August 2015

The Transdiagnostic Prevention of Emotional Disorders: A Randomized Controlled Study

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A thesis submitted in partial fulfillment of the requirements for the degree in Doctor of Philosophy

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The Transdiagnostic Prevention of Emotional Disorders: 
A Randomized Controlled Study

Monograph

by

Rebecca McDermott

Clinical Psychology

A thesis submitted in partial fulfilment 
of the requirements for the degree of 
Doctor of Philosophy in Psychology

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Abstract

Major Depression and anxiety disorders are prevalent, costly, and comorbid disorders. These emotional disorders also share some vulnerability factors, making them good candidates for transdiagnostic or simultaneous prevention. The current study is a double-blind, primary prevention study that focuses on preventing emotional disorders in at risk, first and second year undergraduate students. Three internet-delivered preventative programs were compared: a Cognitive Behavioural Therapy (CBT) intervention (MoodGYM), an attentional bias modification program (Dandeneau & Baldwin, 2004), and an active attentional control. Participants (n = 354) completed symptom measurement pre- and post- a six-week intervention and again at a four-month follow-up, when they were also administered a structured diagnostic interview. Participants in the CBT condition showed more rapid and continuous depressive symptom improvement between baseline and follow-up than did participants in the other two conditions. In addition, significantly fewer individuals in the CBT condition met diagnostic criteria for Major Depression at follow-up than in the other conditions. By contrast, anxiety all groups demonstrated a similar and significant level of improvement over time. No significant differences were found in the frequency of anxiety disorders across conditions. Additionally, the attentional training and control conditions performed identically, consistent with recent research on internet-delivered attentional training. These results demonstrate the clear benefit of MoodGYM for reducing the symptom severity and frequency of depression, and suggest this intervention may also hold some benefit for
reducing anxiety symptoms. These results are discussed in the context of future prevention research and implementation.

Keywords

Depression, Anxiety, Transdiagnostic, Prevention, MoodGYM, Attentional Bias Modification
Acknowledgments

I would like to thank my supervisor, Dr. David Dozois for his continued support and encouragement. I would also like to thank my committee members and examiners, Dr. Rod Martin, Dr. Betram Gawronski, and Dr. Donald Saklofske for their assistance and instrumental feedback during this study and subsequent dissertation. I would also like to thank my lab mates, Lyndsay Evraire, Katerina Rnic, and Francois Botha for their patience and continued assistance. Without the support of my parents and my partner I would not have gotten this far and I will always appreciate their love, support, and guidance (and occasional statistical consultation).
# Table of Contents

Abstract ............................................................................................................................. ii

Acknowledgments .......................................................................................................... iv

List of Tables ................................................................................................................... vii

List of Figures ................................................................................................................ viii

List of Appendices ......................................................................................................... x

Introduction ...................................................................................................................... 1

Transdiagnostics .............................................................................................................. 3

Common Vulnerability ................................................................................................... 6

Information Processing ................................................................................................... 7

Interventions ................................................................................................................... 10

Methodological Considerations for Prevention Research ............................................. 21

Summary ....................................................................................................................... 38

Method ......................................................................................................................... 38

Participants ................................................................................................................... 38

Measures ....................................................................................................................... 39

Interventions .................................................................................................................. 44

Procedure ...................................................................................................................... 48

Results ......................................................................................................................... 53

Participant Enrolment ................................................................................................. 53
List of Tables

Table 1: Demographic Information by Condition ........................................................ 56
Table 2: Demographics of the Completer and Attrition Groups .............................. 58
Table 3: Mean and Standard Deviations of Depression and Anxiety Symptom Scores .................................................................................................................................... ..61
Table 4: Means and Standard Deviations for imputed data using Multiple Imputation..
............................................................................................................................................................................................. 74
Table 5: Means and Standard Deviations for imputed data using Maximum likelihood
........................................................................................................................................................................................................ 74
Table 6: F-statistic and p-values for Maximum likelihood data..................................... 75
Table 7: Simple effects contrasts of BDI-II scores Testing for Significant Change
between Baseline and Follow-up .................................................................................. 76
List of Figures

Figure 1: CONSORT Diagram ........................................................................................................ 54

Figure 2: Beck Depression Inventory-II symptom scores across conditions at baseline, post-intervention, and follow-up. ......................................................................................................... 64

Figure 3: Depression scale of the Depression Anxiety Stress Scale-21 symptom scores across conditions at baseline, post-intervention, and follow-up. .......................................................... 65

Figure 4: State anxiety symptom scores across conditions at baseline, post-intervention, and follow-up. .......................................................................................................................... 68

Figure 5: Trait anxiety symptom scores across conditions at baseline, post-intervention, and follow-up. .......................................................................................................................... 69

Figure 6: Anxiety scale of the Depression Anxiety Stress Scale-21 symptom scores across conditions at baseline, post-intervention, and follow-up. .............................................................. 71

Figure 7: Beck Depression Inventory-II symptom scores across conditions compared to the Benchmarking study at baseline, post-intervention, and follow-up. .............................................. 91

Figure 8: Depression scale of the Depression Anxiety Stress Scale-21 symptom scores across conditions compared to the benchmarking study at baseline, post-intervention, and follow-up. .......................................................................................................................... 92
Figure 9: Anxiety scale of the Depression Anxiety Stress Scale-21 symptom scores across conditions compared to the benchmarking study at baseline, post-intervention, and follow-up.
List of Appendices

Appendix A: Letter of Information and online consent for screening survey.........146
Appendix B: Letter of Information and electronic consent..............................148
Appendix C: Debriefing form...........................................................................151
Appendix D: Ethics approval .............................................................................157
Appendix E: Histogram of responses on the Kessler Distress Scale.................158
Appendix F: Histogram of responses on the NEO-FFI neuroticism scale ..........159
Appendix G: Demographics of the Benchmarking Study sample....................160
Appendix H: Curriculum Vitae .......................................................................162
Introduction

Depression and anxiety are among the most common and costly of psychological disorders. The lifetime prevalence rates of Major Depressive Disorder (MDD) and anxiety disorders are 17% and 31%, respectively (Kessler et al., 2007). The prevalence of these disorders is at least as high or higher in undergraduate students. Bayram and Bilgel (2008) found that 27% of undergraduate students reported depressive symptoms that reached moderate to severe intensity. A recent study also indicated that 30% of students demonstrated pathological levels of state anxiety (Ozen, Ercan, Irgil, & Sigirli, 2010).

These disorders and their associated symptoms exert a high personal cost. In fact, their diagnoses are dependent on whether the symptoms result in marked distress or notably impact the individual’s functioning. In addition to low mood, individuals with MDD are more likely to experience marital distress, low work performance, and earn less than their healthy peers (Kessler, 2012). Mendlowicz and Stein (2000) found that anxiety disorders (relatively irrespective of diagnosis) had a significant negative impact on quality of life. Significant impairment was also found in individuals with subthreshold anxiety symptoms.

These emotional disorders also represent a significant financial burden. In 1990, the respective annual economic cost of anxiety disorders and MDD in the United States was estimated at 46.6 billion (DuPont et al., 1996) and 77.4 billion dollars (Greenberg et al., 2003; 70 and 116 billion in today’s dollars). These disorders also present a notable economic burden in Canada (Koerner et al., 2004; Stephens & Joubert, 2001). Stephens and Joubert (2001) estimated the annual costs associated with depression and
psychological distress (including anxiety symptoms) in Canada to be 6.3 billion Canadian dollars, and costs associated with lost productivity to be in excess of 8.1 billion dollars.

Despite the high financial and personal costs associated with emotional (i.e., mood and anxiety) disorders, treatment is often unavailable or insufficient (Trivedi et al., 2006). Even with sufficient treatment, interventions are not always successful, particularly for depression, as approximately 30% of patients fail to remit (DeBattista, Solvason, Poirier, Kendrick, & Schatzberg, 2003). In addition, even after successful treatment many emotional disorders have an increased likelihood of recurrence. Between 50% and 85% of depressed individuals experience multiple subsequent episodes (Dozois & Bieling, 2010). With each successive episode, the risk of another episodes increases and the time between episodes decreases (Keller & Boland, 1998).

Although improving treatment efficacy and effectiveness continues to be important, preventing these disorders before their first occurrence is optimal. Early prevention could substantially reduce the societal and personal impact of these conditions. Indeed, even a prevention program that was only successful at delaying the first onset would have a measurable impact on long-term outcomes, as early onset of anxiety or depression is associated with poorer prognosis (Burcusa & Iacono, 2007). Although preventing one disorder would be worthwhile, an intervention that could simultaneously prevent multiple disorders would be even more valuable, as the number of individuals who benefit would increase significantly.
Transdiagnostics

The search for efficient interventions has led to an interest in transdiagnostic prevention. Transdiagnostic prevention approaches are interventions that target generalized risk or protective factors relevant to multiple disorders. For example, one might prevent a number of birth complications with a prenatal check-up program, which, by targeting multiple disorders, would be considered transdiagnostic. In contrast, a disorder-specific vaccination prevention program, which prevented only one illness, would not be transdiagnostic. The idea of using transdiagnostic preventions has been popular for some time in anxiety research, with many studies targeting anxiety symptoms broadly rather than a specific anxiety disorder per se (Ginsburg, 2009; Kenardy, McCafferty, & Rosa, 2003). In these cases, a shared vulnerability factor, such as anxiety sensitivity, is targeted (Schmidt et al., 2007), or tools are provided to prevent anxiety from reaching pathological levels (e.g., graduated exposure; Lowry-Webster, Barrett, & Dadds, 2001).

