We also hypothesized that treatment gains would be sustained and stable in both treatment modalities at 6-months follow-up, with the magnitude of enduring benefits comparable for the two groups.

**METHODS**

**Participants**

The study sample consisted of 17 participants with moderate to severe, chronic ABI. Participants were recruited from Peel Halton Acquired Brain Injury Services (PHABIS), a large non-profit community ABI service provider that is funded by the Ministry of Health, Long Term Care in Ontario, Canada. Twenty-nine patients were approached to participate in the study.
based on a known history of mood disturbance of which 20 met operationally defined mood cut-off criteria on the SCL-90-R (described below) and consented to participate\textsuperscript{19}. The study was conducted in accordance with the human ethics standards and received approval from the ethics committee from the Toronto Rehabilitation Institute. All participants provided informed, written consent.

All 17 participants in the current study were part of the Bradbury et al\textsuperscript{19} study investigating the short-term efficacy of adapted CBT\textsuperscript{19}. Ten participants had received their CBT treatment as part of the experimental group of Bradbury et al\textsuperscript{19}, and seven subjects came from the waitlist, education control group. (There were a total of 10 waitlist participants. Two declined CBT due to the time commitment of the study; the third was ineligible due to participation in an individual psychotherapy program). Those from the waitlist education cohort received treatment approximately 5-months after the original experimental cohort; they also received 11 sessions of ABI education prior to CBT treatment (See Figure 1).

Inclusion criteria were: (1) elevated level of psychological distress, operationally defined as one standard deviation or more above the mean (i.e., a T-score \( \geq 60 \)) on the Global Severity Index (GSI) of the Symptom Checklist -90-Revised (SCL-90-R), which placed individuals in 84\textsuperscript{th} percentile or within the high-average range of scores for psychological distress using community outpatient normative data\textsuperscript{92}, (2) a medically diagnosed ABI, (3) greater than 1-year post-injury, (4) between the ages of 18 and 65, (5) on a stable dosage of psychoactive medication and, (6) in the moderate to severe range of severity for ABI. This was operationally defined for TBI participants (N= 9) by an initial GCS score of 12 or less and/or positive neuroimaging and/or moderate to severe cognitive impairments in at least one cognitive domain as measured by Repeatable Battery of Adult Neuropsychological Status (RBANS). For patients
with non-traumatic injuries, (N=8), this was operationally defined as moderate or severe impairments in at least one cognitive test domain on the RBANS and/or an inpatient rehabilitation stay at least double the provincial average, which was 27 days. As well, all participants (necessarily) were eligible for ongoing, outpatient ABI services.

Participants were excluded if they were: (1) endorsing significant suicidal ideation at the time of assessment based on clinical interview and assessment using the SCL-90-R, (2) currently receiving psychological treatment from another source (not including case management support, social work support and monthly neuropsychiatry follow-up for monitoring of medications), (3) had a concurrent neurological disorder (e.g., multiple sclerosis) or psychotic disorder (e.g., schizophrenia) or (4) had a diagnosed communication disorder (e.g., aphasia) that would preclude them from participating in treatment.

All demographic and injury-severity information was ascertained through clinical interview and review of medical records. As can be seen in Table 1, the overall sample was an average 43 years of age and almost 10 (9.65) years post-injury. The number of male and female participants and traumatic vs. non-traumatic injuries were equal. On average, the group’s psychological distress was a mean T-score of 70.71 (SD= 7.59) on the GSI subscale of the SCL-90-R. (Significance testing for the two cohorts is discussed in the Results section.)
Table 1. Demographic and injury variables for the entire CBT group and for those drawn from the Experimental and Waitlist control groups from Bradbury et al (2008)^19

<table>
<thead>
<tr>
<th></th>
<th>All participants</th>
<th>Experimental group</th>
<th>Waitlist control group</th>
<th>Experimental vs. Waitlist Control Cohorts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(N=17)</td>
<td>n=10</td>
<td>n=7</td>
<td>t(15)/P/ES (Cohen’s D)</td>
</tr>
<tr>
<td>Age</td>
<td>42.94 ± 11.23</td>
<td>39.80 ± 10.44</td>
<td>47.43 ± 11.53</td>
<td>-1.42/.17 (NS)</td>
</tr>
<tr>
<td>Sex (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>9(53%)</td>
<td>5(50%)</td>
<td>4(57%)</td>
<td>X²=.01/1.00 (NS)</td>
</tr>
<tr>
<td>Years of Education</td>
<td>12.71 ± 1.57</td>
<td>12.90 ± 1.73</td>
<td>12.43 ± 1.40</td>
<td>.59/.56 (NS)</td>
</tr>
<tr>
<td>Years Post-injury</td>
<td>9.65 ± 8.35</td>
<td>7.00 ± 6.15</td>
<td>13.43 ± 10.05</td>
<td>-1.64/.12 (NS)</td>
</tr>
<tr>
<td>Injury Type</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trauma, N (%)</td>
<td>9(53%)</td>
<td>6(60%)</td>
<td>3(43%)</td>
<td>X²=.48/.63 (NS)</td>
</tr>
<tr>
<td>Non-Trauma, N (%)</td>
<td>8(47%)</td>
<td>4(40%)</td>
<td>4(57%)</td>
<td></td>
</tr>
<tr>
<td>RBANS</td>
<td>70.65 ± 15.18</td>
<td>69.10 ± 15.62</td>
<td>72.14 ± 15.43</td>
<td>-.49/.63 (NS)</td>
</tr>
<tr>
<td>WTAR</td>
<td>97.82 ± 12.70</td>
<td>95.40 ± 11.58</td>
<td>101.29 ± 14.32</td>
<td>-.93/.36(NS)</td>
</tr>
<tr>
<td>SCL-90-R (GSI)</td>
<td>70.71 ± 7.59</td>
<td>69.70 ± 7.71</td>
<td>72.14 ± 7.75</td>
<td>-.64/.53 (NS)</td>
</tr>
</tbody>
</table>

**Abbreviations:** RBANS, Repeatable Battery of Adult Neuropsychological Status; ES, effect size; SCL-90-R (GSI), Symptom Checklist-90-Revised, Global Severity Index; WTAR, Wechsler Test of Adult Reading
Materials

*Repeatable Battery of Adult Neuropsychological Status (RBANS)*

The RBANS is a brief neuropsychological assessment tool that is used to evaluate performance across a range of cognitive variables: attention, speed of processing, visuospatial/constructional abilities, immediate and delayed memory and language. The psychometric properties of the RBANS’ subscales have been well established with other neuropsychological measures such as the Judgment of Line Orientation (JOLO), the Controlled Oral Word Association Test (COWAT) and the Boston Naming Test (BNT). Moreover, the RBANS Total Score has been shown to correlate with the Full Scale IQ from the WAIS-R. Although originally designed as a psychological screening tool for dementia, the RBANS has been shown to be a reliable and valid measure of cognitive abilities for the traumatic brain injury and stroke populations.

*Wechsler Test of Adult Reading*

The WTAR is a 50-item, single word reading test that provides an estimate of pre-morbid intelligence based on an individual’s reading level. The WTAR was designed and co-normed with the Wechsler Adult Intelligence Scale -III (WAIS-III) and the Wechsler Memory Scale (WMS-III). The prediction intervals for both WMS-III and the full scale intelligence quotient (FSIQ) have been shown to be within a 95% level. In addition, validation studies have demonstrated that the WTAR is a reliable and valid tool for estimating pre-morbid intelligence after TBI.

*CBT Protocol*

The adapted CBT protocol is described by Bradbury et al. (2008). The protocol adhered to proven and standardized CBT procedures and incorporated specific adaptations recommended in
the literature to meet the unique cognitive and emotional needs of ABI survivors\textsuperscript{89, 90}. These adaptations included: the use of ABI specific case examples, repetition of materials, the use of summarization, simplified language and homework prompts and reminders. In addition, the rate of speech at which the material was delivered was taken into account and breaks were also offered throughout the session to accommodate for attentional deficits and/or fatigue. Each participant received a CBT workbook, which was used as a session-by-session guide, modeled after Greenberger & Padesky’s (1995) Mind Over Mood protocol\textsuperscript{99}. The workbook contained course material, homework assignments and ABI specific case examples. The facilitators also used the Mind Over Mood Clinician’s handbook as facilitation guide for therapy sessions\textsuperscript{73}. Neuropsychological performance reviews using the RBANS further allowed the authors to make individual adaptations based on subscale scores, thus enabling the identification of individual cognitive strengths and weaknesses. Examples of these additional adaptations included the tailoring of individual homework assignments and the use of multimodal teaching approaches during therapy sessions. For example, material was presented both verbally and visually using a whiteboard in the CBT group or by using visual references within the workbook for teletherapy participants.

CBT treatment was provided by a combination of two licensed psychologists, a clinical psychology PhD student in the final year of their program and a master’s student who had received training in CBT, including the completion of a CBT certificate program offered jointly from the Centre of Addition and Mental Health and the University of Toronto. Both graduate students were closely monitored and supervised by the primary study psychologist to ensure adherence and competence to which CBT was delivered.
**Outcome Measures**

**Symptom Checklist-90-Revised (SCL-90-R)**

The SCL-90-R is a 90-item self-report questionnaire that is used to assess a range of psychological symptoms. The inventory has been widely employed to examine the impact of psychotherapeutic treatment in both research and in clinical practice\(^{92, 100, 101}\). The inventory has 9 symptom scales including: depression, anxiety, obsessive-compulsive, hostility, psychoticism, somatization, inter-personal sensitivity, phobic anxiety and paranoid ideation. In addition to these scales, the SCL-90-R also includes three global indices, including a Global Severity Index (GSI). The GSI subscale is specifically designed to measure an individual’s overall level of emotional distress. The SCL-90-R has acceptable psychometric properties and has been shown to be both a valid and reliable psychological measure\(^{102}\). Internal consistency coefficients for the depression and anxiety subscales of the SCL-90-R subscales range from .85 for anxiety to .90 for depression. Test-retest reliability coefficients are also within the acceptable for the depression (.75) and anxiety (.80) subscales, respectively. Validation studies for the SCL-90-R have demonstrated strong convergent validity with a number of psychological measures including dimensions of the MMPI\(^{102}\) and the General Health Questionnaire (GHQ)\(^{103}\). In addition, studies have supported the use of the SCL-90-R as a measure of psychological distress among the brain injury population\(^{104}\). In the present study, the GSI was employed as our primary outcome measure to examine therapeutic impact and changes in levels of psychological distress over time. The GSI index also enabled us to draw comparisons across individuals with differing diagnoses (e.g., depression vs. anxiety).

**Depression Anxiety Stress Scales-21 (DASS-21)**

The DASS-21\(^{105}\) is a brief 21-item questionnaire that is comprised of three subscales; depression, anxiety and stress. The instrument also includes a total score, which provides a
measure of an individual’s overall level of psychological distress. The DASS-21 has sound
psychometric properties providing support for its clinical utility as measure of psychological
distress\textsuperscript{106}. The DASS-21 subscales have adequate reliabilities with an alpha of .85 for
Anxiety, .88 for Depression, .90 for Stress and .93 for the Total Score\textsuperscript{106}. In addition, the
DASS-21 subscales have good convergent and discriminate validity with other measures of
depression and anxiety such as the Hospital Anxiety and Depression Scales (HADS)\textsuperscript{106}. In the
present study, the DASS-21 Total Score was employed as a secondary outcome measure to
examine changes in mood over time. Similar to the GSI, the DASS-21 Total Score also allowed
us to draw comparisons across individuals with differing diagnoses (e.g., depression vs.
anxiety).