However, few studies have targeted the broader category of emotional disorders, for which, the concept of transdiagnostic prevention for emotional disorders is appealing (Dozois, Seeds, & Collins, 2009). Anxiety and depression are highly comorbid conditions (Brady & Kendall, 1992; Sartorius, Üstün, Lecrubier, & Wittchen, 1996) and demonstrate high symptom overlap (Cole, Truglio, & Peeke, 1997). More importantly, a number of universal risk factors link all or most emotional disorders, and many of these can be modified through preventative interventions (Dozois, Seeds, et al., 2009). The high overlap between emotional disorders makes them viable candidates for transdiagnostic prevention.
Few research trials have comprehensively tested the efficacy of transdiagnostic prevention for emotional disorders. Many interventions target a single disorder, such as MDD (Garber et al., 2009; Robinson et al., 2008; van't Veer-Tazelaar et al., 2009) or Posttraumatic Stress Disorder (Foa, Hearst-Ikeda, & Perry, 1995; Gidron et al., 2001), whereas other studies target depression (Dobson, Hopkins, Fata, Scherrer, & Allan, 2010; Vazquez et al., 2013) or anxiety symptoms (Ginsburg, 2009; Kenardy et al., 2003) more generally. Occasionally, both anxiety and depression symptoms are measured, due to their high comorbidity. However, only one disorder is typically considered the primary intervention target (Barrett, Farrell, Ollendick, & Dadds, 2006; Lock & Barrett, 2003), so that these studies do not meet the criteria for transdiagnostic prevention.

Transdiagnostic prevention for emotional disorders contains two elements: (1) it targets common vulnerabilities of two or more mood and anxiety disorders; and (2) it attempts to prevent or ameliorate multiple disorders rather than having a single disorder as a primary focus. Both these elements are present in the studies of Calear et al., (2009), Braithwaite and Fincham (2007) and Seligman, Schulman, and DeRubeis (1999). Calear and colleagues used an internet delivered CBT program to prevent anxiety and depression in a mass school sample. Teachers facilitated student access to an online CBT program. The authors found that while the intervention group outperformed a waitlist control in preventing anxiety symptoms, there was no overall effect for depression; however, exploratory analysis did find an intervention benefit in depression for male participants.

Braithwaite and Fincham (2007) conducted trials using a computerized intervention based on the Cognitive Behavioural Analysis System of Psychotherapy (CBASP;
McCullough, 2003), a cognitive behavioural intervention designed to address maladaptive thinking in individuals with chronic depression. Maladaptive thinking is a common risk factor for both anxiety and depression. Braithwaite and Fincham implemented a brief, one-session intervention and then reminded participants to implement the learned skills to target maladaptive thinking over the following eight weeks. Compared to a control condition in which participants were provided with psychoeducational material about anxiety and depression, the authors found that the CBASP intervention significantly lowered anxious and depressive symptoms.

Seligman, Schulman, and DeRubeis (1999) also conducted a Cognitive Behavioural Therapy (CBT) prevention study with transdiagnostic aims. The authors targeted undergraduate students who exhibited a pessimistic explanatory style, a transdiagnostic vulnerability factor. Participants were followed for three years after completing an eight-week group CBT intervention, or an assessment only control condition. Seligman et al. found that participants in the treatment condition had fewer episodes of moderate depression and a lower incidence of Generalized Anxiety Disorder.

Despite limited research on transdiagnostic prevention for emotional disorders, the promising results in this area are deserving of future study. The aim of the current study was to compare the transdiagnostic efficacy of two evidence based interventions: CBT and Attention Bias Modification. The present study targeted transdiagnostic vulnerability factors to reduce the risk of anxiety and depression in undergraduate students.

Type of intervention is important, particularly in preventative interventions focused on transdiagnostic outcomes, which require multiple disorders to be targeted
simultaneously. Preventative interventions reduce vulnerability factors and/or enhance protective factors. For example, an intervention directly targeting depression may teach strategies to increase positive affect (a protective factor), whereas another may teach relaxation to those at risk for anxiety to reduce physiological hyperarousal (a vulnerability factor). Schmidt and colleagues (2007) for example, targeted anxiety sensitivity - a transdiagnostic vulnerability factor for anxiety disorders to prevent an increase in anxiety symptoms.

CBT can target risk factors specific to anxiety or depression, such as anxiety sensitivity through interoceptive exposure or lack of positive affect through behavioural activation. However, CBT can also target shared risk factors, such as maladaptive thinking (Braithwaite & Fincham, 2007; Dozois, Seeds, et al., 2009). Targeting shared risk factors reduces the risk of a broader spectrum of disorders, thus achieving transdiagnostic prevention.

**Common Vulnerability**

As noted earlier, anxiety and depression are highly co-morbid and share both genetic and environmental risk factors (Kendler et al., 1995). Comorbidity and overlapping risk factors may be due to shared vulnerability factors. The notion of shared vulnerability is particularly important in transdiagnostic interventions, which often target common vulnerability factors. In the present study, two different interventions (CBT and attentional bias modification) were used to target a transdiagnostic vulnerability factor (biased information processing).
Biased information processing is a common and modifiable vulnerability factor for both anxiety and depression (Dozois, Seeds, et al., 2009), and can be targeted by attentional bias modification and cognitive behavioural therapy. A number of information processing biases have been observed in anxiety and depression. Individuals with both disorders demonstrate difficulty disengaging their attention from disorder-relevant stimuli (Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & Van Ijzendoorn, 2007; Mogg, Bradley, & Williams, 1995; Salemink, van den Hout, & Kindt, 2007). They also demonstrate disorder-congruent biases in memory (Dalgleish & Watts, 1990), and interpretation (Amin, Foa, & Coles, 1998; Hadwin, Frost, French, & Richards, 1997; Leppänen, Milders, Bell, Terriere, & Hietanen, 2004).

In addition, both types of disorders are often characterized by disorder-congruent dysfunctional attitudes (Lee & Hankin, 2009) and core beliefs (Beck & Clark, 1988). Dysfunctional attitudes are trait-like intermediate beliefs, rules, and assumptions purported to cause individuals to make inaccurate or unconstructive attributions (Miranda & Persons, 1988). Core beliefs are strong beliefs or opinions that influence how individuals see themselves and interact with the world (Beck, 2005). Thus, individuals who suffer from different emotional disorders share a variety of information processing biases.

Dual-system models have been used to describe the cognitive systems involved in processing negative content in both anxiety (Ouimet, Gawronski, & Dozois, 2009) and depression (Beevers, 2005; Haeffel et al., 2007). These models suggest that there are two competing processes: associative and rule-based, which compete to direct the way
information is processed. The associative system is described as a spreading pattern of
associations that are rapidly activated. In contrast, the rule-based system applies a system
of rules to the processing of information and to the factual relationships between concepts.
Unlike the rule-based processing system, the associative system is data based on bottom-
up processing. The associative system processes incoming information directly, i.e.,
decisions are based on the available data. For example, if an individual with depression
has a friend reschedule a meeting the individual with depression may recall all the other
occasions when his or her friend had changed plans or signalled lack of interest, without
equally recalling all the events in which the friend had shown interest. Thus, after only
considering the biased recalled data, this individual may conclude that his or her friend is
uninterested in getting together. This example illustrates the associative system, in that the
decision is made based on the data rather than a pre-set rule.

In contrast, individuals with depression may have the prior assumption that they are
worthless and not interesting, qualities they believe cause other people not to like them.
This dysfunctional rule about self may shape how subsequent information is processed.
An individual operating under this rule might, for instance, interpret a friend rescheduling
a date as evidence the friend did not want to see him or her. This is an example of the rule-
based system as the individual’s decision is made based on a pre-set rule rather than on an
examination and review of available data.

Many of the early processing biases, previously conceptualized as “automatic,”
represent processes of the associative system. The interpretive and attentional biases seen
in anxiety (Bar-Haim et al., 2007; Salemink, van den Hout, & Kindt, 2007) and depression
(Mogg, Bradley, & Williams, 1995), for instance, would be conceptualized as biases of the associative system. For example, a negative attentional bias may cause an individual with Social Anxiety Disorder to attend to signs of disinterest in others (e.g., yawning, looking away) rather than signs of interest (e.g., continued eye contact, nodding and further questioning) when recounting a story. This biased information processing style could result in the individual misinterpreting how the audience felt about the storytelling. Similarly, an individual’s interpretive bias might alter how he or she views previously collected data. For example, rather than a sign of disinterest, an audience member yawning might also simply be an indication that the individual was tired or even saw a peer yawn. However, an individual with a negative interpretive bias may attribute the yawn to a more negative cause. Placing this negative interpretive lens over incoming information would give the individual a disproportionately negative view of the information and, as with the above example, a negative view of his or her performance recounting a story.

By contrast, the dysfunctional attitudes, core beliefs, and maladaptive thinking patterns also seen in anxiety (Burns & Spangler, 2001; Riskind, Williams, Gessner, Chrosniak, & Cortina, 2000) and depression are functions of the rule-based system. Inaccurate or dysfunctional rules may also alter the way an individual with an emotional disorder interprets information. For example, if individuals adhere to the dysfunctional attitude or rule, “Asking for help is a sign of weakness,” they may then experience self-deprecation in occasions when they need help. Thus, the rule-based system can also alter how information is interpreted.
Recent advances in the field have provided interventions that can target the processing of negative content at each level of the rule-based and associative systems: CBT and attentional bias modification (ABM). Biased information processing is a common vulnerability factor for depression and anxiety, and occurs in both the associative and rule-based systems. Both CBT and ABM target biased information processing. However, CBT primarily targets biased processing at the rule-based level by targeting dysfunctional attitudes and maladaptive core beliefs. ABM, on the other hand, targets biased processing at the associative level by modifying attentional biases. These biases, at the different levels, are believed to perpetuate the dysfunctional processing of negative content and maintain emotional disorders (Hollon & Beck, 2004).

CBT and ABM are thought to prevent, or lower the risk of depression and anxiety by altering biased information processing. Thus, they are both good candidates for transdiagnostic preventions. CBT has been tested for the prevention of anxiety or depression and occasionally as a transdiagnostic prevention tool. In contrast, ABM is new and a relatively untested intervention. The present study simultaneously compared the efficacy of CBT and ABM as transdiagnostic preventions.

Interventions

CBT and ABM are broad categories of interventions comprised of a number of more specific treatments. In the current study, MoodGYM (CBT) and the modified Face-in-the-crowd-task (ABM: Dandeneau & Baldwin, 2004) were chosen as the specific interventions. Both interventions are empirically supported and can be implemented over the internet.
Cognitive Behavioural Therapy (CBT). CBT is an empirically supported, psychotherapeutic intervention. CBT modifies targeted maladaptive behaviours and cognitive processes using techniques developed from cognitive and behavioural principles. Techniques include psychoeducation, the alteration of maladaptive behaviour (e.g., exposure and behavioural activation), and the identification and modification of dysfunctional thinking patterns and rules (DeRubeis, Webb, Tang, & Beck, 2010; Dozois & Bieling, 2010). Although CBT has a number of mechanisms of action, one mechanism may be altering the dysfunctional beliefs about self and the world (e.g., Dozois, Bieling, et al., 2009). During CBT, an individual might challenge a dysfunctional belief by collecting and exploring the evidence for and against the thought. Consider, for example, the dysfunctional belief “Asking for help is a sign of weakness.” A CBT therapist might guide a client in assessing this belief. By collecting evidence and considering alternative hypotheses (e.g., everyone needs help; asking for help can be brave; strong-successful people frequently ask for help), the individual may alter this belief. Through such exploration the patient or client may alter his or her previously held dysfunctional belief and develop a more balanced thought (e.g., “Everyone needs help sometimes and asking for help doesn’t mean I am weak”). This cognitive shift will, in turn, influence subsequent information processing, as this client will no longer interpret asking for help as a failing. Thus, by altering cognitive rules, CBT can impact information processing through changes in the rule-based system.

The CBT-based intervention used in the current study was MoodGYM. MoodGYM is an internet-delivered, brief CBT intervention with five modules aimed at
reducing affective symptoms. MoodGYM was initially designed for treatment of mild to moderate depression but has also been used in prevention research. The first three modules focus on identifying, exploring, and changing dysfunctional thoughts and maladaptive thinking styles. Although participants do not interact with a live therapist, MoodGYM uses quizzes, examples, and interactive thought challenging exercises with multiple choice and fillable answers to help participants identify the content and causes of ‘warped’ thoughts (as they are referred to in MoodGYM) and modify them so that they can be more functional and adaptive.

CBT is a potentially successful tool for transdiagnostic prevention and has been widely used in prevention research for both anxiety and depression, as well as in both the previous transdiagnostic interventions for emotional disorders (Braithwaite & Fincham, 2007; Seligman, Schulman, & DeRubeis, 1999). CBT has also been successfully administered over the internet (Lintvedt et al., 2013; Warmerdam, van Straten, Jongsma, Twisk, & Cuijpers, 2010). MoodGYM, specifically, has wide empirical support and has been used for the prevention and treatment of mild to moderate affective disorders. Although it has been used mainly to treat depression, MoodGYM has also shown some positive outcomes for anxiety (Christensen, Griffiths, & Korten, 2002).

Lintvedt et al. (2013) used MoodGYM as a preventative intervention for depression in an undergraduate sample. The authors found that MoodGYM was effective at reducing depressive symptoms; however, due to both sample size and design, there was no investigation of whether CBT reduced the number of participants who met diagnostic criteria for depression. O’Kearney and colleagues explored the effectiveness of
MoodGYM in adolescent male (O’Kearney, Gibson, Christensen, & Griffiths, 2006) and female (O’Kearney, Christensen, & Griffiths, 2009) samples. In both studies, MoodGYM was integrated into the secondary school curriculum. O’Kearney et al. (2006) found that post-intervention, adolescent males in the MoodGYM condition showed a slight reduction in depressive symptoms over the care-as-usual controls, but these effects were not maintained at follow-up. The authors suggested poor adherence in the sample as a possible complication. O’Kearney et al. (2009) found that MoodGYM was not significantly more effective for female students than the control condition at post-intervention, however, the effects rose to the level of significance by the 20-week follow-up. The authors also found that individuals who experienced higher levels of pre-intervention symptoms showed the largest level of symptom decline. A notable limitation is that none of these prevention trials measured diagnostic outcomes. This is an important outcome measure, as symptoms and diagnostic outcomes are not synonymous and the primary aim of prevention is to reduce the onset of disorder.

A number of treatment studies have also been conducted with MoodGYM to establish its effectiveness and long-term efficacy. Christensen, Griffiths, MacKinnon, and Brittliffe (2006) conducted a randomized trial with 2,794 MoodGYM internet users. The authors found that participants who engaged in at least one module of treatment showed significant reductions in depressive symptoms. Mackinnon, Griffiths and Christensen (2008) conducted one of the few studies to explore the long-term efficacy of internet delivered CBT. These authors found that MoodGYM maintained its advantage over a
control group at 6 and 12 month follow-ups; however, the study examined only depressive symptoms and was not transdiagnostic in its focus.

The demonstrated efficacy of MoodGYM in reducing affective symptoms (Christensen et al., 2002) and preventing depressive symptoms (Lintvedt, 2013) makes it a strong candidate for a transdiagnostic, cognitive behavioural intervention. This intervention also contains a number of modules that directly target dysfunctional thinking and teach the rational, objective exploration of thoughts. Thus, MoodGYM was selected as the CBT intervention for this transdiagnostic preventative trial.

Attention bias modification (ABM). Preventative cognitive behavioural strategies have been effectively implemented over the past decade (Carlbring, Ekselius, & Andersson, 2003; Spek, Cuijpers, et al., 2007). Attentional training, on the other hand, is relatively new and has not yet acquired a large empirical base. Individuals with anxiety and depression have a tendency to over-attend to negative information, i.e., they exhibit negative attentional biases. ABM acts by training individuals to attend away from negative information and to actively engage with positive or neutral information (a pattern of attention often seen in healthy individuals; Mogg, Bradley, & Williams, 1995).

Attentional biases are mechanisms theorized to be causally related to the maintenance of anxiety and depression (Mathew & McLeod, 2002; McDermott & Dozois, in press). When individuals attend predominantly to negative or threat relevant information, they are more likely to consolidate that information into short-term and long-term memory. Koster, De Raedt, Leyman, and De Lissnyder (2010), for example, tested the relationship between
attentional bias and memory. The authors found that attentional bias for negative words predicted the subsequent free recall of negative words.

An attention bias can also contribute to an altered view of the world. Consider, for example, an individual with social phobia leaving his apartment. If this individual only noticed when people were looking at him, and not when others were looking somewhere else, he might feel as though he is constantly being watched or stared at, as this is all he had noticed. Thus, selectively attending to threatening information can cause individuals to experience an inaccurate view of the world around them. This individual with social phobia now may perceive that everyone stares at him, and, thus conclude that there is something odd or irregular about him. This example illustrates how biases in the associative system can propagate emotional disorders. Modifying these biases through ABM may improve information processing and allow individuals to perceive their world more accurately.

ABM techniques are developed from tasks originally designed to measure attentional biases. Through slight modifications to the original paradigms, ABM tasks have enabled modification, rather than simply measurement, of attentional allocation in individuals with anxiety and depression (Mathews & MacLeod, 2002; Wells & Beevers, 2010). Negative attentional biases have been linked theoretically to a number of psychiatric disorders including anxiety and depression. However, only within the last decade have techniques been established that permit the manipulation of attention biases. Such techniques have been used to demonstrate the etiological role of attentional biases and their treatment.
potential in affective disorders (Mathews & MacLeod, 2002; McDermott & Dozois, in press; Wells & Beevers, 2010).

Most attentional training studies use one of two paradigms: a modified Face-in-the-Crowd Task or a modified dot-probe task. Dandeneau and colleagues (2004) established the efficacy of the modified Face-in-the-Crowd Task. In this task, participants search through a grid of photographed faces displaying negative affect to find a face displaying positive affect (i.e., a smiling face). Participants are asked to find the different or positive face as quickly as possible. For instance, a participant might view a four-by-four grid of faces displaying angry, sad, and frightened expressions (i.e., distractors). One of the faces in the grid would display a positive or happy facial expression (i.e., the target) and participants would be asked to search for this face. This task trains participants to search for or selectively attend to positive information and also to attend away from negative facial expressions. The act of looking at a face displaying a negative expression and shifting their gaze away to continue looking for the positive face is thought to improve participants’ ability to disengage from negative faces. The continued focus on the positive face, necessary to make a correct response, purportedly trains individuals to attend selectively to positive information. Previous research has shown that attentional training with one ABM task can generalize to other attentional tasks (Dandeneau et al. 2004).

The modified dot-probe task has also been shown to be effective at modifying attentional allocation (MacLeod, Rutherford, Campbell, Ebsworthy, & Holker, 2002; Mathews & MacLeod, 2002). In this task, participants see two valenced photographs of faces or two valenced words (e.g., positive and negative). The faces or words then
disappear and are replaced by a probe (e.g., asterisks) that appears where one of the faces or words was originally located. Participants are then asked to make some decision about the probe; for example, to indicate where the probe was located on the screen or to describe some feature of the probe (e.g., colour, number of probes, etc.). The speed with which the participant responds to the probe suggests where the individual had been attending immediately before the probe appeared. Thus, using repeated trials it is possible to measure if the individual is disproportionately attending to a certain valence of word or image.

In the modified version of this task, the probe either predominantly or exclusively appears behind the positive face (or neutral face, depending on the design). For example, an individual completing positive training with the dot-probe task may see a photograph of a happy and a sad face placed on either side of the screen. Then both faces would disappear and the probe would appear where the positive face had been. The participant would be asked to make a response to the probe that appeared on the screen as rapidly as possible. It is easier and faster for participants to perceive and respond to the probe when it is in the location they were already focused on rather than the opposite side of the screen. Thus, with the repeated pairing of the positive stimuli and the probe, the individual learns to associate these stimuli and redirect attention towards the positive as he or she anticipates the probe’s location. Through repeated pairing, this task trains individuals to attend to the positive information.

Changing the valence of the target and distracter faces can vary the type and specificity of the induced bias in both the modified dot-probe and Face-in-the-Crowd
Tasks. For example, to train a positive bias exclusively using the Face-in-the-Crowd Task, in contrast to training participants to avoid negative information (i.e., reducing a negative bias), participants are asked to search for a positive facial expression in a grid of neutral facial expressions. The current study employed a strategy designed to train attention both away from negative and toward positive information. Participants searched through a matrix of faces displaying negative (not neutral) facial expressions to find a face displaying a positive expression. Given this methodology, participants were forced both to disengage from negatively valenced stimuli and attend or shift toward positively valenced stimuli. It was expected that this method would result in the largest treatment effect by both reducing negative attentional biases and increasing individuals’ attentional engagement with positive information. By training individuals to attend toward positive and disengage from negative facial expressions this task could modify both types of biases, thereby correcting how participants collect information from their environment.