**Design**

The study employed a longitudinal design with a within-subjects factor (pre-treatment vs. 6-
month follow-up) and a between-subjects factor (T-CBT vs. G-CBT). The dependent variables
were DASS-21 and SCL-90-R, GSI scores for the total group as well as for the T-CBT and G-
CBT sub-groups.

**Procedures**

10 participants that had already received their CBT treatment and post-treatment follow-up as
part of the Bradbury et al study\textsuperscript{19}. The seven participants from the waitlist control received their
treatment in the current study. All participants (both cohorts) were assigned to one of two
treatment groups: G-CBT or T-CBT. Of those participants from the Bradbury et al\textsuperscript{19} study who
had already received treatment, 5 had been assigned in that study to the G-CBT subgroup and 5
to the T-CBT subgroup. From the waitlist control group, 5 of the 7 subjects were assigned to G-CBT and 2 to the T-CBT subgroup. Thus, a combined total of seventeen participants received CBT, 10 in G-CBT and 7 in the T-CBT subgroup. Figure 1 illustrates a flowchart of participants and procedures.

Participants were assigned to the CBT subgroups on the basis of logistical considerations such as geographical proximity to the organization where the groups were being held (PHABIS) and/or having access to reliable transportation for group attendance. In general, participants who resided farthest away from PHABIS or did not have access to reliable transportation were assigned to the T-CBT group.

The intervention procedures and the procedures immediately following treatment employed in this study were identical to those described by Bradbury and colleagues (2008), as follows: Prior to treatment, all participants completed the SCL-90-R and DASS-21; the RBANS and the WTAR; and, two additional measures (not discussed in this paper). Immediately, following completion of the pre-treatment assessment, all participants received 11 sessions of CBT delivered in either a face-to-face group format or individually over the telephone. The first session for all participants was conducted individually 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. The sessions ranged from 45 minutes to 90 minutes depending on the needs of the client and/or administration modality (group versus individual therapy). In general, the G-CBT groups tended to run longer than the T-CBT sessions to accommodate and address all participants’ needs. At the beginning of each session, participants completed the DASS-21 to monitor their
mood and progress over time. Following completion of their eleventh session, participants completed a post-treatment battery consisting of the SCL-90-R and DASS-21.

The primary difference between this study’s procedures and those of Bradbury et al\textsuperscript{19} was that the current study entailed the re-administration of the primary outcome measures at 6-months (See Figure 1) following cessation of treatment in order to assess retention and stability of benefits.\textsuperscript{1}

\textsuperscript{1} Note that Bradbury et al\textsuperscript{19} also employed a 1-month follow-up assessment using the DASS-21 and the SCL-90-R. The 1-month follow-up was not measured in the current study.
Figure 1: Study procedure and participant flowchart
Statistical Analyses

Data Processing

Data for the larger CBT group and the two subgroups were checked for normality, skewness and kurtosis for the SCL-90-R, the DASS-21, the RBANS and the WTAR. All data were normally distributed with no significant skewness or kurtosis. No outliers were identified, and all participant data were included in analyses.

Justification of collapsing cohorts (i.e., Bradbury et al. Experimental and Waitlist Education Control groups)

Demographic and injury severity variables of the two cohorts of patients were compared using unpaired t-tests and chi-square analyses. It was also important to demonstrate that the groups did not differ significantly with regard to potential to benefit from treatment. Thus, paired t-tests on the primary outcome measures (DASS-21 and SCL-90-R) from pre-treatment to post-treatment were conducted on each cohort separately to ensure that both benefitted significantly from treatment.

Comparison of G-CBT and T-CBT subgroups

To also ensure that the CBT sub-groups (G-CBT vs. T-CBT) were similar, demographic variables, neuropsychological test results and SCL-90-R scores were compared prior to treatment using independent t-tests and chi-square analyses.

Hypothesis 1

To confirm Hypothesis 1, concerning the long-term efficacy of the adapted CBT protocol, paired t-tests were conducted from pre-treatment to 6-months follow-up for both SCL-90-R and DASS-21 measures.
To examine the stability of treatment effects over time, paired t-test analyses were conducted between post-treatment scores and 6-month follow-up scores. The stability of treatment effects would be illustrated by no significant differences on either the SCL-90-R or DASS-21 with small effect sizes.

**Hypothesis 2**

To confirm Hypothesis 2 that both CBT subgroups would demonstrate commensurate treatment effects, a 2 by 2 group (T-CBT vs. G-CBT) x time (pre-treatment vs. 6-months follow-up) repeated measures ANOVA was conducted for both SCL-90-R and DASS-21. Support of the hypothesis would be (1) an absence of a group and a group by time interaction on the ANOVAs, and (2) planned comparisons for each of the subgroups (comparing pre-treatment to 6-month follow-up) showing significant reductions in distress. Independent t-tests examining change scores between the G-CBT and T-CBT subgroups from pre-treatment to 6-month follow-up were also undertaken to directly compare change over time; here, support for the hypothesis would be no significant difference in change scores between the two groups and small effect sizes differences.

**RESULTS**

**Collapsing of Cohorts**

Table 1 illustrates that the two cohorts were similar with respect to gender distribution and type of injury. There were no significant differences between the groups on age, years post-injury, education level, pre-morbid IQ, RBANS or on pre-treatment SCL-90-R scores. However, the effect size difference for the two groups was large for age and years post-injury, with the waitlist control group older and further from injury on average. On the Wechsler Test of Adult Reading (WTAR), the effect size difference was moderate with the waitlist group scoring higher
than the experimental group. The differences on the SCL-90-R and RBANS were small, however.

Table 2 presents the means T-scores on the primary outcome measures. On the SCL-90-R, a significant reduction in distress was observed from pre-treatment to post-treatment for both the original Experimental group ($t_9 = 4.12$, $p<.01$, 1-tailed, Cohen’s $D = 1.85$) and the Waitlist education control group ($t_6 = 3.80$, $p < .01$, 1-tailed, Cohen’s $D = 2.03$) cohorts.

On the DASS-21, significantly reduced levels of distress from pre-treatment to post-treatment were also observed for both the Experimental ($t_9 = 5.69$, $p<.000$, 1-tailed, Cohen’s $D = 2.56$) and Waitlist ($t_9 = 3.06$, $p<.00$, 1-tailed, Cohen’s $D = 2.29$) cohorts of treatment.
Table 2: Mean SCL-90-R and DASS-21 scores at pre-treatment and post-treatment for cohorts of treatment [Experimental (Cohort 1) and Waitlist (Cohort 2) subgroups]

<table>
<thead>
<tr>
<th></th>
<th>SCL-90-R (Mean ± SD)</th>
<th>Total DASS-21 Scores (Mean ± SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-Treatment</td>
<td>Post-Treatment</td>
</tr>
<tr>
<td>Experimental Group</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Cohort 1)</td>
<td>69.70 ± 7.7</td>
<td>58.60 ± 9.3</td>
</tr>
<tr>
<td>Waitlist Group</td>
<td>72.14 ± 7.8</td>
<td>61.86 ± 10.8</td>
</tr>
<tr>
<td>(Cohort 2)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Collectively, these data demonstrate that the two cohorts of CBT treatment were not significantly different in terms of demographic and injury severity variables and that both subgroups were amenable to CBT intervention. Therefore, we considered it justifiable to collapse the cohorts. All results reported henceforth are for both cohorts combined.

**Pre-treatment Analysis between G-CBT and T-CBT subgroups**

There were no significant differences observed between the G-CBT and T-CBT subgroups on demographic or injury variables of age ($t_{15}=1.08$, $p=.29$ NS, 2-tailed, Cohen’s $d=.55$), gender ($X^2=.01$, $p=.65$, NS), years of education ($t_{15}=-.32$, $p=.75$ NS, 2-tailed, Cohen’s $d=-.16$), years post-injury ($t_{15}=.70$, $p=.44$ NS, 2-tailed, Cohen’s $d=.36$) or type of injury sustained ($X^2=.08$, $p=.58$, NS). Although, a moderate effect size was observed for age, with the G-CBT group being on average, 6 years older than the T-CBT group. On neuropsychological and psychological variables, no significant differences were observed on the RBANS ($t_{15}=.79$, $p=.44$ NS, 2-tailed, Cohen’s $d=.40$), WTAR ($t_{15}=-.62$, $p=.58$ NS, 2-tailed, Cohen’s $d=.32$), nor on the SCL-90-R ($t_{15}=.57$, $p=.58$ NS, 2-tailed, Cohen’s $d=.29$).

**Hypothesis 1: Long-term Efficacy of CBT and Stability of Treatment Gains**

Paired t-test analyses revealed a significant reduction in distress from pre-treatment to 6-months follow-up on both SCL-90-R ($t_{16}=6.22$, $p<.000$, 1-tailed, Cohen’s $D=1.60$) and DASS-21 ($t_{16}=7.32$, $p<.000$, 1-tailed, Cohen’s $D=1.78$) measures. These findings support the first hypothesis regarding the efficacy of adapted CBT treatment at 6-months post-cessation of treatment.
Figure 2 illustrates mean T-score reductions on the SCL-90-R, GSI from pre-treatment to 6-months follow-up. As illustrated, the participants demonstrated an average reduction of 1.5 standard deviations on the GSI (from > 84th to 55th percentiles) from pre-treatment to 6-months follow-up. Inspection of these data revealed that 11 (65%) of the 17 participants showed a reduction of psychological distress greater than or equal to 1 standard deviation unit.

Figure 3 illustrates the mean Total DASS-21 scores across time. Participant scores, on average, decreased from the moderate range of distress at pre-treatment to the borderline normal-to-mild range at 6-months follow-up. In total, 65% (N=11) of the participants’ scores fell within the normal range at 6-months follow-up compared to 18% (N=3) at pre-treatment and 70% (N=12) at post-treatment.

With regard to the stability of these findings over time, paired t-tests demonstrated no significant differences between post-treatment and 6-month follow-up scores on the SCL-90-R, GSI, (t_{16} = 1.63, p = .12, 2-tailed), although a medium effect size was observed (Cohen’s d=0.55). These data support the hypothesis that stability would be observed from post-treatment to long-term follow-up. Interestingly, the medium effect size difference represents some degree of continued psychological improvement after cessation of treatment.

In contrast to the above findings, the stability of treatment effects were not observed on the DASS-21, whereby a significant increase in psychological distress from post-treatment to the 6-month follow-up (t_{16} = -2.83, p<.05, 2-tailed, Cohen’s d=-0.30) was observed, though with a small-to-medium effect size. Inspection of these data revealed that 8 (47%) of the 17 participants showed an increase in DASS-21 Total score of 10 points or greater (see Figure 3).
A detailed inspection of the SCL-90-R subscales was undertaken to identify whether any or all of the subscales were driving long-term improvements observed on the GSI. All 9 subscales demonstrated a reduction from pre-treatment to post-treatment of 0.6 of a standard deviation or greater. From pre-treatment to 6-months follow-up, 8 of the 9 subscales, including both depression and anxiety exhibited a reduction of at least 1 standard deviation unit or greater, with the exception of somatization where no further gains were attained after the end of treatment.

An examination of the DASS-21 subscales was also carried out to investigate the instability of the findings observed from post-treatment to 6-months follow-up. From post-treatment to 6-months follow-up, a notable increase in the anxiety and stress subscales were evident, while the depression subscale exhibited greater stability over time. Table 3 illustrates mean DASS-21 subscale scores across time.
Table 3: Mean DASS-21 subscale scores at pre-treatment, post-treatment and 6-months follow-up (N=17)

<table>
<thead>
<tr>
<th></th>
<th>Depression</th>
<th>Anxiety</th>
<th>Stress</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pre-Treatment</strong></td>
<td>18.47 ± 11.24</td>
<td>10.60 ± 6.66</td>
<td>18.82 ± 8.15</td>
</tr>
<tr>
<td><strong>Post-Treatment</strong></td>
<td>8.24 ± 7.50</td>
<td>3.41 ± 3.40</td>
<td>8.24 ± 9.16</td>
</tr>
<tr>
<td><strong>6-Month Follow-up</strong></td>
<td>8.47 ± 8.50</td>
<td>6.35 ± 6.20</td>
<td>10.94 ± 9.30</td>
</tr>
</tbody>
</table>
Hypothesis 2: Comparing the effectiveness of CBT delivered in a face-to-face group format (G-CBT) versus CBT delivered individually over the telephone (T-CBT)

In addition to the findings for all subjects combined, Figures 2 and 3 also illustrate mean SCL-90-R T-scores and mean Total DASS-21 scores over time for the G-CBT and T-CBT subgroups, respectively. As hypothesized, on the 2 by 2 group x time repeated measures ANOVA for the SCL-90-R, there was no main effect of group (F_{1,15} = .377, p=.549, NS) and no group by time interaction (F_{1,15} = .149, p=.705, NS). The same was true for the DASS-21: group (F_{1,15} = .026, p=.873, NS); group x time (F_{1,15} = .186, p=.673, NS). Consistent with the paired t-tests results discussed above under Hypothesis 1 results, a significant main effect of time (from pre-treatment to 6-months follow-up) was revealed for both outcome measures: SCL-90-R (F_{1,15} = 36.34, p<.000); DASS-21 (F_{1,15} = 18.56, p<.001).

Planned comparisons from pre-treatment to 6-months follow-up on the SCL-90-R showed a significant decrease in psychological distress with large effect sizes for both the G-CBT (t_9 = 4.71, p<.000, 1-tailed, Cohen’s d=2.87) and T-CBT (t_6 = 3.83, p<.01, 1-tailed, Cohen’s d=2.40). Similarly, on the DASS-21 measure, both subgroups also demonstrated a significant reduction in distress with large effect sizes: G-CBT (t_9 = 4.12, p<.000, 1-tailed, Cohen’s d=1.85) and T-CBT (t_6 = 2.22, p=.05, 1-tailed, Cohen’s d=1.27) (Figure 2). Stability of benefits was also observed on the SCL-90-R for both G-CBT (t_9 = 1.21, p=.23, 2-tailed, Cohen’s d=.61) and T-CBT (t_6 = 1.03, p=.34, 2-tailed, Cohen’s d=.56) subgroups. On the DASS-21 stability was evident for the G-CBT (t_9 = -1.79, p=.11, NS 2-tailed, Cohen’s d= -.86 ) subgroup. However, similar to the findings of hypothesis 1, a trend towards a significant increase was observed for T-CBT (t_6 = -2.2, p=.07, NS 2-tailed, Cohen’s d=-1.35).
To directly compare the gains between the T-CBT and G-CBT subgroups, independent t-tests were conducted on change scores. From pre-treatment to the 6-month follow-up, there were no significant differences between the G-CBT and T-CBT change scores on the SCL-90-R ($t_{15}= .423, p=.68, 2$-tailed, Cohen’s $d=0.20$) or the DASS-21 ($t_{15}= -.43, p=.67, 2$-tailed, Cohen’s $d=-0.20$) with small effect sizes.

Taken together, these data reveal that both the G-CBT and T-CBT subgroups were significantly benefiting from treatment at 6-months post-cessation of treatment, and that the magnitude of benefits was commensurate between the two groups.
**Figure 2:** Mean changes (± SE) over time on the SCL-90-R for all participants (N=17) and the G-CBT (N=10) and T-CBT (N=7) subgroups

*Note:* Error bars represent Standard Error (±SE).

P values: *p<.05, **, p<.01, ***p<.001
**Figure 3:** Mean changes (± SE) over time on the DASS-21 for all participants (N=17) and the G-CBT (N=10) and T-CBT (N=7) subgroups.

**Note:**

Error bars represent Standard Error (±SE). The range of scores for the Total DASS-21 Score is from 0-121 (interpretation and scoring based on the full version of scale: DASS-42). Clinical cut-offs and categorical ranges are: Normal (0-26), Mild (27-35), Moderate (36-60), (Severe (60-79), Extremely Severe (>79).

P values: *p<.05, **, p<.01, ***p<.000
DISCUSSION

The results of this study demonstrate the long-term efficacy and maintenance of gains of adapted CBT treatment for moderate to severe ABI survivors. These findings are consistent with the large body of literature demonstrating the enduring effects of CBT treatment for a number of psychiatric disorders including depression and anxiety\textsuperscript{75}. With regard to the brain injury population, this is the first study to demonstrate the long-term therapeutic benefits of CBT. In the present study, psychological distress was, on average, reduced by 1.5 standard deviation units on the SCL-90-R, GSI subscale from pre-treatment to 6-months follow-up. Notably, at the 6-month follow-up, participants in this study were, on average, scoring within the normative functional range on the SCL-90-R, GSI (T-score = 55). Similarly on the Total DASS-21 score, psychological distress was significantly reduced from pre-treatment to 6-months follow-up. Importantly, the participants were on average scoring within the normal-to-mild range of psychological distress at 6-months follow-up compared to the moderate range at pre-treatment.

The study also demonstrated that long-term benefits were obtained both from telephone administered CBT and face-to-face group CBT, and that the magnitude of retained benefits were commensurate. These results are consistent with, and extend upon published studies demonstrating that CBT delivered over the telephone is not only an effective modality of intervention, \textsuperscript{77, 78, 107}, but also may be as effective as face-to-face therapy\textsuperscript{107}. For example, Lovell and colleagues demonstrated in an randomized control trial (RCT), that telephone administered CBT for the treatment of obsessive compulsive disorder (OCD) was equally effective as face-to-face treatment\textsuperscript{107}. 
Consistent with the findings of the current study, the efficacy of telephone CBT has also been demonstrated for the treatment of depression in other neurological populations. For example, Mohr et al (2000) showed that CBT administered over the telephone significantly decreased depressive symptomatology in a group of multiple sclerosis (MS) patients when compared to the usual standard of care77. In another study, Mohr and colleagues (2005) compared telephone administered CBT to telephone administered emotion focused therapy for the treatment of major depressive disorder in MS patients78. Significantly greater post-treatment improvements in mood were observed in the T-CBT group compared to participants who received emotion-focused therapy. Importantly, their study also showed that the telephone CBT treatment group exhibited long-term maintenance of gains over a 12-month duration78.

Collectively, these findings suggest that telephone administered psychotherapy is not only feasible for conferring lasting benefits, but as demonstrated in the current study, it is also a practical and effective therapeutic modality for brain injury survivors. This is an important and critical finding of this study because it demonstrates that we can provide greater access to psychological services for ABI survivors, who may otherwise not receive treatment due to geographical remoteness, functional impairments or transportation barriers.

With our adapted CBT protocol, patients exhibited large treatment effects that were maintained at the same level for the most part over the longer-term. It is important to consider the contextual and environmental elements that may have positively influenced these findings. Specifically, the organization from which participants were recruited (PHABIS) provides ABI survivors who are in the later stages of recovery with opportunities for engagement and
socialization. Although participants in this study had all been members of the PHABIS community for at least one year, the accessibility to a supportive social environment coinciding with CBT may have been a key factor in facilitating and/or maintaining therapeutic gains. Future research should focus on an examination of contextual and environmental factors that influence therapeutic outcomes.

With regard to the stability of benefits on the SCL-90-R, post-treatment gains were sustained and followed by an even greater reduction in psychological distress at 6-months follow-up for the larger CBT group. However, this was not the case for the DASS-21 measure, whereby treatment gains were unstable over time, as illustrated by a significant increase in distress from post-treatment to 6-months follow-up. An examination of subscale scores showed that post-treatment gains were particularly unstable for the anxiety and stress subscales of the DASS-21, whereas the depression subscale remained relatively stable over time. Thus, the discrepancy in “stability” findings appears to be attributable to the anxiety and stress subscales on the DASS-21. On the anxiety subscale, these data were in contrast to our findings on the SCL-90-R measure, whereby post-treatment gains were followed by continued improvement in anxiety at 6-months follow-up. Interestingly, Ownsworth and colleagues (2008) recently examined the clinical utility of the DASS-21 for assessing emotional distress in an acquired brain injury population. The results of their analysis revealed that the anxiety and stress subscales had low- and satisfactory- internal consistency for TBI patients, respectively. Thus, the authors cautioned against the use and interpretation of the DASS-21, and in particular the anxiety subscale for evaluating mood in TBI patients. With regard to assessing anxiety, the subscales of the DASS-21 and SCL-90-R differ in terms of the number and content of items used to measure anxiety. For example, the anxiety subscale of the DASS-21 is a 7-item subscale that is
largely comprised of somatic and autonomic symptoms of anxiety such as “dryness of mouth”, “rapid breathing”, “trembling” and “heart rate increase”. The SCL-90-R is a 10-item scale that similarly includes somatic and autonomic symptoms of anxiety, but additionally measures the dysfunctional thinking that is characteristic of people with anxiety disorders with items such as, “the feeling that something bad is going to happen to you” and “thoughts and images of a frightening nature”. In this regard, the SCL-90-R may be viewed as a more robust measure of anxiety than the DASS-21, not limited to the physical and somatic components of anxiety but also incorporating cognitive aspects commonly associated with anxiety.

**Study Limitations**

The study’s small sample size and the representativeness of the sample may affect the generalizability of the findings. The participants in this study represent a subset of brain injury survivors from a large community outpatient ABI service provider. As previously noted, contextual and environmental factors may have, in part, influenced our findings. Therefore it is not clear to what extent these findings will generalize to ABI survivors who are not members of such community organizations.

Other limitations of this study include non-random assignment and the use of a single group design to evaluate long-term therapeutic impact. Despite the latter limitation, we were unable to ethically withhold treatment from waitlist participants who were experiencing clinically elevated levels of psychological distress for an extended period of time. As illustrated by Bradbury et al (2008) there were no significant changes in psychological distress in the waitlist control group following completion of an ABI education program\textsuperscript{19}. Thus, the benefits of socialization, peer support and therapist contact was insufficient to have an effect on measures of mood. Based on these findings, the lack of a longitudinal control group comparison may be
justified, as it is unlikely that waitlist participants would have shown statistically significant improvements in mood subsequent to their 1-month follow-up in the Bradbury et al (2008) study\textsuperscript{19}.

**Clinical Implications**

The current study provides compelling evidence supporting the long-term maintenance of gains for CBT administered in either a face-to-face or teletherapy format for treating psychological distress after brain injury. These findings are extremely promising and could ultimately contribute the development of clinical practice guidelines that may be employed in both primary care and community based settings. It is possible that the treatment may be of even greater value if applied during the earlier stages of recovery as it may potentially act as a buffer for the development of psychiatric disorders that are commonly observed during late stages of recovery.

From an economic perspective, the current study has several implications. First, it has been well documented that mental health disorders pose a substantial economic burden to society due to lost productivity and increased use of our health care system\textsuperscript{33}. Although the direct mental health care costs associated with ABI are difficult to determine due to the confounding cognitive and physical consequences of brain injury, it is possible that psychological treatment may be of some economic benefit. In addition, CBT treatment has been shown to be a cost effective therapeutic intervention compared to pharmacotherapy for the treatment of depression and anxiety\textsuperscript{82}.  