A number of studies have successfully used ABM for the treatment of affective disorders. Amir, Beard, Burns, and Bomyea (2009), for instance, administered eight sessions of positive attention training, using a modified dot-probe task, to patients with Generalized Anxiety Disorder (GAD). At the end of treatment 50% of patients in the training group no longer met criteria for GAD, whereas only 13% of the control group had remitted. These results are consistent with findings from other psychosocial intervention trials, with estimated effect sizes ranging from 0.72 to 0.88 (compared to other psychosocial treatments which range from 0.71 to .91). Using a similar methodology, Amir et al. (2009) demonstrated nearly identical remission rates in patients suffering from
Social Anxiety Disorder. Moreover, Wells and Beevers (2010) demonstrated that training a positive attentional bias effectively reduced depressive symptoms both post-intervention and at a two week follow-up. These results are impressive, particularly when cost effectiveness is considered. Traditional psychosocial treatments are expensive to implement because they require trained professionals in addition to adequate facilities in which the treatment can be conducted. In contrast, ABM can be conducted electronically, over the internet, with little facilitator involvement.

Three studies have explored the preventative utility of attention modification. Dandeneau et al. (2007) found that a group of telemarketers, who underwent positive attention training, using the modified Face-in-the-Crowd Task, experienced less stress, demonstrated higher self-esteem, and sold more products than did controls. See, MacLeod, and Bridle (2009) used an internet-based modified dot-probe task to induce positive attentional biases in a group of students before they moved between countries. Participants who received preventative training had lower anxiety post-immigration than did a control group of similar students. Browning and colleagues (2012) used ABM to reduce residual symptoms with recurrent depression and demonstrated that ABM reduced cortisol-awakening response, another risk factor for depression. The significant results from of these studies, together with those from the treatment literature, suggest that positive attentional training may be effective at both reducing the onset of affective disorders and improving symptoms. Even though the potential of attention training is promising, no large-scale prevention study has tested whether such interventions are
capable of preventing the onset of diagnosable conditions. Additionally, the previous studies were short-term which is not ideal for measuring preventative effects.

There is no clear evidence to suggest which of the modified dot-probe or the Face-in-the-Crowd Task is more effective, as these strategies have never been directly compared. The modified Face-in-the-Crowd Task was selected in this study for a number of reasons. First, the Face-in-the-Crowd Task targets a wider range of biases per trial than the dot-probe task. Attentional biases in anxiety are thought to occur earlier and involve both rapid engagement and delayed disengagement (Fox, Russo, & Dutton, 2002; Koster, Crombez, Verschuere, Van Damme, & Wiersema, 2006). In contrast, the attentional biases seen in depression occur later in the attentional window and are predominantly associated with delayed disengagement (Mogg & Bradley, 2005). Thus, between disorders, there is some variability in when attentional biases occur. The dot-probe task must target a specific point in the attentional window in each trial so multiple types of trials, would be required to target the biases observed in both anxiety and depression. In contrast, the Face-in-the-Crowd Task has a different design, which does not target specific points in the attentional window and is therefore less affected by the temporal variability in attentional biases.

Incorporating multiple types of trials would make the dot-probe task quite long. It may even be impossible to incorporate enough trials at each variation of time intervals to obtain sufficient dosing for attentional bias training. In contrast, the Face-in-the-Crowd Task is less restricted to specific attentional periods or specific attentional mechanisms. The Face-in-the-Crowd Task requires both active engagement (searching for the target face) and disengagement (moving gaze away from the distractor faces) in every trial,
because it is thought to act on both attentional mechanisms, only one type of trial is necessary to ensure the task acts on the attentional biases seen in both anxiety and depression. Thus the Face-in-the-Crowd Task is a more easily implemented method of transdiagnostic training.

The modified Face-in-the-Crowd Task was also selected for pragmatic reasons. Given that participants completed the tasks at home, it was important that the task incentivized compliance. The dot-probe task normally requires participants to press one of two keys to indicate their response. As such, it would have been easy for non-compliant participants to repeatedly press both buttons simultaneously (or one button if a correct response was not required). Thus, the most rapid method of completing the task would not require attention and would thereby preclude the intended training effect. In the Face-in-the-Crowd Task a participant must “click” on the correct face to complete each trial. Therefore, the fastest method for completing the face-in-the crowd task is to search for the target face, which is the desired participant behaviour. Given that these tasks were administered frequently and may have been perceived as highly repetitive by participants, it was important that the most effective method of completion correspond to the desired participant behaviour.

Methodological Considerations for Prevention Research

In addition to the administration of specific interventions, a number of other considerations are important in prevention research and implementation. Anxiety and depression prevention is a rapidly developing field. The growing body of research in this area has highlighted elements that make interventions more effective as well as areas in need of further development. These important elements include: the population targeted,
the study design (study classification and how biases are controlled), and the method of treatment delivery. As these elements have a notable impact on outcomes, the literature pertaining to each element is reviewed here, to outline the best practices for prevention implementation and research design.

Population. The population targeted in prevention research is important for a variety of reasons. Features of the populations can influence both the relative base-rates of affective disorders and the efficacy of the interventions administered. One defining feature of samples used in prevention research pertains to the age of participants. Logically, anxiety and depression prevention research typically targets young individuals, because the first onset of affective disorders most commonly occurs during youth. In depression, for example, the mean age of first onset is 14-29 (Cyranowski, Frank, Young, & Shear, 2000; Lewinsohn, Clarke, Seely & Rohde, 1994; Sorenson, Rutter, & Aneshensel, 1991). The mean ages of onset for Panic Disorder, Social Anxiety Disorder, and Obsessive Compulsive Disorder are 24, 13, and 19 years, respectively (Kessler et al., 2007). Although the mean age of first onset is slightly higher in GAD (i.e., 31 years) this condition may begin to develop earlier, as many sufferers indicate that they have been “worriers” for as long as they can remember (Rapee, 2001; Wells, 1995). Due to the early age of onset of these disorders, many prevention studies target primary, secondary, and post-secondary students (Bienvenu & Ginsburg, 2007; Calear & Christensen, 2010; Calear & Christensen, 2010; Fisak, Richard, & Mann, 2011).

Interventions focused on youth have many distinct advantages. First, interventions are likely to target individuals before or at the age when the first onset of emotional disorders
is likely to occur. This timing may help to prevent the first onset of the disorders (rather than preventing future relapses). Moreover, it is arguably most efficacious to target individuals when they are most at risk of developing an emotional disorder (over individuals who might be at risk at some future point), primarily because the preventative effects of these interventions may be most efficacious soon after the skills are delivered and learned. For example, if one learns how to challenge thoughts immediately prior to a stressful period, he or she might have the opportunity to practice the skill in vivo and experience its immediate effectiveness (as opposed to learning the skill at a time when it was less relevant or applicable). It is also unknown how long preventative effects last, because they are rarely measured over extended periods (e.g., a decade). Thus, the closer the temporal proximity between the preventative intervention and the high-risk period, the more likely is the intervention to be effective.

A second practical advantage to studying youth populations is that children, adolescents, and young adults often congregate in schools thereby, allowing for mass recruitment and easier recruitment of participants. When interventions are woven into the curriculum, as with some larger scale prevention studies (Calear, Christensen, Mackinnon, Griffiths, & O’Kearney, 2009), participants do not need to be financially compensated for their time, creating fiscal efficiency and conditions more representative of a population health implementation strategy.

Results from prevention studies that target youth have been promising (Gladstone & Beardslee, 2009; Horowitz & Garber, 2006; Merry, McDowell, Hetrick, Bir, & Muller, 2004; Stice, Rohde, Gau, & Wade, 2010). A meta-analysis of child and adolescent anxiety
prevention studies found an overall positive (if small) effect size ($d = 0.18$) at post-intervention (Fisak et al., 2011). In their meta-analysis, Stice, Shaw, Bohon, Marti, and Rohde (2009) noted a slightly larger effect size of 0.30 at post-intervention for depression prevention trials. In both reviews, the authors found that the effects dissipated somewhat at follow-up.

Although the majority of prevention trials investigate children and young adolescents, post-secondary students are also frequently targeted (Vazquez et al., 2013). These students frequently experience a number of stressors (moving, starting higher education, and/or change in social supports and romantic relationships). This sudden increase in stress, combined with their young age, puts these students at elevated risk for the first onset of MDD (Christie et al., 1988; Sorenson et al., 1991) and anxiety disorders (Cukrowicz & Joiner, 2007).

Eisenber, Gollust, Golberstein, and Hefner (2007) estimated that the point-prevalence of depression and anxiety disorders was over 15% in undergraduate samples. For this reason, an undergraduate university sample was selected for the present study. Research has demonstrated that the severity and frequency of major depression and anxiety disorders are highest during the first two years of university; consequently, participants were chosen from this range (Bayram & Bilgel, 2008).

University students also present a practical advantage over a younger sample. Given that the interventions were delivered online, participants in this study needed regular access to a computer. In addition, they were more likely than a younger sample to have sufficient reading ability and attention span to complete the online tasks.
Classification. The classification or recruitment criteria used for prevention studies also has an important impact on obtained outcomes. The Institute of Medicine (Mrazek & Haggerty, 1994) described three typologies of prevention trials: universal, selective, and indicated. Universal trials recruit participants from a whole population (e.g., nation, local community, or school). For example, a classroom-based intervention where all the students participate would be classified as universal prevention. Selective prevention programs recruit participants who demonstrate elevated risk of developing a disorder. Recruiting individuals with a family history of depression, for instance, would be considered a selective prevention. In indicated prevention, individuals are targeted if they demonstrate sub-threshold signs or symptoms of a particular disorder (also see Dozois & Dobson, 2004).