Finally, psychological distress after brain injury has been widely associated with reduced quality of life\textsuperscript{5, 13} and lower levels of community integration\textsuperscript{8, 10, 11, 59}. Thus, it may be reasonable to suggest that improvements in mood may translate into greater functional gains such as higher levels of community integration and improved quality of life.

**Conclusion**

The current study supports and extends upon the findings of Bradbury and colleagues (2008)\textsuperscript{19}. To our knowledge, this is the first study demonstrating the long-term efficacy of CBT treatment adapted for ABI. Moreover, the results of the study not only validate the efficacy of CBT, but also demonstrate that CBT delivered over the telephone is as effective at conferring lasting benefits as CBT delivered in face-to-face format for ABI survivors. Despite these compelling data, empirical validation using a multisite randomized control trial design is warranted. Future investigations should also examine patient characteristics and environmental factors that may mediate long-term therapeutic outcomes.
CHAPTER 4: MANUSCRIPT 2

Cognitive Behaviour Therapy After Acquired Brain Injury: An Investigation of the Benefits for Coping Strategy Use and Community Integration at 6-Months Post-Treatment

ABSTRACT

Objectives: The primary objective of the current study was to evaluate the long-term changes in community integration and coping in patients with acquired brain injury subsequent to receiving cognitive behaviour therapy (CBT) treatment. A secondary objective was to compare long-term changes in coping and community integration of CBT administered in either a face-to-face group format (G-CBT) or individually over the telephone (T-CBT).

Design: The study design was longitudinal, with both a within subjects factor (time: pre-treatment vs. 6-months post-cessation of treatment) and a between subjects factor (groups: G-CBT vs. T-CBT).

Setting: Outpatient, community brain injury centre.

Participants: Seventeen participants with moderate to severe acquired brain injury.

Intervention: Eleven sessions of CBT administered in either the G-CBT format (N=10) or T-CBT format (N=7). The CBT treatment, designed to improve coping and reduce psychological distress, was adapted (1) to accommodate individuals with cognitive impairments and (2) for telephone administration to increase service accessibility for participants with mobility restrictions and/or geographical remoteness.
**Outcome Measures:** The Ways of Coping Questionnaire–Revised (WOC-R) and the Community Integration Questionnaire (CIQ) was used to examine changes in coping and community integration over time.

**Results:** Community Integration was significantly enhanced on the CIQ Total score at 6-months follow-up ($F_{1,15} = 38.85, p<.000$). On the WOC-R, a significant increase in planful problem focused coping ($F_{1,15} = 11.78, p<.004$) was observed from pre-treatment to 6-months follow-up. No significant changes were observed on the escape-avoidance coping subscale. Subgroup analyses revealed that both G-CBT ($t_9 = -3.41, p<.01$, Cohen’s D= -1.69) and T-CBT ($t_6 = -7.86, p<.000$, Cohen’s D = -4.17) modalities were equally effective for enhancing community integration. Similarly, both modalities give rise to long-term improvements in planful problem focused coping (G-CBT; $t_9 = -3.09, p<.01$, Cohen’s D= -1.46, T-CBT; $t_6 = -1.97, p<.05$, Cohen’s D = -1.06).

**Conclusions:** CBT treatment adapted for people with ABI is a promising approach for producing lasting benefits in community integration and problem focused coping, and can be administered by telephone or face to face. A greater understanding of which treatment and post-treatment environments allow for maximal attainment and retention of benefits is an important challenge of future research.

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**INTRODUCTION**

The chronic effects of serious acquired brain injury are notoriously deleterious, with many individuals left unemployed$^{109}$ and socially isolated$^{110}$. Extensive research has been devoted to understanding those factors that contribute to poor outcome. Demographic variables (e.g., age, gender) and injury related factors (e.g., severity of injury; type of cognitive impairment) have
received a great deal of attention in the literature\textsuperscript{111, 112}. However, such variables can not be altered by therapeutic intervention, and it is arguably of greater clinical value to focus on those variables with a known impact on clinical outcome that are also amenable to intervention. Two such variables are coping and psychological distress. Maladaptive coping has been shown to have a negative impact on community integration and return to productivity\textsuperscript{22, 23}. Elevated psychological distress in ABI – with depression estimated at upwards of four times that of the general Canadian population\textsuperscript{15, 36, 113} - is associated with reduced employability, poorer social functioning and reduced independent living skills\textsuperscript{8, 10, 11, 59}. Coping strategy selection and psychological distress have been shown to be themselves related\textsuperscript{20, 21, 65}. For example, individuals who employ coping strategies that are characterized by escape avoidant behavior will endorse higher levels of psychological distress than those who adopt a more adaptive and problem-focused approach\textsuperscript{20, 21, 65}. Thus, treating one may have an impact on the other. Indeed, there is evidence that impaired executive functioning increases the probability of engaging in maladaptive coping behaviours in TBI populations\textsuperscript{69}. Therefore, use of poor coping strategies may, in part, explain elevated distress in ABI suggesting that a treatment that improves coping might also substantially improve mood in patients with brain injury.

Given that mood and coping have a known influence on ABI outcome and are treatable, the identification of treatments with proven efficacy could improve the lives of those suffering the chronic effects of ABI. Cognitive Behaviour Therapy (CBT) is a widely used clinical intervention with demonstrated efficacy for a number of clinical populations, including neurological ones\textsuperscript{76, 77}. Unfortunately, few studies have investigated CBT in patients with brain injury\textsuperscript{19, 83-85}, and even fewer have investigated measures of the broader functional benefits of CBT for day to day life, such as community integration\textsuperscript{19}. Holistic milieu rehabilitation programs incorporating CBT and psychotherapeutic components to rehabilitation have been
shown to improve functional and community integration outcomes after brain injury\textsuperscript{86-88}. However the confounding effects of CBT treatment with additional cognitive and physical therapies prevent us from elucidating the specific effects of psychological treatment on community integration outcomes. Therefore, further investigation is warranted.

From the few studies examining CBT as a stand-alone treatment for mood and/or coping after brain injury there have been mixed, albeit promising findings\textsuperscript{19, 83-85}. Anson and Ponsford (2006) evaluated the effectiveness of a CBT-based coping skills intervention for 31 individuals with TBI\textsuperscript{85}. Participants showed significant post-treatment improvements in adaptive coping. Although these treatment effects were not sustained at a 5-week follow-up assessment, participants exhibited improvements in adaptive coping at long-term follow-up (6- to 24-months). However, this may have been a consequence of the natural recovery process rather than intervention (more than half the sample were less than a year post-injury at the time of intervention), but on the other hand, the findings may also reflect the need for the passage of time for the full benefits of treatment to manifest. Unfortunately, no significant improvements in mood or psychosocial function nor reductions in maladaptive coping were observed\textsuperscript{85}. However, this may have been due to the inclusion of patients without significant emotional distress at baseline rather than to a failure of the intervention per se.

In a more recent study, Bradbury and colleagues (2008)\textsuperscript{19} examined the efficacy of an adapted CBT protocol designed to improve mood and coping in a group of 20 moderate to severe ABI survivors\textsuperscript{19}. Patients with significant emotional distress were assigned to either CBT treatment or a waitlist control group that received ABI education. The treatment and control groups were further sub-divided into either a conventional face-to-face group format (G-CBT; G-Ctrl) or
individual telephone treatment (T-CBT; T-Ctrl). The findings revealed a significant reduction in emotional distress for the CBT treatment group after treatment. However, treatment effects were not observed on measures of coping or community integration (although trends were observed in the expected directions). The failure to demonstrate treatment effects on coping and community integration may have been attributable either to limited power of the small sample size or to the early timing of measurement. Moreover community integration benefits may not emerge on testing until patients have had time to increase their level of engagement in productive or social activities.

In a follow-up study by Arundine et al (in preparation), we extended the work of Bradbury and colleagues (2008) and examined the long-term efficacy of CBT treatment for measures of psychological distress (the Depression and Anxiety Stress Scales [DASS-21] and the Symptom Checklist-90-Revised [SCL-90-R]). The results of the study revealed a significant reduction in psychological distress from pre-treatment to 6-months follow-up, demonstrating that ABI survivors can maintain the benefits of CBT up to at least 6-months post-cessation of treatment. These benefits were observed when CBT was administered in a face-to face group modality and over the telephone. Collectively, these findings provide promising support for the short and long-term effectiveness of CBT adapted for ABI.

The aim of the current study was to further extend the findings of Bradbury et al (2008) and those of Arundine et al (in preparation), by examining long-term changes in coping and community integration following CBT treatment. Given the relationship between psychological adjustment and coping, and their demonstrated impact on community integration outcomes, it is likely that long-term improvement in mood observed in Arundine et al (in
preparation) would translate into improved coping and community integration over the same period. Accordingly, the following hypotheses were made:

(1) From pre-treatment to 6-months follow up, we would observe (a) a significant increase in community integration, (b) a significant increase in planful problem focused coping (i.e., adaptive coping), and (c) a significant reduction in escape-avoidance coping (i.e., maladaptive coping).

(2) Improvements in community integration and coping would be stable or better over time, from immediately post-treatment to 6-months follow-up.

(3) The G-CBT and T-CBT subgroups will both (a) exhibit significant improvements in long-term coping and community integration from pre-treatment to 6-months follow-up, (b) show no significant differences in their respective improvements, with comparable effect sizes from pre-treatment to 6-month follow-up, and (c) demonstrate stability or improvement from post-treatment to 6-months follow-up.

METHODS

Participants

The study sample consisted of 17 participants with moderate to severe ABI. This was the same sample as described in Arundine et al (in preparation) where the participants and recruitment procedures have been outlined in detail. In brief, participants were recruited from Peel Halton Acquired Brain Injury Services (PHABIS), a large community-based ABI service provider in Ontario, Canada. This study was conducted in accordance with the human ethics standards and received approval from the ethics committee from the Toronto Rehabilitation Institute. All participants provided informed, written consent.
Inclusion/exclusion criteria are described in full in Arundine et al (in preparation). In brief, the inclusion criteria were: (1) elevated level of psychological distress (T-score ≥ 60 on the SCL-90-R, GSI), (2) a medically diagnosed ABI, (3) greater than 1-year post-injury, (4) aged 18 to 65, (5) on a stable dosage of psychoactive medication, and (6) in the moderate to severe range of severity for ABI based on injury severity information from medical records and current neuropsychological findings. Exclusion criteria were: (1) significant suicidal ideation at the time of assessment, (2) currently receiving psychological treatment from another source, (3) a concomitant neurological or psychotic disorder, and, (4) a diagnosed communication disorder precluding participation in treatment.