In general, universal trials have not been highly effective (Calear et al., 2009; Creedy, 2007; O'Kearney, Kang, Christensen, & Griffiths, 2009; Sheffield et al., 2006; Stice et al., 2009). Universal interventions have significantly less power than indicated or selective interventions, due to the comparatively low point prevalence of affective disorders in the general population. For example, consider that the point prevalence of MDD may only be 2% in the general population. Even if an intervention were able to halve the prevalence of depression (a highly successful intervention) the difference in prevalence rates would only be 1%. A difference of one percentage point would be difficult to detect without a very large sample size. Indeed, even studies with large samples sizes may fail to find significant preventative effects. For example, Calear et al. (2009) recruited 1477 participants and Sheffield et al. (2006) obtained a sample size of 2479, but neither trial
showed significant benefits in depression. Given their cost, coupled with mixed results, universal interventions do not appear to represent the best investigative practice at this time. One exception to this conclusion may be when an entire population selected represents a high-risk group, for example, stroke patients for whom the base-rate of MDD is approximately 50% (Robinson et al., 2008). However, such an intervention strategy aligns better with selective interventions, as a previous stroke may alternatively be viewed as a risk factor rather than a characteristic of the population. Generally, researchers need a higher prior probability of occurrence to increase the power of the study, even if the intervention tested could then be used in a more diverse population with lower disorder prevalence.

In contrast to universal prevention, indicated and selective interventions often demonstrate consistently positive outcomes (Gladstone & Beardslee, 2009; Horowitz & Garber, 2006; Jane-Llopis, Hosman, Jenkins, & Anderson, 2003; Merry et al., 2004; Stice et al., 2010). Indicated interventions are the most common type of prevention and have some clear advantages. For instance, current symptoms are strong predictors of future symptomatology or psychopathology; thus, selecting symptomatic individuals helps to obtain a sample with high base-rates of psychopathology. In addition, the presence of distressing symptoms may incentivize participants to engage in an intervention more than participants in universal prevention studies (e.g., they may be more likely to fully engage in an intervention to reduce existing symptoms and prevent them from worsening).

One of the earliest indicated prevention trials for anxiety was conducted by Dadds and colleagues (Dadds, Spence, Holland, Barrett, & Laurens, 1997) who used a 10-week,
group, CBT intervention in 7-14 year olds experiencing anxiety symptoms. Although the control condition (family-based group) and the CBT condition both showed improvements post-intervention, only the CBT group maintained its effects at follow-up. More recently Rohde, Stice, Shaw, and Briere (2014) conducted a depression prevention trial with adolescents, comparing a 6-session CBT group to a minimal contact (CBT) bibliotherapy group and an information brochure control. The CBT intervention outperformed the bibliotherapy and brochure control condition at preventing MDD onset. However, at the symptom level there were no significant differences between the bibliotherapy and the CBT conditions, although both outperformed the brochure control at post-test and six-month follow-up. Although these positive results have not been replicated in every indicated trial, this method demonstrates promise for both anxiety and depression prevention (Nehmy, 2010).

Indicated interventions also have disadvantages. If affective disorders are viewed on a continuum as opposed to discrete categories (Hankin, Fraley, Lahey, & Waldman, 2005; Prisciandaro & Roberts, 2005), then treating individuals high in affective symptoms would accurately be considered mild treatment rather than prevention. Indeed, treatment and preventive interventions are often similar. Many prevention trials, for instance, utilize interventions that range from 12 to 15 sessions (Allart-van Dam, Hosman, Hoogduin, & Schaap, 2007; Allart-van Dam, Hosman, Hoogduin, & Schaap, 2003; Barrett et al., 2006; Barrett & Turner, 2001; Clarke et al., 2001; Dobson et al., 2010; Gillham, Hamilton, Freres, Patton, & Gallop, 2006; Gillham et al., 2007; Munoz et al., 2007); interventions of such intensity closely resemble the intensity of interventions seen in treatment for both
depression (Clarke, Rohde, Lewinsohn, Hops, & Seeley, 1999) and anxiety disorders (Andrews, 2003; Compton et al., 2004; Norton & Price, 2007). If the dose of treatment and prevention are similar, and participants are recruited based on symptomatology, then these studies better resemble early treatment than they do prevention.

Selective interventions that target individuals with demonstrated risk for depression or anxiety have been widely discussed (Horowitz & Garber, 2006; Jane-Llopis et al., 2003; Stice et al., 2009), but less frequently implemented, particularly for depression. However, a few studies have implemented selective recruitment strategies (Clarke et al., 2001; Clarke et al., 2009; Lintvedt et al., 2013). These selective interventions have used a number of different risk/vulnerability factors to select participants. For example, participants have been recruited based on medical health indicators of depression (e.g., increased hospital visitation; Clarke et al., 2009), family history (Clarke et al., 2001), and temperament/attitudes associated with anxiety and depression (Rapee, 2002; Rapee, Kennedy, Ingram, Edwards, & Sweeney, 2005; Seligman et al., 1999). Interestingly, many selective intervention studies have yielded positive results.

Few selective intervention trials have recruited participants based on shared or universal risk/vulnerability factors for anxiety and depression. Dozois, Seeds et al. (2009) pointed to a number of shared vulnerability factors, which included negative cognitive content and processes, parental psychopathology and parenting, stress and coping (e.g., stress reactivity), and behavioural inhibition and avoidance. Another recognized transdiagnostic vulnerability factor is neuroticism (Righetti-Veltema, Conne-Perreard, Bousquet, & Manzano, 1998; Roberts & Kendler, 1999; Schmitz, Kugler, & Rollnik,
Neuroticism is strongly related to Major Depressive Disorder (onset and severity; Duggan, Lee, & Murray, 1990; Scott, Eccleston, & Boys, 1992), anxiety symptomatology (Gershuny & Sher, 1998), and anxiety diagnoses (Bienvenu & Ginsburg, 2007; Gomez & Francis, 2003).

Targeting participants based on transdiagnostic risk/vulnerability factors has a number of advantages. By increasing the base-rate of emotional disorders in the sample recruited, selected interventions have increased statistical power relative to universal samples. However, unlike an indicated sample, it is possible to recruit participants who are not currently experiencing symptoms but are still at risk for emotional disorders. In addition, many risk/vulnerability factors are common among emotional disorders. A selective prevention strategy provides the ability to target individuals transdiagnostically instead of selecting individuals who are high in depression or anxiety symptoms. Thus, selective interventions may combine some of the benefits of indicated interventions (increased power) with the ability to target participants transdiagnostically even before symptoms become problematic.

Although both selected and indicated trials have been found effective, indicated trials are much more common in the literature. Though both strategies offer the benefit of increased power, they differ in other ways. Selective interventions afford researchers the opportunity to intervene before symptoms become problematic (at least in some cases) whereas the presence of problematic symptoms in indicated trials may incentivize participant compliance. As both recruitment methods have notable benefits, the current
study implemented a combined approach. Participants were recruited who either
demonstrated elevated symptoms or transdiagnostic vulnerability.

Given that this study broadly targeted affective disorders, it was important to have a
symptom measure that encompassed both mood and anxiety symptoms. The Kessler
Distress Scale was selected, because it was designed to screen population samples for
anxiety and mood disorders (Kessler et al., 2003). The scale queries individuals about
general symptoms of emotional disorders, such as nervousness, low mood, and fatigue.
The Kessler Distress Scale has also been successfully used in other MoodGYM prevention
trials (Lintvedt et al., 2013).

In addition to symptoms of distress, participants were also recruited based on the
presence of vulnerability for emotional disorders. Neuroticism is a transdiagnostic
vulnerability factor for emotional disorders, and has been used to recruit participants for
transdiagnostic, internet-delivered treatment (Titov et al., 2011). Neuroticism is also
highly correlated with both anxiety (Jorm, 1989; Jylhä & Isometsä, 2006) and depression
(Fanous, Gardner, Prescott, Cancro, & Kendler, 2002), and is predictive in both cases
(Jorm et al., 2000). Using neuroticism as a selection criterion allowed for the recruitment
of participants who were not then symptomatic but were at future risk for an anxiety
disorder or MDD.

Controlling for Bias. One element that is lacking in prevention research is the use of
effective comparison or control conditions to mitigate the influences of participant and
experimenter bias. Non-active control conditions predominate in the prevention literature.
The most common non-active control conditions are either waitlist conditions, in which
participants are restricted from using other services, or care–as-usual conditions, in which participants are free to access community treatment resources. These non-active control conditions are economical to use and, in the case of the care-as-usual conditions, accurately represent standard treatment. However, studies with non-active controls are vulnerable to the influence of performance bias, demand characteristics, and placebo effects. Indeed, the prevention literature is generally poor at controlling for such biases. A number of meta-analyses have noted that the effect sizes of studies with active controls are notably smaller than are those with non-active control conditions (Horowitz & Garber, 2006; Jane-Llopis et al., 2003; Stice et al., 2009).

Active control conditions represent an important element of randomized control trials as they control for performance bias and placebo effects. Ideally, active controls parallel the treatment condition as closely as possible without delivering the active ingredient of change. To this end, Mohr et al. (2009) defined important considerations in designing control conditions: 1) the amount of clinician attention or contact should be comparable across conditions; 2) human interaction variables (such as warmth and empathy) should be consistent across conditions; and 3) the control should have a treatment rationale to reduce outcome expectancy bias. The majority of prevention studies with active control conditions have used what is often referred to as attention controls. Attention controls refer to a control condition that occupies the participant’s attention without delivering an active intervention. These conditions often include the provision of education about mental health or related information (Johansson, 1991). For example, Cho and colleagues (2008) provided participants in the control condition with a brief education session about
depression, whereas Austin et al. (2008) gave control participants an information booklet to read. While these control conditions are methodologically superior to a waitlist comparison, and may have met Mohr’s first criterion (equal human contact across conditions), they would not have addressed expectancy bias to the same extent as would a more active intervention. Neither of these conditions had a treatment rationale; thus, participants would not have predicted that learning information about anxiety or depression would reduce their symptoms. Without the expectation of treatment or improvement these conditions would not have controlled for outcome expectancy bias.

In contrast, other controls may have had an active ingredient. Dobson and colleagues’ (2010) depression prevention trial had an active control group (group discussions). However, this condition may have contained some of the active components of treatment. In this study, both conditions (the CBT treatment and Control) showed symptom reduction but there were no significant differences between conditions. Although it is possible that all the change observed in the control condition could be accounted for by participant bias, an alternative hypothesis is that the control condition also contained active ingredients of change. For instance, the control condition may have inadvertently trained problem-solving skills, increased social support, and helped students engage in pleasurable and meaningful activities. The lack of effective control conditions has been a significant weakness in the prevention literature.

To ensure that expectancy biases were accounted for in the current study, an active control condition that met the criteria outlined in Mohr et al (2009) was included. This control condition was designed to mirror the treatment conditions as closely as possible.
As has often been implemented in attentional bias modification research, the control condition was the unmodified version of the attentional bias measurement task. Thus, in the control condition participants repeatedly completed the Face-in-the-Crowd Task, alternately searching for both negative and positive facial expressions. This condition differs from the attentional training condition where participants are only asked to search for the positive face. This task was designed to mimic the attentional training as closely as possible while removing the active component of attentional training. However, the control condition used in this trial also acted as an effective control for the CBT condition. Although it did not resemble the CBT condition as closely as the ABM condition, participants were led to believe that it could be an active intervention and that they might expect to see symptom improvement. The control condition also matched both treatment conditions in terms of participant and research involvement. All participants received similar levels of experimenter contact and spent similar lengths of time engaging in the tasks.

Treatment Delivery. As with treatment interventions, treatment delivery is an important consideration in prevention research, particularly with regard to cost effectiveness. In prevention, unlike treatment, interventions are rarely delivered in an individualized format; rather, group and internet-delivered interventions are the most common mode of delivery. Richardson, Stallard, and Velleman (2010) reviewed the use of computerized CBT for the prevention and treatment of depression. The authors referenced a number of advantages to using computerized treatments. Computerized therapies are easily accessible, inexpensive to deliver, and can be highly structured yet
adaptable. Computerized therapies may also diminish the stigma barrier to treatment as some individuals find it easier to disclose to a computer than to a live therapist (Gega, Marks, & Mataix-Cols, 2003; MacGregor, Hayward, Peck, & Wilkes, 2009). Internet administered interventions also reduce the demands for trained CBT providers (Van Den Berg, Shapiro, Bickerstaffe, & Cavanagh, 2004), which is particularly important in rural areas with a shortage of trained therapists (Griffiths & Christensen, 2007).

Despite the many advantages of internet administered CBT, there are also some acknowledged disadvantages. The most substantial disadvantage seems to be attrition rates. Waller and Gilbody (2009) analysed dropout rates among internet administered CBT treatment studies and found that only 56% of participants completed all the assigned sessions. Attrition rates are even higher in prevention research; on average, only 50% of participants remain in a given study at follow-up (Lintvedt et al., 2013; Spek et al., 2008; Spek, Nyklicek, et al., 2007; Warmerdam et al., 2010). Warmerdam and colleagues (2010), for instance, found that only 37.5% of participants completed all five internet sessions. Such poor compliance was notable as the intervention was so brief.

In terms of performance, however, internet preventions appear comparable to in-person, group interventions. Spek and colleagues (2007, 2008) compared internet administered CBT with group administered CBT. The authors found that both interventions were comparably effective at post-intervention (Spek, et al., 2007) with the internet group demonstrating some superiority at follow-up (Spek et al., 2008). If the compliance issues in internet delivered prevention can be addressed, the ease of delivery and cost-effectiveness make a compelling case for its use.
To address the issue of non-compliance and elevated attrition, a rigorous contact/reminder structure was established in this study. During the study participants were regularly contacted if they failed to complete their tasks on time. There are some disadvantages to contacting participants during an internet administered intervention. For example, it makes the trial less ecologically valid, because in practice individuals would be unlikely to be reminded regularly by a clinician if they had not completed the intervention. Despite this risk, the reminder methodology was implemented to avoid the greater problem of elevated attrition found in previous research.

Statistical techniques were also implemented to reduce the impact of attrition on the findings. Intent-to-treat (ITT) analyses are statistical tools designed to reduce the impact of attrition and non-compliance on the accuracy of research findings. In the ITT method, data are analysed for all participants who entered the study, whether they completed the study or not. To analyse all participants’ outcomes it is necessary to compute an approximation of final outcomes for participants who fail to complete the study, and thus did not provide final outcome data. In addition, compliance is assumed, and participants would not be removed from analyses because they did not engage fully or accurately in the assigned tasks. ITT analyses are seen as the ‘gold standard’ for randomized controlled trials (Armijo-Olivo, Warren, & Magee, 2009; Gupta, 2011; Moher et al., 2010).

Intent-to-treat analyses help to account for biases that may occur due to attrition. For example, an intervention could be highly effective for some participants while not at all effective or even harmful to others. Individuals participate in an ineffective intervention
or experience negative effects might stop participating in a study. Thus, without accounting for attrition this intervention would appear highly effective, even compared with an intervention that was moderately effective for all participants. Therefore intent-to-treat analyses have become a recommended component of randomized controlled trials. However, few internet delivered prevention studies have implemented ITT analyses, which is problematic given the rate of attrition reported in the literature. Thus, ITT analysis seems to be particularly indicated for prevention studies.

Numerous forms of intent-to-treat analysis exist. One common type of intent-to-treat analysis is known as ‘last observation carried forward’ (LOCF) or ‘endpoint analysis’ (Armijo-Olivo et al. 2009). In this method the last observation before the missing data point is used to substitute for the missing data. Although originally popular, the LOCF method had fallen out of favour, as some researchers argue that it increases Type I error (Gadbury, Coffey, & Allison, 2003), and others note that the LOCF method can inflate treatment effects if attrition is due to symptom deterioration (Little & Yau, 1996; Unnebrink & Windeler, 2001). Given the limitations of replacement methods such as the LOCF method (also known as single imputation), multiple imputation methods have become increasingly popular.

In multiple imputation, estimates of the missing values are generated using regression models. Several different data sets that include the actual data and estimates of the missing data are generated and are referred to as imputation sets. The imputed data, or approximated missing data, are generated using regression models built from the available data or bootstrapping methods. Analyses on each imputation set are averaged to
approximate the outcomes that could have been expected if participants had not withdrawn, or had provided all requested information. Thus, multiple imputation estimates missing values. For example, for an individual who is missing his or her final follow-up scores, estimates would be based on the available information (e.g., the participant’s previous score and how scores in that sample tend to change with time) and substituted for the missing score. In fact this process would occur several times (ten in the current study) to make different estimates (i.e., imputations) of what that score would have been. Thus, ten different data sets are created, each with a set of estimates of the missing values. Statistical analyses are performed on each data set and then averaged to approximate the results had all participants remained in the study.

Two of the most common forms of multiple imputation are maximum likelihood estimation and multiple iteration. Although these models are different, neither is inherently better than the other (Collins, Schafer, & Kam, 2001). One advantage to maximum likelihood estimation is that it provides identical results each time it is run. Therefore, if one researcher was interested in replicating another’s results, he or she could do so. In contrast, multiple iteration relies on random number generation to approximate missing values, and thus each time it is run different imputed values are generated. In some circumstances, multiple iteration models may build more accurate models, by accounting for a greater number of variables that may provide important information for model generation. For example, it is easier to have a multiple iteration model account for what condition participants are in when approximating values. When missing values occur randomly (e.g., are not driven by some feature of the intervention) both methods will
reveal relatively similar results. To ensure consistency, both multiple iterations and maximum likelihood estimates were used to approximate the missing values in this study.

Summary

Building on current empirical knowledge, this dissertation was designed to compare and establish the transdiagnostic preventative efficacy of MoodGYM and the Face-in-the-Crowd Task in at risk, first and second year, undergraduate students. Symptom measures were administered before and after the six-week interventions and at a four month follow-up. Going substantially beyond previous MoodGYM research, at follow-up participants underwent structured diagnostic interviews to determine if any affective disorders were present. Given the limited research available when this trial was conducted, it was unknown how the two treatment conditions would compare with one another. However, both treatment interventions were expected to outperform the control condition at reducing affective symptoms and diagnoses.

Method

Participants

Participants were recruited for this study through various means (e.g., website advertising, class presentations, mass emailing, and posters distributed across campus). Each of these advertising methods provided a link to an online screening questionnaire. Only participants in their first or second year of an undergraduate degree at Western University were invited to participate. Participants were required to be fluent in English and have access to an internet-connected computer or touch screen device. Participants were also required to be between the ages of 17 and 64 years. To meet criteria for this
study, participants had to score 22 or higher on the Kessler Distress Scale (Christensen, Griffiths, & Jorm, 2004; Kessler et al., 2003), or 35 or higher on the NEO-FFI-neuroticism index (McCrae & Costa, 2004). No restrictions were made based on whether participants were currently in treatment, using psychotropic medications, or had a current mental health diagnosis.

Measures

Kessler Distress Scale (K10: Kessler et al., 2003). The Kessler Distress Scale is a ten item, multiple-choice measure designed to screen for non-specific psychological distress on a population basis. An example item from the K10 is “During the last 30 days, about how often did you feel tired out for no good reason”. Participants are asked to indicate a number from 1 (“none of the time”) to 5 (“all of the time”). This instrument has been used in a number of large-scale studies, most notably by the World Health Organization, for population mental health screening (Kessler et al., 2010). The K10 has shown high internal consistency (coefficient alpha > 0.84; Kessler et al., 2003) and has also demonstrated good validity by predicting affective disorders with an accuracy of 76.7% (Kessler et al., 2003). The measure is also an effective screening tool for affective disorders. Individuals who score higher than 27 on the K10 are 10 times more likely to have an affective disorder than are those who score below 27 (Hides et al., 2007). The K10 has also been used over the internet to screen for depression (Donker, van Straten, Marks, & Cuijpers, 2009), in which context it has demonstrated high internal reliability (Cronbach’s alpha = .90). In the present study, a lower cut-off (i.e., scores > 22) was used than in some previous studies (e.g., Hides et al., 2007) to ensure that less symptomatic
individuals were included in the sample. Given the nature of this prevention trial, the intention was to create a high-risk group rather than a likely pathological group. The same cut-off score has been used in previous depression prevention studies (e.g., Christensen et al., 2004) in which the authors were attempting to recruit a similar sample.