All demographic and injury-severity information was ascertained through clinical interview and review of medical records. Table 1 presents demographic, psychological and injury related variables for all participants, as well as the two CBT subgroups (G-CBT and T-CBT) described below.
### Table 1: Demographic and injury variables for the entire CBT group and the G-CBT and T-CBT sub-groups

<table>
<thead>
<tr>
<th></th>
<th>All participants</th>
<th>Group-CBT (G-CBT) n=10</th>
<th>Telephone-CBT (T-CBT) n=7</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N=17 Mean (SD)</td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
</tr>
<tr>
<td>Age</td>
<td>42.94 ± 11.23</td>
<td>45.40 ± 12.41</td>
<td>39.43 ± 9.00</td>
</tr>
<tr>
<td>Sex (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>9(53%)</td>
<td>6(60%)</td>
<td>3(43%)</td>
</tr>
<tr>
<td>Years of Education</td>
<td>12.71 ± 1.57</td>
<td>12.60 ± 1.58</td>
<td>12.86 ± 1.67</td>
</tr>
<tr>
<td>Years post-injury</td>
<td>9.65 ± 8.35</td>
<td>11.00 ± 9.04</td>
<td>7.71 ± 7.47</td>
</tr>
<tr>
<td>Injury Type</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trauma, N (%)</td>
<td>9(53%)</td>
<td>5(50%)</td>
<td>4(57%)</td>
</tr>
<tr>
<td>Non-Trauma, N (%)</td>
<td>8(47%)</td>
<td>5(50%)</td>
<td>3(43%)</td>
</tr>
<tr>
<td>RBANS</td>
<td>70.65 ± 15.18</td>
<td>72.10 ± 16.63</td>
<td>68.57 ± 13.82</td>
</tr>
<tr>
<td>WTAR</td>
<td>97.82 ± 12.70</td>
<td>96.20 ± 14.42</td>
<td>100.14 ± 12.26</td>
</tr>
<tr>
<td>SCL-90-R (GSI)</td>
<td>70.71 ± 7.59</td>
<td>71.60 ± 8.22</td>
<td>69.43 ± 7.00</td>
</tr>
</tbody>
</table>

**Abbreviations:** RBANS, Repeatable Battery of Adult Neuropsychological Status; SCL-90-R (GSI), Symptom Checklist-90-Revised, Global Severity Index; WTAR, Wechsler Test of Adult Reading
Materials

Neuropsychological Battery

Repeatable Battery of Adult Neuropsychological Status (RBANS)

The RBANS is a brief neuropsychological assessment tool that is used to evaluate performance across a range of cognitive variables: attention, speed of processing, visuospatial/constructional abilities, immediate and delayed memory and language.\(^93\) The RBANS has been shown to be a reliable and valid measure of cognitive abilities with the brain injury population.\(^94\)

Wechsler Test of Adult Reading

The WTAR\(^96\), is a brief single word reading test that provides an estimate of intelligence based on an individual’s reading level. The WTAR has demonstrated validity and reliability for estimating pre-morbid intelligence in TBI survivors.\(^98\)

Outcome Measures

The Ways of Coping Questionnaire- Revised (WOC-R)

The WOC-R\(^114\) is a 66-item questionnaire that was designed to measure the cognitive and behavioural strategies that individuals uses to cope with a difficult situation. Participants are asked to recall a stressful situation that has occurred in the past week and rate the frequency to which they used each strategy on a 4-point Likert scale ranging from 0 (not used) to 3 (used a great deal). The scale produces scores for eight different coping subscales: distancing, positive reappraisal, planful problem focused coping, escape avoidance coping, confrontive coping, self-controlling, seeking social support and accepting responsibility.\(^115\) The WOC-R has acceptable psychometric properties with internal consistency ranging from .61 to .79.\(^115\) The current study employed the planful problem focused coping and escape-avoidance coping subscales to
evaluate changes in adaptive and maladaptive coping over time. As previously noted, individuals with higher levels of distress have a greater propensity towards adopting an escape avoidance style of coping, whereas greater use of problem focused coping is associated with lower levels of psychological distress and better adjustment after brain injury\(^{20,21,65}\).

**The Community Integration Questionnaire (CIQ)**

The CIQ\(^{116}\) is a tool that was specifically designed to measure an individual’s level of community integration after brain injury. It is a 15-item questionnaire that consists of three separate subscales measuring home integration, social integration and productivity. Participants are required to indicate their level of independence, engagement in, and/or frequency to which they perform activities in each of these domains. In addition, the CIQ provides a Total score, which is the summation of three subscales. The Total score can be used as a measure of one’s overall level of community integration. The CIQ Total score ranges from 0-29, with higher scores indicative of higher levels of integration. The CIQ has acceptable psychometric properties and had been shown to be a valid and reliable measure of community integration after brain injury. Test re-test reliability for the subscales is good, and ranges between .83 and .93\(^{116}\). For the Total score, test re-test reliability was .91\(^{116}\). The CIQ has been shown to significantly correlate with other measures of rehabilitation outcome such as the Functional Independence Measure, Functional Assessment Measure and the Disability Rating Scale\(^{117}\).

**CBT Protocol**

The adapted CBT protocol is fully described by Bradbury and colleagues (2008)\(^ {19}\) and Arundine et al (in preparation). In brief, the protocol adhered to proven and standardized CBT procedures and incorporated specific adaptations recommended in the literature to meet the
unique cognitive and emotional needs of ABI survivors\textsuperscript{89, 90}. These adaptations included: the use of ABI specific case examples, repetition of materials, the use of summarization, simplified language and homework prompts and reminders. In addition, the rate of speech at which the material was delivered was taken into account and breaks were also offered throughout the session to accommodate for attention deficits and/or fatigue. Neuropsychological performance reviews using the RBANS further allowed the authors to make specific individual adaptations to accommodate for cognitive deficits.

CBT treatment was provided by a combination of two licensed Psychologists, a clinical psychology PhD student in the final year of their program and a Master’s level student who had received training in CBT, including the completion of a CBT certificate program offered jointly from the Centre of Addition and Mental Health and the University of Toronto. Both graduate students were closely monitored and supervised by the primary study Psychologist to ensure adherence and competence to which CBT was delivered.

\textit{Design}

The study employed a longitudinal design with a within-subjects factor (pre-treatment vs. 6-months follow-up) and a between-subjects factor (T-CBT vs. G-CBT). The dependent variables were the WOC-R and the CIQ, for the total group as well as for the T-CBT and G-CBT sub-groups.

\textit{Procedures}

Participants were assigned to one of two treatment groups: G-CBT (n=10) or T-CBT (n=7). Participant recruitment and group assignment details are described fully in Arundine et al (in preparation) as are all procedures. In brief, 10 of the patients (5 G-CBT and 5 T-CBT) were
drawn from the treatment group of Bradbury et al (2008) and 7 (5 G-CBT and 2 T-CBT) were drawn from the waitlist (education) control group from that study. Group assignment was based on logistical considerations and not random assignment, as described in Arundine et al (2008). A pre-treatment battery comprised the RBANS, WTAR, CIQ and WOC-R along with mood questionnaires (discussed in Bradbury et al (2008) and Arundine et al in preparation). After 1 face-to-face session and 10 further sessions in group or telephone format, depending upon treatment group assignment, the pre-treatment battery was then re-administered (minus the RBANS and WTAR) immediately post-cessation of treatment and again at 6-months follow-up.

Statistical Analyses

Data Processing

Data for the larger CBT group and the two sub-groups were checked for normality, skewness and kurtosis for the SCL-90-R, the RBANS and WTAR, the CIQ Total score and the WOC-R planful problem focused and escape-avoidance subscales. All data were normally distributed with no significant skewness or kurtosis. No outliers were identified, and all participant data was included in analyses.

Hypothesis 1a-c

To examine the hypothesis that community integration and coping would improve from pre-treatment to 6-month follow-up, three separate paired t-tests were conducted for the CIQ (Total Score), and the WOC-R planful problem focused coping and escape-avoidance coping subscales.
Hypothesis 2

To examine the stability of improvements, paired t-tests with effect sizes were conducted comparing scores on the outcome measures immediately post-treatment with scores at 6-months follow-up.

Hypothesis 3 a-c

In order to evaluate the hypothesis that the T-CBT and G-CBT subgroups would show significant improvements and that there would be no significant differences in improvements between the subgroups, three separate 2 by 2 group (T-CBT vs. G-CBT) x time (pre-treatment vs. 6-months follow-up) repeated measures ANOVAs were conducted for the CIQ (Total Score) and for the WOC-R planful problem focused coping and escape-avoidance coping subscales, followed by pre-treatment vs. 6-month follow-up planned comparisons. The absence of a group by time interaction and significant improvements on planned comparisons would provide support for hypotheses 3a and 3b, respectively.

To examine the stability of improvements within each of the T-CBT and G-CBT subgroups, paired t-tests were conducted comparing scores on the outcome measures immediately post-treatment with scores at 6-month follow-up for each subgroup. Effect sizes were also calculated.

RESULTS

Pre-Treatment Analyses

There were no statistically significant differences between the G-CBT and T-CBT subgroups (see Table 1) on any of the demographic, neuropsychological or psychological variables: age ($t_{15} = 1.08$, p = .29 NS, 2-tailed, Cohen’s $d = .55$) (although the T-CBT group was 6 years older on
average), gender ($X^2 = .01, p = .65, NS$), years of education ($t_{15} = -.32, p = .75 NS, 2$-tailed, Cohen’s $d = -.16$), years post-injury ($t_{15} = .70, p = .44 NS, 2$-tailed, Cohen’s $d = .36$) or type of injury sustained ($X^2 = .08, p = .58, NS$). No significant differences were observed on the RBANS ($t_{15} = .79, p = .44 NS, 2$-tailed, Cohen’s $d = .40$), the WTAR ($t_{15} = -.62, p = .58 NS, 2$-tailed, Cohen’s $d = .32$) or on the SCL-90-R ($t_{15} = .57, p = .58 NS, 2$-tailed, Cohen’s $d = .29$).

Hypothesis 1a, 1b, and 1c: Improved coping and community integration from pre-treatment to 6-months follow-up

Paired t-tests from pre-treatment to 6-months follow-up revealed significant increases with large effect sizes on both the CIQ Total Score ($t_{16} = -6.15, p < .000, 1$-tailed, Cohen’s $d = -2.29$) and the planful problem focused subscale ($t_{16} = -3.67, p < .01, 1$-tailed, Cohen’s $d = -1.27$). These data provide support for our initial hypotheses regarding long-term improvements in community integration and problem-focused coping subsequent to CBT. In contrast to our hypothesis, no significant change was found on the escape avoidance subscale ($t_{16} = -.43, p = .68, NS$), although a moderate effect size was observed (Cohen’s $D = .75$).

Figures 1 and 2 illustrate mean score changes on the CIQ Total Score and planful problem focused coping subscale from pre-treatment to 6-month follow-up for the larger CBT group and CBT subgroups (discussed below).
Figure 1: Mean Total CIQ scores from pre-treatment to post-treatment and 6-month follow-up for the larger CBT group and G-CBT and T-CBT subgroups.

Note:
Error bars represent Standard Error (±SE). The range of scores for the CIQ Total Score is from 0-29.

P values: *p<.05, **, p<.01, ***p<.00
**Figure 2:** Mean scores on the WOC-R, planful problem focused coping subscale from pre-treatment to post-treatment and 6-month follow-up for the larger CBT group and G-CBT and T-CBT subgroups.

Note: Error bars represent Standard Error (±SE). The range of scores for the problem focused coping subscale is from 0-18.

P values: *p<.05, **, p<.01
Hypothesis 2: Stability of change from post-treatment to 6-month follow-up

To examine the stability of post-treatment findings at 6-months follow-up, paired t-tests were undertaken.

Note that in the Bradbury et al (2008) study, significant improvements were not observed following treatment on the CIQ or the WOC-R measures. One explanation was power. In the current study, we added 7 new subjects. With increased power, significant increases with large effect sizes on the CIQ Total Score ($t_{16} = -4.83$, $p < .000$, 2-tailed, Cohen’s $d = -1.65$) and on the planful problem focused subscale ($t_{16} = -2.79$, $p < .05$, 2-tailed, Cohen’s $d = -0.96$) were observed from pre- to post-treatment, and consistent with 6-month follow-up data, there were no significant changes observed on the escape-avoidance subscale from pre- to post-treatment ($t_{16} = -.572$, $p = .57$, NS, 2-tailed, Cohen’s $d = -.22$).