NEO- Five Factor Inventory (NEO-FFI: McCrae & Costa, 2004). The neuroticism subscale from the NEO-FFI is a 12-item, Likert-type scale. Participants rank each item from 1 (“strongly agree”) to 5 (“strongly disagree”). A sample item for the NEO-FFI neuroticism is “I am easily disturbed”. The NEO-FFI is a shorter version of the NEO-Personality Inventory Revised (Costa & McCrae, 1992). The NEO-FFI neuroticism scale has coefficient alphas ranging from 0.79 (McCrae & Costa, 2004) to 0.85 (Sherry, Hewitt, Flett, Lee-Baggley, & Hall, 2007). The neuroticism scale of the NEO-PI-R is correlated with emotional exhaustion (r = .44: Cano-Garcia, Padilla-Munoz, & Carrasco-Ortiz, 2005), anxiety r = .69, and depression, r = .71 (Jylha & Isometsa, 2006). A cut-off score of 35 was selected for this study as it corresponds to the 60th percentile of young adults based on the test manual (McCrae & Costa, 2010) and the 50th percentile of female, Canadian, university students (Holden & Fekken, 1994). Thus, this cut-score can be expected to select individuals with higher than average neuroticism levels.

Beck Depression Inventory-Second Edition (BDI-II: Beck, Steer, & Brown, 1996). The BDI-II is a 21-item measure that assesses the presence and degree of depressive symptoms consistent with the description of Major Depressive Disorder in the fourth edition of the *Diagnostic and Statistical Manual of Mental Disorders* (APA, 1994.; Beck et al., 1996). The BDI-II is the most common self-report measure used to quantify
depression symptoms in research with adult populations. Each item is rated using a 4-point multiple-choice scale ranging from 0 to 3. For example participants are asked to choose one of four answers that reflect how they have felt over the past week “0 – I do not feel sad; 1- I feel sad much of the time; 2- I am sad all the time; 3 I am so sad or unhappy that I can’t stand it”.

BDI-II has strong empirical support for its use in both clinical (Beck et al., 1996) and non-clinical (Dozois, Dobson, & Ahnberg, 1998) populations. Storch, Roberti, and Roth (2004), for example, found good internal consistency for the BDI-II with a Cronbach’s alpha coefficient of .90 in an undergraduate university sample. In the current study an identical Cronbach’s alpha coefficient (.90) was found. The BDI-II has also shown good concurrent validity in undergraduate samples. Sprinkle et al. (2002) found that the BDI-II correlated strongly ($r = .83$) with the depression module of the Structured Clinical Interview for the DSM-IV Axis I Disorders (First, Spitzer, Gibbon, & Williams, 1997b). The authors also found a test-retest reliability of .96 with periods between test administrations ranging from 1 to 12 days. Carmody (2005) investigated the effect of race on BDI-II scores and concluded that this measure was suitable for use in ethnically diverse university communities.

State Trait Anxiety Inventory (STAI: Spielberger, Gorsuch, Lushene, Vagg & Jacobs, 1970). The STAI is a widely used 40-item, self-report measure designed to assess both trait and state anxiety. The inventory includes two 20-item subscales that measure trait and state anxiety. For example, an item from the trait subscale would be “I am inclined to take things hard”, whereas a sample item from the state inventory would be “I feel jittery”. 

41
Participants rate each question from 1 (“almost never”) to 4 (“almost always”). The STAI has robust test-retest reliability, particularly on the trait subscale (where greater temporal stability would be expected). This measure also has good internal consistency, plus convergent and divergent validity (Oei, Evans, & Crook, 1990; Scott et al., 2007; Spielberger, Gorsuch, & Lushene, 1970). In the current study the trait and the state inventory demonstrated Cronbach’s alpha coefficients of .87 and .84, respectively. The trait inventory, intended to be stable over time, showed a 21-day retest reliability of .97; the state inventory, which measures current anxiety, had a retest reliability of .45 (Metzger, 1976).

Depression Anxiety and Stress Scale-21 (DASS-21: Lovibond & Lovibond 1983). The DASS-21 is a shortened version of the DASS-42 (Lovibond, 1983). The DASS-21 and the DASS-42 have highly consistent psychometric properties and high convergent validity (Dozois & Dobson, 2010). The DASS-21 is comprised of three scales (depression, anxiety, and stress) each of which is has seven-items rated on a four-point scale. Scores on each scale can range from 0 to 28. An example item from the depression subscale is “I couldn’t seem to experience any positive feelings at all”, whereas an example item from the anxiety subscale is, “I was aware of dryness of my mouth”. The DASS-21 has been well validated. Both the depression and anxiety scales exhibit high internal consistency, with Cronbach’s alpha coefficients of .88 and .82, respectively, in a general adult sample. In the current study these scales had similar Cronbach’s alpha coefficients of .86 and .75, respectively. The DASS-21 has also shown good convergent validity: the anxiety scale
correlates .81 with the Beck Anxiety Inventory and the depression scale correlates .74 with the Beck Depression Inventory-II (Dozois & Dobson, 2010; Lovibond & Lovibond, 1995).

Structured Clinical Interview for the DSM-IV-I-Non-patient version (SCID-I/NP: SCID-I/NP: First, Gibbon, & Williams, 1997a). The SCID-I/NP is a semi-structured interview designed to assess Axis I psychiatric diagnoses in non-psychiatric populations. The SCID-I is considered the “gold standard” for diagnostic assessment in research studies (First et al., 1997b). This instrument is administered by a clinician and contains nine modules. Each module contains a series of questions about a group of disorders. For example, Module A is comprised of questions relevant to making the diagnosis of a mood disorder. This format was designed so that modules could be removed without compromising the study design. Reliability of the SCID-I is determined by exploring the reliability of each diagnosis made. Inter-rater reliability (Kappa coefficients) of the diagnosis of depression ranges from .61 to .80 (Lobbestael, Leurgans, & Arntz, 2011; Zanarini et al., 2000). The reliabilities for Social Phobia range from .83 to .59, for Generalized Anxiety Disorder from .75 to .44, for Panic Disorder from .67 to .65, for Obsessive-Compulsive Disorder from .65 to .57, and for Posttraumatic Stress disorder from .88 to .77 (Lobbestael et al., 2011; Zanarini et al., 2000).

SCID-Is were administered by senior, clinical PhD students, either in-person or by phone. All interviewers were blind to participant condition. All interviews were audio-recorded (unless participants withheld permission) to assess inter-rater reliability. All interviewers were trained to administer the SCID-I interview. Training consisted of reading the SCID-I Users Guide (First et al., 1997a), viewing the 11 hour training video,
watching one SCID-I interview administered, and completing a SCID interview while being watched by an experienced SCID-I interviewer. All interviewers also had access to a licensed clinical psychologist, trained on the SCID-I, who could answer any questions that arose.

Interventions

MoodGYM/CBT (Christensen, Griffiths, Korten, 2002). MoodGYM is an empirically supported, internet-administered intervention (Calear & Christensen, 2010). MoodGYM consists of five individual modules containing 29 exercises and assessments, an interactive game, and resource downloads. Module 1 is the feelings module, in which participants are introduced to a set of characters who illustrate a range of functional and dysfunctional thinking patterns. Module 2, the ‘thoughts’ module, addresses types of dysfunctional thinking. Module 3, “unwarping”, directs participants to use cognitive behavioural strategies to target their maladaptive thoughts. Module 4, the de-stressing module, focuses on providing participants with ways to tackle stress and engage in behavioural activation; it also provides participants with the option of downloading a relaxation recording. Module 5 focuses on relationships, and covers simple problem solving strategies and typical responses to relationship break-ups. Each module is intended to take participants between 40-60 minutes to complete. Participants in this study were given 40 minutes a week over six-weeks to complete the modules. Thus, although participants might not have completed an entire module every week, they had an extra week to complete the unfinished portion of MoodGYM or to review what they had done previously. This week
allowed participants who moved more quickly through the modules time to review and those who took longer, more time to complete the intervention.

MoodGYM was developed primarily for the treatment of depression, with a secondary aim of reducing anxiety. Although it was developed to treat mild depression and anxiety, MoodGYM has also been validated for the prevention of affective symptoms (O'Kearney et al., 2009).

Attentional Training Task. The modified Face-in-the-Crowd Task (Dandeneau & Baldwin, 2004) was selected as the attentional training task. In this task, participants repeatedly searched through arrays of facial images displaying negative emotions (anger, sadness, and disgust) to find an image displaying a happy expression. In the training condition, participants were always asked to search for a positive face; thus the target face always displayed a happy expression. Participants identified the target image by clicking on it with a cursor if they used a personal computer, or pressing on it directly on a touch screen device.

The facial stimuli for this task were adopted from the Montreal Set of Facial Displays of Emotion (MSFDE; Beaupré & Hess, 2005). Four sets of facial expressions were selected: happy, sad, angry, and rejecting. Faces displaying happy expressions were classified as happy or positive whereas the faces displaying sad, angry, or rejecting faces were classified as negative faces. The same 16 models displayed each of the four facial expressions and all images were presented in grey scale. Half of the models were Caucasian and the other half were Hispanic (the most visually similar models in the data set); in addition, half of the models were male and half were female. There were equal
number of female and male Caucasian and Hispanic models; four Caucasian female, 
Caucasian male, Hispanic female, and Hispanic male models. Each of the facial 
expressions displayed was coded using the Facial Action Coding System, to ensure that all 
faces displayed a similar intensity and category of emotion across actors. Using these 
stimuli, Thibault, Bourgeois, and Hess (2006) found that participants correctly identified 
the emotion displayed 85 percent of the time.

Each trial consisted of 16 facial images containing all 16 models. The faces were 
displayed in a four by four matrix. The location assignment of each face was random with 
the restriction that the same model would never display the target face in the same location 
on two consecutive trials. In the training trials 15 models displayed a negative facial 
expression (sad, angry, or disapproving), while one model, the target face, displayed a 
happy facial expression. The number of times each model was selected to display the 
target face was controlled, with each model displaying the target face 9 times; however, 
the order in which the models were selected to display the target face was randomized. 
The type of facial expression (sad, angry, or disapproving) displayed by the non-target 
faces was randomly assigned. Thus, during any one trial it was likely that sad, angry and 
disapproving facial expressions were all present.