Scores from post-treatment to 6-month follow-up were compared. It was expected that scores would be comparable or better at 6-months following treatment. On the CIQ Total Score a significant increase in community integration with a large effect size was observed from post-treatment to 6-months follow-up indicating that participants demonstrated even greater improvements in community integration over time ($t_{16} = -3.59$ $p < .01$, 2-tailed, Cohen’s $d = -1.28$). On the planful problem focused subscale, there was no significant improvement from post-treatment to 6-months follow-up, but a moderate effect size was observed ($t_{16} = -1.71$ $p = .11$, NS, 2-tailed, Cohen’s $d = .60$), suggesting that there may have been an increase in strategy use over time compared to that observed immediately post-treatment.
These data show that not only is community integration significantly better than baseline at 6-months post-injury, but that there is continued improvement from immediately post-treatment to this point in time.

In light of these findings, further examination of the CIQ subscales were conducted to identify which of the individual subscales demonstrated improvements over time. Figure 3 illustrates mean subscale scores across time. These analyses were conducted using paired t-tests with a Bonferroni-Holm adjustment to control for inflated Type 1 error due to multiple comparisons. Significant improvements with large effect sizes were observed from pre-treatment to 6-months follow-up on the Home (t_{16}=-3.07, p<.01, 2-tailed, Cohen’s D = -1.02) and Social (t_{16}=-3.93, p=.001, 2-tailed, Cohen’s D = -1.40) subscales after Bonferroni-Holm adjustment. Productivity showed significant improvement and a moderate-to-large effect size (t_{16}=-2.30, p<.05, 2-tailed, Cohen’s D = 0.78), though the effect size was smaller than those for the Home and Social subscales.
**Figure 3:** Mean CIQ subscale scores from pre-treatment to 6-months follow-up for all participants (N=17)

![Bar chart showing mean CIQ subscale scores from pre-treatment to 6-months follow-up for all participants. Error bars represent Standard Error (±SE). The range of scores for subscale is as follows: Home (0-10), Social Domain (0-12), Productivity Domain (0-7). P values: *p<.05, **p<.01, ***p<.001.]

**Note:**
Error bars represent Standard Error (±SE). The range of scores for subscale is as follows: Home (0-10), Social Domain (0-12), Productivity Domain (0-7).

P values: *p<.05, **p<.01, ***p<.001
Hypothesis 3 a-c: Examination of G-CBT and T-CBT sub-groups

To compare the effectiveness of G-CBT versus T-CBT, we conducted three separate 2 by 2 repeated measures ANOVAs.

Data are presented for the subgroups in Figure 1 for the CIQ Total score. For this measure, a significant main effect of time (F\(_{1,15} = 38.85, \ p<.000\)) and no main effect of group (F\(_{1,15} = 1.27, \ p=.28, \ NS\)) or group by time interaction (F\(_{1,15} = 1.01, \ p=.33, \ NS\)) was observed from pre-treatment to 6-months follow-up. Planned comparisons showed a significant improvement with large effect sizes for both G-CBT (t\(_9 = -3.41, \ p<.01, 1\)-tailed, Cohen’s D = -1.69) and T-CBT (t\(_6 =-7.86, \ p<.000, 1\)-tailed, Cohen’s D = -4.17), illustrating that both modalities give rise to long-term improvements in community integration.

Figure 2 shows the WOC-R findings for the planful problem-focused coping subscale. There was a main effect of time (F\(_{1,15} = 11.78, \ p<.004\)), and no main effect of group (F\(_{1,15} = .01, \ p=.93, \ NS\)) or group by time interaction effect (F\(_{1,15} = .876, \ p=.364, \ NS\)). Planned comparisons demonstrated significant increases in planful problem focused coping strategy use for both G-CBT (t\(_9 = -3.09, \ p<.01, 1\)-tailed Cohen’s D = -1.46) and T-CBT (t\(_6 =-1.97, \ p<.05, 1\)-tailed Cohen’s D = -1.06 ) from pre-treatment to 6-months follow-up (See Figure 2).

On the escape avoidance subscale, there was no main effect of time (F\(_{1,15} = .28, \ p=.603, \ NS\)), group (F\(_{1,15} = .09, \ p=.77, \ NS\)) or group by time interaction (F\(_{1,15} = 1.59, \ p=.226, \ NS\) revealing no significant differences between the groups from pre-treatment to 6-months follow-up, but also revealing the absence of improvement in this subscale as reported earlier in Hypothesis 1. Similarly, planned comparisons showed no significant reduction on the escape avoidance subscale for the G-CBT subgroup and a small effect size (t\(_9 = -542, \ p=.30, 1\)-tailed, Cohen’s D=...
- .26). For the T-CBT subgroup, there was no significant improvement ($t_6 = 1.28$, $p = .12$, NS, 1-tailed, Cohen’s D = .70) but a moderate effect size was observed. These findings are consistent with those of Hypothesis 1 for the full group, although they suggest that with greater power, T-CBT might have shown a significant reduction in escape avoidance coping.

To examine the stability of post-treatment findings at 6-months follow-up for the CBT subgroups, paired t-tests were undertaken. On the CIQ Total Score a significant increase in community integration with large effect sizes were observed from post-treatment to 6-months follow-up for both G-CBT ($t_9 = -2.61$, $p < .02$, 2-tailed, Cohen’s $d = -.134$) and T-CBT ($t_6 = -3.10$, $p < .01$, 2-tailed, Cohen’s $d = -.166$). On the planful problem focused subscale, no significant improvement was observed from post-treatment to 6-months follow-up for the G-CBT, although a moderate effect size was observed ($t_9 = -1.32$, $p = .11$, NS, 1-tailed, Cohen’s D = .60). T-CBT also showed no substantive improvements ($t_6 = -1.01$, $p = .17$, NS, 1-tailed, Cohen’s D = .35). These data indicate that the significant CIQ and problem focused coping improvements from post-treatment to 6-months follow-up in the larger group was driven by participants in both subgroups.

**DISCUSSION**

Bradbury et al (2008) demonstrated that following an adapted CBT intervention for people with ABI, mood was significantly enhanced immediately following treatment, though benefits for coping and community reintegration were not observed\(^ {19} \). One explanation of these findings was power. Another was that the variables were examined too early. Therefore, the purpose of the current study was to examine coping strategy selection and community integration at 6-months post-treatment using the same protocol as Bradbury et al.
We found that adaptive (problem-solving) coping and community integration were significantly better at 6-months following treatment than at baseline. With respect to the specific domains of community integration, participants significantly increased their engagement in, and the frequency to which they performed home and social activities, and to some extent productive activities at 6-month post-treatment.

In the current study (which comprised the Bradbury et al patients plus a further 7), we did observe significant improvements in adaptive coping and community integration immediately post-cessation of treatment (in contrast to Bradbury et al), suggesting that power played a role in their study. However, community integration increased over the following 6-months, suggesting that at least for community integration, the passage of time is needed for the full benefits of CBT to manifest. Importantly, improvement over time cannot be attributed to the natural recovery process, as the participants were on average almost 10 years post-injury.

One explanation for these findings is that depression and anxiety results in reduced or restricted activity level\textsuperscript{67, 68}. These behavioural symptoms are often coupled with negative thinking and the biological/physiological symptoms of depression and anxiety, which can, in turn, result in an even greater reduction or restriction in activity\textsuperscript{67, 68}. In short, people with depression and anxiety stop doing activities they previously enjoyed and their level of psychological distress then interferes with day- to- day activities, social engagement and overall productivity level (i.e. all factors used to measure one’s level of community integration). Two of the key components of CBT are behavioral activation (e.g. activity scheduling) and cognitive restructuring, which in turn, enhance mood by promoting more adaptive thinking and gradual re-engagement in activity.
Accordingly, this cycle of positive change may account for gradual improvements in community integration observed in the current study (from pre- to post-treatment, and at its highest level at 6-months follow-up). However, further research is needed to determine which components of CBT (behavioural activation versus cognitive restructuring) or combination thereof, are of greatest benefit for ABI survivors.

In contrast to our hypotheses, no significant changes were observed in the escape avoidance coping subscale. These findings are consistent with Bradbury and colleagues (2008) which suggested that CBT was less effective (immediately after treatment) for reducing escape avoidance coping than productive (adaptive) coping\(^\text{19}\). Although the findings are counter-intuitive, they are also similar to those of Ponsford and Anson (2006), whereby significant improvements in productive coping, but no changes in unproductive (maladaptive) coping were observed subsequent to their CBT coping skills intervention for TBI\(^\text{85}\). One possible interpretation for these findings is that escape avoidance coping is more pervasive than problem focused coping, and that the CBT intervention was too brief to elicit change in maladaptive coping strategy use. Thus, escape avoidance coping may require a more intensive intervention program that extends beyond 11 sessions of therapy for ABI survivors. As Dawson et al (2006) showed, maladaptive coping accounted for 22.3\% of the variance in predicting productivity outcomes after brain injury\(^\text{22}\). This suggests that a CBT intervention that could reduce maladaptive coping strategy use might produce even greater gains in community integration than were observed in the current study.

Another interpretation of these findings arises from the items used to categorize the escape avoidance subscale of the WOC-R. Lazarus (1993) cautioned against the classification of wishful thinking (which are a subset of items contained in the escape-avoidance subscale
measure) as being maladapative\textsuperscript{62}. Although research has shown that wishful thinking is associated with higher levels of depression\textsuperscript{20,65}, Lazarus (1993) suggests that this interpretation is contextually dependent. For example, if wishful thinking prevents the individual from engaging in problem focused coping, then it is possible to consider these strategies as maladaptive\textsuperscript{62}. However, if the situation is not amenable to change, then under these circumstances, wishful thinking should not be considered dysfunctional \textit{per se}\textsuperscript{62}. However, in the absence of context measures, we are unable to make this determination in the current study.

Another important finding of this study was that both CBT delivered over the telephone as well as face-to-face in group format were found to be effective at enhancing community integration and adaptive problem focused coping at 6-months post-cessation of treatment.

\textbf{Study Limitations}

The limitations described in Arundine et al (in preparation) are also applicable to the current study. These include the study’s single group design, non-random assignment, participant selection bias and small sample size, which may affect the generalizability of the findings. With respect to participant selection bias, we cannot rule out the possibility that these findings are distinctive to this particular group of ABI survivors. Participants in this study represent a subset of ABI survivors from a community ABI service provider. Although the catchment area of this organization is quite large and crosses multiple regional areas, most of the participants resided in the same geographical location. Moreover, the opportunity for engagement in social and recreational activities, which is offered by the organization, may have influenced improvements observed in coping and community integration. Accordingly, we cannot determine to what extent these findings will generalize to other ABI survivors whom are not members of such organizations.
This distinctive environment, however, may offer clues as to the type of environment that is optimal for enabling patients to benefit from CBT treatment.

Another limitation of the current study pertains to the measurement of coping strategy selection using the WOC-R include the classification of coping into maladaptive versus adaptive strategies. As previously discussed, the categorization of coping is contextually dependent and therefore, the interpretation of these findings on the problem focused and escape avoidance coping subscales may be limited in the absence of context\(^\text{62}\).

Finally, a potential limitation was the reliance on a self-report measure for assessing changes in community integration. Community integration scores represent the participants’ subjective perceptions rather than objective measures of community integration. Future studies should consider additionally employing proxy ratings\(^\text{55}\) to provide a more comprehensive evaluation of changes that may occur in community integration subsequent to CBT treatment.

**Clinical Implications**

The findings of the current study suggest that the focus of rehabilitation should be broadened beyond traditional cognitive and physical rehabilitation to include the treatment of the psychological consequences of ABI. Our data demonstrate that CBT can be effectively used to enduringly improve coping and community integration in patients who are many years post-brain injury. Thus, it is possible that if this intervention were applied during the earlier stages of rehabilitation, that this might avert the development of post-ABI psychological distress and improve functional outcomes at a much earlier stage in the recovery process.
Conclusions

This study demonstrates that when psychological distress is addressed through CBT intervention, it enables people with ABI to improve coping strategy selection and attain higher levels of community integration. To our knowledge this is the first study to investigate the long-term benefits of CBT treatment for community integration following ABI. While the literature examining the effectiveness of psychological interventions after ABI is scarce, there are even fewer studies examining the effectiveness of psychotherapy designed to overcome service barriers in ABI. Importantly, the findings of the current study also demonstrate that the observed benefits of CBT for coping and community integration can be attained from both face-to-face group therapy and treatment administered individually over the telephone. These adaptations allow for greater accessibility and do not preclude those who reside in remote geographical regions or those who are unable to access treatment due to transportation/mobility barriers.

Although these findings are promising, there is a need for a multi-centre, randomized control trial to confirm the reliability of these findings and to demonstrate their generalizability.
CHAPTER 5: DISCUSSION

Introduction

This chapter integrates the major contributions of my thesis research to the body of knowledge for the treatment of psychological distress after brain injury. The findings from the two manuscripts are discussed in relation to their broader clinical implications and overall contribution to emotional recovery and neuropsychological rehabilitation after brain injury.

Summary of Findings

The primary objectives of the current thesis were to examine: (1) longer-term (i.e., 6-months post-cessation of treatment) maintenance of benefits of the adapted CBT protocol of Bradbury et al (2008)\(^\text{19}\) and (2) the effects of treatment on community integration and coping over the longer term.

*Manuscript 1:* Manuscript 1 supports and extends the findings of Bradbury et al (2008)\(^\text{19}\), which demonstrated the benefits of a CBT treatment adapted for acquired brain injury. In the study for Manuscript 1, significantly reduced levels of psychological distress were observed from pre-treatment to 6-months follow-up, thereby providing confirmation of the long-term efficacy of adapted CBT.

An additional objective of the current study was to examine the evolution of the psychological effects over time: Was psychological functioning at 6-months after the cessation of treatment better, worse or commensurate with psychological functioning immediately after the treatment? The results on the two outcome measures were discrepant, with the SCL-90-R scores improving over time, that is, showing a significant reduction in distress from post-treatment to 6-months follow-up, and with participants improving to the normative range by this time point. In contrast, on the DASS-21, the benefits diminished from post-treatment to 6-months follow-up.
Closer inspection of the data revealed that the anxiety and stress subscales were driving the overall increase in distress. Of note, recent research has shown that the DASS-21 lacks internal consistency for TBI and thus, may not be a reliable measure for assessing stress and in particular anxiety in this population\textsuperscript{108}. The discrepant findings may also be attributed to differences in items used to assess anxiety on the DASS-21 and SCL-90-R. For example, the anxiety subscale of the DASS-21 is a 7-item subscale that is largely comprised of somatic and autonomic symptoms of anxiety such as “dryness of mouth”, “rapid breathing”, “trembling” and “heart rate increase”. The SCL-90-R is a slightly larger 10-item subscale that similarly includes somatic and autonomic symptoms of anxiety, but additionally measures the dysfunctional thinking that is characteristic of people with anxiety disorders with items such as, “the feeling that something bad is going to happen to you” and “thoughts and images of a frightening nature”. In this regard, the SCL-90-R may be viewed as a more robust measure of anxiety than the DASS-21, not limited to the physical and somatic components of anxiety but also incorporating cognitive aspects that are commonly associated with anxiety.

Despite the instability of DASS-21 scores over time, it is important to highlight the fact that participants still exhibited significantly reduced levels of distress at 6-months post-cessation of treatment compared to pre-treatment levels.

The results reported in Manuscript 1 also revealed that CBT treatment delivered in a traditional face-to-face group format (G-CBT) was as effective as therapy delivered over the telephone (T-CBT). These findings are in line with those demonstrating the effectiveness of telephone delivered CBT in other mental health and neurological populations\textsuperscript{77, 78, 107}. 
Manuscript 2: The results in Manuscript 2 demonstrated that CBT can be used to improve coping and enhance community integration even in patients who sustained their ABI many years before treatment. In this study, significantly higher levels of community integration were observed at 6-months post-cessation of treatment. Moreover, community integration was higher at this time point than immediately following treatment. This finding not only supported our hypothesis, but was also consistent with our rationale for examining this variable at 6-months post-treatment, namely, that changes in community integration are more likely to occur gradually over time. Gradual improvement may be attributed to behavioral activation (e.g. activity scheduling) and the cognitive restructuring components of CBT, which in turn, enhance mood by promoting more adaptive thinking and re-engagement in activity \(^{71, 72}\). Accordingly, this cycle of positive change may account for ongoing improvements in community integration observed in the current study (from pre- to post-treatment, and at its highest level at 6-months follow-up).

Findings reported in Manuscript 2 further demonstrated that CBT was effective for enhancing problem-focused coping (or adaptive coping). A significant increase in planful problem focused coping was observed on the WOC-R at 6-months follow-up relative to pre-treatment (and this level of coping was greater than that observed immediately post-cessation of treatment). On the other hand, no changes were observed in escape avoidance (or maladaptive) coping, failing to support our hypothesis in this regard. The failure to yield treatment effects on the escape avoidance subscale of the WOC-R may be attributable to either or both of the following factors. First, it is plausible that maladaptive coping behaviours may be more pervasive, thus requiring a more intensive and longer duration of treatment than used in the current study. Second, failure to find treatment effects may be attributed to the way escape coping was measured. For example, several items on the escape avoidance subscale of the WOC-R pertain to a “wishful
thinking” style of coping. Lazarus (1993) has suggested that if wishful thinking does not impede upon the use of adaptive strategies and/or if the problem is not amenable to change, then it should not be classified as a maladaptive form of coping. It is thus possible that for some or all of the patients in this study, pre-treatment endorsement of wishful thinking items did not represent maladaptive coping, and thus would not have changed in response to CBT.

Finally, analogous to the findings in Manuscript 1, both G-CBT and T-CBT subgroups showed significant improvements at 6-months post-treatment in community integration and problem-focused coping strategy.

**Major Contributions**

The current thesis contributes to the field of neuropsychological rehabilitation and extends the current understanding of the treatment of psychological distress after brain injury. The literature has unequivocally shown that depression and anxiety disorders are common mental health sequelae after brain injury, having a profound and negative impact on quality of life and community integration. Despite these observations, the psychological issues in people with ABI have received little clinical attention to date. Moreover, there has been a paucity of literature investigating psychological interventions in people with ABI that investigate both short- and long-term efficacy. This dearth of literature may be attributable to difficulties in treating people with brain injury due to their unique cognitive and emotional needs.

Bradbury and colleagues (2008) demonstrated that a CBT protocol adapted to meet the unique cognitive and emotional needs of ABI survivors has short-term efficacy for reducing psychological distress. The current study demonstrated the durability of these effects - arguably the most important indicator of therapeutic success. Thus, adapted CBT offers an
approach for clinicians to improve the quality of life of patients with ABI.

Another contribution of the current thesis was the demonstration that CBT confers enduring improvements to problem-focused coping strategy use and community integration. These findings suggest that the benefits of CBT treatment extend beyond improvement of mood. Improved coping offers patients the tools with which to manage ongoing stressors in their life and improved community integration illustrates a critical functional benefit of CBT. Moreover, improved community integration may in turn produce further improvements to mood as illustrated by feedback loops incorporated within in the conceptual framework proposed by Moore and Stambrook (1995)\textsuperscript{40} (as discussed below).

Another contribution of this thesis is the finding that CBT delivered by telephone was as effective over the longer term for reducing psychological distress and improving coping and community integration for ABI survivors as a face-to-face group modality. Therefore, this study offers clinicians a tool that can be administered to all patients who possess telephone access. As many ABI survivors are unable to access treatment during the later stages of recovery due to physical impairments, transportation barriers and/or geographical remoteness, this may be a particularly impactful finding.

Finally, this study was undertaken in patients in the very chronic stages of TBI (on average 9.42 ± 8.35 years post-injury). It thus illustrates that survivors of brain injury can still make therapeutic gains even many years after their injury.
Methodological issues

Strengths

The current study incorporated a longitudinal study design, whereby ABI patients were followed over a 6-month period to determine the sustainability of treatment gains. Long-term follow-up is frequently over-looked in studies evaluating therapeutic efficacy, and therefore may be considered a methodological strength of the current thesis. In addition, this study extended the findings of Bradbury et al (2008)\textsuperscript{19} demonstrating the efficacy of CBT for patient populations, and more specifically, validating the utility of our adapted CBT protocol for patients with ABI.

Another strength of the current study was the examination of the impact of treatment on a functional index, namely, community integration. A review of the literature indicates that this is the first study evaluating the long-term effects of CBT treatment on community integration.

An examination of the response to CBT in patients who are many years post-injury is another strength of the study. Observed improvements in mood, coping and community integration could not be attributed to the natural recovery process – a limitation of one of the few prior studies to examine maintenance of benefits of CBT\textsuperscript{85} - because of the chronic stage of patients in the study.

The mixed ABI sample was a strength of the study design, suggesting that the treatment effects can be applied to different etiologies of brain injury; and, perhaps, even more generally to all people with cognitive impairments that are stable.

Finally, the environment in which the therapy was applied represents a strength of the design (though also a weakness as discussed below). The patients in the current study were recruited from a large community outpatient ABI service provider. These patients had opportunity for
social engagement (e.g. recreational programs and social groups) and received ongoing case management support. Although participants in this study had all been members of the PHABIS community for at least one year, the accessibility to a supportive social environment and case management coinciding with CBT may have been a key factor in facilitating and/or maintaining therapeutic gains. This environment may thus provide clues as to the optimal environment for permitting maintenance of benefits after CBT treatment, which can be empirically tested in future studies.

**Limitations**

As discussed above, the environmental factors within the study are also a limitation because it is not clear to what extent current findings will generalize to ABI survivors who are not members of such community organizations. Future research incorporating patients who are not associated with such organizations would yield greater generalizability.

A detailed discussion of other study limitations has been provided in Manuscripts 1 and 2, respectively. Limitations include participant selection bias and small sample size. As well, non-random assignment and the single group design was a limitation, as we are unable to determine whether the long-term benefits are specific to CBT treatment in the absence of a randomized controlled design. The inclusion of a no-treatment psychologically distressed ABI control group, as previously mentioned, was not possible due to concerns regarding the withholding of treatment from such patients. As well, outcome measures relied on the self-reports of participants, and thus are limited by subjectivity and perception-based assessments.
Implications

The current thesis has several implications that can be broadly divided into four categories: clinical, economic, service provision and theoretical implications. Each category is discussed below.

Clinical Implications

The literature has shown that psychological distress is associated with poorer quality of life after injury and increased caregiver burden. Higher levels of psychological distress have also been shown to have a negative impact on cognitive functioning. Therefore, it is possible that a reduction in psychological distress may lead to greater life satisfaction, reduced caregiver burden and even improved cognitive functioning.

Economic Implications

It has been well documented that mental health disorders pose a substantial economic burden. This is primarily due to lost productivity and increased use of the health care system. With respect to ABI, the direct mental health care costs associated are difficult to determine due to the confounding cognitive and physical consequences that are also associated with brain injury. However, it is possible that psychological treatment may be of some economic benefit by leading to a reduction in the use of the health care system and increasing productivity. As illustrated in Manuscripts 1 and 2, CBT has a long-term positive impact on mood, productivity and community integration after ABI. Moreover, CBT in itself has been shown to be a cost effective method of psychological treatment and more so than pharmacological treatment. In this respect, alleviating reliance on medication may also lead to reduced use of the health care system resulting in substantial cost savings.
This study may also help practitioners and health care providers make decisions for appropriate resource allocation. Specifically, this study not only highlights the importance of treating emotional distress, but also supports the allocation of resources for psychological treatment for people with brain injury.

**Implications for Service Provision**

An important implication of the current thesis is that it provides the foundation for a RCT study, which may lead to the development of best practice guidelines for the treatment of psychological distress for people with brain injury.

Another implication pertains to the delivery of psychological services. As illustrated, both group therapy and telephone therapy were found to be equally effective for improving mood, coping and community integration both in the short- and long-term. CBT administered in a group format offers several advantages. First, group therapy is a cost effective approach, providing treatment to several individuals at once compared individual therapy. Group members benefit from vicarious learning and peer support that may be derived from the group. Although group therapy has social and cost effectiveness advantages, teletherapy also has clear advantages in terms of increasing accessibility for those who might not otherwise have access to treatment centers. Teletherapy may also be considered advantageous in that it provides one-to-one therapeutic support and thus greater tailor-ability and flexibility, which may be more difficult to achieve in a group format.

Ultimately, the option for either face-to-face or telephone-based therapy provides clinicians and patients with greater flexibility when choosing a modality of treatment, allowing for consideration of factors such as accessibility, proximity to treatment centers and even personal preference.
Theoretical Implications

The findings of the current studies may be explained within the context of Moore and Stambrook’s (1995) conceptual model of rehabilitation for brain injury. Moore and Stambrook suggest that quality of life outcomes after brain injury are moderated by psychological variables. Specifically, they suggest that cognitive beliefs and coping are not only powerful determinants of psychological adjustment, but that these variables also moderate rehabilitation outcomes. Moore and Stambrook explain the development of post-TBI psychological distress as a ‘negative cycle’, whereby individuals develop a reinforcing negative belief system, and feelings of depression and despair subsequently develop leading to a poor selection of coping strategies and outcomes.

In turn, the negative consequences strengthen the relationship between the individual’s emotions and beliefs resulting in sustained or even greater levels of distress. They suggest that improvements in mood and coping will generate positive feedback loops leading back into individuals’ belief system. Positive outcomes and an alteration in beliefs will in turn produce even greater improvements mood and coping, as reinforcement is received from the individual’s environment.

In short, their conceptual model not only explains the development and maintenance of emotional distress after ABI, but also explains the interaction between cognitive beliefs, coping and outcomes after injury. The clinical utility of their model is illustrated in the current studies, whereby target variables such as cognitive beliefs and coping were utilized in the intervention. As shown in the current studies, improvements in mood and coping strategy selection were facilitated, and higher levels of community integration were attained. Model feedback loops
between mood, coping and rehabilitation outcomes (though not beliefs as they were not explicitly examined in this study) are also supported by the fact that the participant’s in these two studies demonstrated even greater long-term improvements (relative to post-treatment) on measures of mood (SCL-90-R), problem focused coping and community integration (CIQ) outcomes. In addition, Moore and Stambrook’s model incorporates the influence of environmental factors, which in the current study was suspected to have indirectly, but positively influenced outcomes by providing opportunities for social engagement and on-going case management support. In summary, our findings support the utility of their model for both clinical and research applications.

**Future Research**

Despite these compelling data, empirical validation using a multi-site randomized control trial design and larger sample size is warranted. Future studies should consider the inclusion of subsidiary measures of personality, neuropsychological performance, and a more comprehensive psychiatric assessment in order to investigate factors mediating therapeutic outcome after brain injury. An investigation of these variables is important for guiding treatment decisions and determining who will benefit from treatment. For example, pharmacological or behaviour therapy treatments may be more appropriate for an ABI survivor presenting with significant executive dysfunction due to their inability to benefit from or engage in the therapeutic process. Unfortunately, in the current study, a lack of power due to sample size precluded an examination of these variables.
Future studies incorporate additional measures to evaluate psychiatric status, community integration and coping. For example, including proxy ratings may increase the reliability of community integration assessments\textsuperscript{55} and using coping measures that are not contextually dependent such as the COPE inventory\textsuperscript{120} may also provide us with a more accurate comparison of pre-, post- and long-term follow-up changes. As illustrated in the current study, there was also a discrepancy in the findings on the DASS-21 and SCL-90-R measures. Although the SCL-90-R may arguably be a more robust measure of distress, the inclusion of other validated assessments (e.g., Structured Clinical Interview for DSM-IV) may provide a more accurate evaluation of psychiatric status and therapeutic change.

Finally, future studies should consider investigating both the length of treatment and benefits of booster sessions. As illustrated in the current study, there were no significant changes in escape-avoidance or maladaptive coping, which may in part be attributed to the brevity of the intervention and/or the pervasiveness of escape-avoidance coping. Accordingly, an examination of whether changes occur as a result of greater duration of treatment and/or the inclusion of booster sessions may have important implications on treatment effects and also relapse prevention effect.

**Summary and Conclusions**

A comprehensive review of the literature indicates that this is the first study providing evidence for the enduring efficacy of CBT treatment for moderate to severe acquired brain injury survivors. The results of the study not only validate the efficacy of CBT for patients with ABI, but also demonstrate that CBT delivered over the telephone is as effective as face-to-face therapy. Ultimately, these adaptations allow for greater accessibility of psychological treatment, a service need that is currently unmet.
Collectively, the findings of manuscripts 1 and 2 highlight the importance of treating emotional distress, as they show that benefits of CBT treatment extend beyond improvements in mood and coping, and into community integration - which has been labeled the fundamental goal of rehabilitation\textsuperscript{55}.
References


113. Offord D.R, BM, Campbell D, Goering P, Lin E, Wong M, Racine YA. One-year prevalence of psychiatric disorders in Ontarians 15 to 64 years of age. 1996.


Appendices

Appendix 1: Ethics Approval Form

March 19, 2007

Dr. Robin Green
Research
Toronto Rehabilitation Institute

Dear Dr. Green:

RE: TRI REB # 05-054
The Impact of Brief Cognitive Behavioural Treatment on the Emotional Wellness of Individuals with A Traumatic Brain Injury

The above-named study has received continued approval from the Toronto Rehab Research Ethics Board until the expiry date noted below. If the study is expected to continue beyond the expiry date, you are responsible for ensuring the study receives re-approval. The REB must also be notified of the completion or termination of this study and a final report provided.

If, during the course of the research, there are any serious adverse events, changes in the approved protocol or consent form or any new information that must be considered with respect to the study, these should be brought to the immediate attention of the Board.

Sincerely,

Gaetan Tardif MD FRCPC
Chair, Research Ethics Board
Toronto Rehabilitation Institute

January 11, 2006
Date of Initial REB Approval

January 11, 2008
Expiry Date of REB Approval
Appendix 2: Consent Form

CONSENT FORM: IMPROVING PSYCHOLOGICAL WELLNESS AFTER TRAUMATIC BRAIN INJURY
(Full Title: The impact of brief cognitive behavioural treatment on the emotional wellness of individuals with a Traumatic Brain Injury)

Principal Investigators:
Dr. Robin Green, Toronto Rehabilitation Institute
Dr. Bruce Christensen, St. Joseph’s Health Centre, Hamilton
Dr. Cheryl Bradbury, Toronto Rehabilitation Institute
Ms. April Arundine, Peel Halton Acquired Brain Injury Services (PHABIS)

Introduction
You have been invited to participate in a research project taking place at PHABIS with investigators from Toronto Rehabilitation Institute. We are investigating the potential benefits of a psychological therapy, called cognitive behaviour therapy (CBT), for improving your emotional well being after your brain injury. This consent form should give you the basic idea of what the research is about and what your participation would involve. If you would like more information, please ask.

Study Procedures
Before beginning the study, you will meet with an interviewer for a brief interview, to decide if you can participate in the study. The interviewer will ask you questions about your background, your mood and your current situation. In addition you will complete several questionnaires that ask you about your mood and emotions and about yourself. You will also complete a brief cognitive screening assessment, which will assess your attention, problem-solving and memory functioning. If you agree to participate in the study, you will be randomly placed to one of two groups: one group that will receive CBT right away or one that will receive CBT in a few months.
This study is examining the possible benefits of cognitive behaviour therapy. It is expected that this therapy will help improve your well-being and teach ways to help you cope with your injury. Cognitive behaviour therapy is a psychological intervention that helps people with symptoms like depression and anxiety to feel better. However, its effects have not yet been studied among persons who have had a brain injury. A goal of the study is to demonstrate this.

All participants will receive 11 weekly therapy sessions lasting approximately one hour each. Participants will meet in-person with their study therapist for the first session, and then the remaining 10 sessions will be conducted either (1) on the telephone or (2) in person in a group at Peel Halton Acquired Brain Injury Services (PHABIS), where you will be asked to come for 1.5 hours every week. If your sessions are on the telephone, then during each weekly telephone session you will be asked to complete a questionnaire about your mood, to help us in keep track of how you are doing.

After the sessions are over, you will also be contacted by telephone one month after the end of treatment as a follow-up. With your permission, we will also audiotape the weekly sessions, so that the study therapist can review the tapes to ensure that the therapy is being conducted correctly and so that you can have a copy of the tape to listen to, if you wish. We do not have to tape the sessions if you do not want to, and you can still participate in the study if we don’t tape the sessions.

If you are a participant in the group receiving therapy later, you will get the therapy as described above, except your CBT therapy will happen 3 to 4 months later. In the interim, you will be called on a weekly basis and will be provided with 11 sessions of telephone education about brain injury. Once a month, you will also be asked to complete a brief telephone questionnaire about their mood, so that we keep track of how you are doing while waiting to start CBT.

Participation in this treatment study will not affect any of your treatment at PHABIS. Following the completion of your therapy sessions, you will be asked to complete another brief questionnaire package. The questionnaires ask questions about your mood and other psychological symptoms.
Risks and Discomforts
The study assessments involve no more risk to you than there are in your routine therapies/clinical assessments. It is possible that the therapy will not provide any benefits to your mood. If you should experience a worsening of your psychological symptoms (such as a low mood, or feeling more anxious), you will be advised to contact Dr. Robin Green at the phone number provided, so that appropriate intervention and follow-up can take place.

Benefits
One benefit of your participation is that you will receive 11 sessions of therapy, which may help you to feel better emotionally and may also be helpful to your rehabilitation. This study will help us to better understand the way that feeling better emotionally may improve patients’ recovery from brain injury.

Confidentiality
The information obtained for this research study will be kept locked in a secure area and will only be made available to researchers involved in the study and to your therapist, if you wish. Any information that identifies you personally (e.g. name, address) will be removed before the results from the study are published.

Participation
You are free to choose not to participate in this study. You are also free to stop participating study at any time without affecting your health care. If you do not participate in this research study, but still want to receive cognitive behaviour therapy, we can provide you with a list of community resources.
Your Rights
If you have questions concerning the study, you can call Dr. Cheryl Bradbury, the **study** therapist at 416-597-3422 ext. 6223 or Dr. Robin Green, the supervising neuropsychologist, at 416-597-3422 ext. 7606. If you have any questions concerning your rights as they relate to participation in the study, you can call Dr. Gaetan Tardif, Chair of the Research Ethics Board, Toronto Rehab Institute at 416-597-3422 ext. 3730. You can also contact Mr. Al McMullan, Director of Operations at PHABIS at 905-949-4411 ext. 241. You will receive a copy of this consent form.

Consent
I have had a chance to discuss this study and my questions have been answered to my satisfaction. I voluntarily consent to participate in this study.

Participant name: ________________________________

Signature: ________________________________ Date__________

Person who obtained consent: ________________

Signature: ________________ Date______________