Each training session included six blocks of 24 trials for a total of 144 trials. 
Given that participants completed the task over the internet on their personal computers or 
touch screen devices, the visual angle at which participants viewed the images would vary 
from participant to participant; however, the display ratios remained consistent with all 
images being of equal size and equal distance from their bordering images. The attentional
training program was written and run in JavaScript and participants’ recorded reaction times and error rates were uploaded to a secure server. Participants were asked to use the same device each time they completed the study and they were also asked to use the same method to select the faces, i.e. mouse, track-pad, or touch screen. Participants completed this task semi-weekly and each session was designed to take 20 minutes to complete. This task has been well validated for positive attentional training over the internet.

Attentional Control Condition. Participants in the control condition completed a similar task to those individuals in the attentional training group; however, instead of consistently searching for a positive face, participants were asked to search for both positively- and negatively-valenced faces in equal proportion. Thus, participants searched for a negative face in an array of positive faces for one block, and then a positive face in a matrix of negative faces. Participants completed six blocks of 24 trials (as in the attentional training task), and each block alternated between searching for positive or negative faces. As with the attentional training task, the control task was expected to take 20 minutes.

The same facial stimuli were used in the attentional control condition as in the attentional training condition. During the alternating three blocks, in which participants were asked to search for the positive face in an array of negative faces, the negative facial expressions were again a mixture of angry, sad, and rejecting faces while the target face was happy. During the blocks in which participants were asked to search for the negative facial expression in the array of positive faces, one of the 16 models would display one of the three negative facial expressions; sad, angry, or rejecting. As in the attentional training
task, the target face was never the same model, and never in the same location, on two consecutive trials. Models were also randomly distributed across the 16 possible locations but were only selected as the target a total of nine times.

The control task mimics the original Face-in-the-Crowd Task (Hansen & Hansen, 1988). The Face-in-the-Crowd Task is commonly used to measure information processing and attention allocation (Hansen & Hansen 1988), and is not thought to influence degree of attentional bias or mood.

Procedure

Screening. Before enrolling in the study, participants completed a brief online screening questionnaire to assess their eligibility. Participants were asked to provide consent to participate in the study’s screening process (see Appendix A). They then provided demographic information and completed the two screening scales: the Kessler Distress Scale (Kessler et al., 2003) and the neuroticism subscale of the NEO - Personality Inventory – FFI (McCrae & Costa, 2010). Participants who scored either above 22 on the Kessler Distress Scale or above 35 on the Neuroticism subscale of the NEO-Personality Inventory- FFI were electronically provided with a letter of information about the study and were then asked to indicate if they were interested in participating. Those who agreed to participate were randomly assigned, by computer, to one of the three conditions (CBT, Attentional Training, or Attentional Control). All participants who completed the screening instrument were placed in a draw to win $100. Participants who did not meet criteria were informed and thanked for their time.
Enrolment. Participants were sent an email containing the letter of information within 24 hours of completing the online screening survey. Within approximately 48 hours, a researcher telephoned the participants to give them scripted information about the study and the opportunity to ask questions about study procedures, requirements, and compensation.

Baseline - Week 1: The baseline questionnaires were assigned one week after participants had indicated an interest in participating. Participants received an email, which provided them with instructions, and a link that took them directly to the baseline questionnaires and tasks. After clicking on their individualized link, participants were asked to provide separate, electronic, informed consent to participate in the study (see Appendix B). Completion of both consent forms took approximately 15 minutes. After completing the consent forms, participants completed two interactive tasks that were not included in this study\(^1\). Completion of these two tasks took approximately half an hour. After completing these interactive tasks, participants completed the Beck Depression Inventory-II BDI-II: (Beck et al., 1996), the State Trait Anxiety Inventory (Spielberger et

\(^1\) The Face-in-the-Crowd Task and the Psychological Distance Scaling Task (Dozois & Dobson, 2001) were the two interactive task completed (in the order listed). They were included in this study as part of a larger research agenda and results from this work will be explored in separate publications.
al., 1970) and some additional questionnaires not included in this study. These questionnaires were delivered to participants in four pre-set random orders. The questionnaires took participants approximately 45 minutes to complete.

**Intervention - Week 2-7:** Participants completed their assigned intervention over the six-weeks following their baseline session. Once a week, before completing their weekly intervention session, participants completed a series of brief measures that were not part of the current investigation. In total, the weekly questionnaires were expected to take approximately 15 minutes. After completion of the questionnaires participants were directed to their specific intervention.

**CBT Intervention.** Participants in the CBT condition underwent six weekly sessions of MoodGYM. On the first week, only module one was accessible to participants, whereas

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[2] The additional questionnaires were: The Fear of Negative Evaluation Scale (Brief-FNE: Leary, 1983), the Penn State Worry Questionnaire (PSWQ: Meyer, Miller, Metzger, & Borkovec, 1990), Rosenberg Self-Esteem Questionnaire (RSE: Rosenberg, 1965), and Satisfaction with Life Scale (SWLS: Diener, Emmons, Larsen, & Griffin, 1985).

[3] Participants were asked to complete the DASS-21 (Lovibond & Lovibond, 1995), the Automatic Thought Questionnaire (ATQ: Hollon & Kendall, 1980), and the Dysfunctional Attitude Scale – Short Form (DAS-SF; Beevers, Strong, Meyers, Strong, Pilkonis, & Miller, 2007), as well as a brief life events check list that was not included in this study. Participants always received these questionnaires in the same order (i.e., the Life Events Checklist, DASS-21, ATQ, and DAS-SF).
on the second week module two also became available. This continued through week five, when all five modules were available to participants. Participants were able to move back and forth between the modules and within the individual pages in each module. On the sixth week participants were asked either to complete the portions of MoodGYM that they had not previously completed or to review the other five modules. Participants were asked to spend 40 minutes a week on MoodGYM, and to complete the sessions in one sitting. They were also asked to logon to MoodGYM only when prompted by the study.

Attentional Interventions (Control and Training). Participants in the attentional training and control intervention completed 12, 20-minute, semi-weekly sessions of a modified Face-in-the-Crowd Task. Participants were prompted by email to complete these tasks every three to four days. They completed the assigned questionnaires before their first session and only began to complete the attentional task during their second weekly session. Participants were asked to complete the attentional task in one sitting and to use the same device each time they engaged in the study.

Post-Intervention - Week 8: Participants were alerted to the post-intervention session by email, as they had been for the earlier sessions. During the post-intervention phase, participants completed the same tasks and questionnaires that they had done during the baseline. The randomized order also remained the same. This session took participants approximately 75 minutes.

Structured Reminder Schedule. Participants were asked to complete weekly tasks within 24 hours of receiving a prompting email. If participants failed to complete the task within 24 hours, they were sent another reminder email prompting them to complete the
task on the following day. Participants who still had not completed the task 48 hours later received reminder phone calls from an experimenter and/or personalized emails. Emails were used if it was not possible to make phone contact with the participant. Thus, participants received repeat promptings until 1) they completed the task; 2) they indicated an intention to withdraw from the study; or 3) two weeks elapsed, at which time they were deemed non-contactable. After two weeks passed, participants were temporarily terminated from the study and given one last chance to re-enrol. If participants still did not make contact, they were eliminated from the study. Communication with participants was predominantly scripted although there was some script variation contingent upon participants’ responses.

The two-week policy was established because of the trial’s short time frame. Given that participants needed to complete an in-person interview four months after completing the intervention, it was important that they completed the intervention in a timely manner. If participants had been permitted to complete tasks at their leisure, without a time limit, they could have continued intermittent participation for months, greatly exceeding the trial’s time frame and potentially invalidating the results. For these reasons the amount of time participants could go without completing any tasks was limited. To encourage timely completion of tasks participants were placed in a draw for 100 dollars if they completed the weekly task on time.

Follow-up - Week 23-25: Sixteen weeks after completing the intervention and 15 weeks after the post-intervention session, participants were asked to engage in a follow-up. One week before their follow-up date participants were contacted by phone, reminded
about their upcoming follow-up questionnaires, and asked to schedule their follow-up interview. Sixteen weeks post intervention participants were asked to complete the same series of questionnaires as at baseline and post-intervention. Completion of these questionnaires took approximately 45 minutes. Participants were asked to complete their follow-up questionnaires before they came in for an interview. Participants were called several days before their follow-up interview. If at this point participants had not completed their online follow-up session they were reminded to do so.

When participants came in for their follow-up they were asked to complete a brief survey about their compliance in the study. During the follow-up interview participants completed a Structured Clinical Interview for DSM-IV Axis I Disorders-Non-patient version (SCID-I/NP: First et al., 1997a) with one of five trained interviewers. With permission, these interviews were audio-recorded. After the interview, participants were debriefed (see Appendix C), compensated, and asked to provide consent to be re-contacted. Participants who completed the entire study received $130 in compensation while those who only completed a portion were compensated proportionally.

Results

Participant Enrolment

Eight hundred and sixty-six participants completed the screening questionnaire and provided demographic information. Of the 564 participants who met criteria for the study and were invited to participate, only 456 enrolled in the study and completed the baseline questionnaire. A Consolidated Standards of Reporting Trials (CONSORT) diagram is displayed in Figure 1.
**Figure 1:** CONSORT Diagram

Enrollment

Assessed for eligibility (n=866)

Excluded (n=410)
- Not meeting inclusion criteria (n=302)
- Declined to participate (n=108)

Randomized (n=456)

Allocation

Allocated to CBT (n=144)
- Started intervention (n=141)
- Did not start intervention (unable to contact n=3)

Allocated to Attentional Training (n=154)
- Started intervention (n=146)
- Did not start intervention (unable to contact = 6, physical illness = 1, too busy = 1)

Allocated to Control (n=158)
- Started intervention (n=150)
- Did not start intervention (unable to contact = 6, too busy = 2)

Post-Intervention

Lost to follow-up/ discontinued intervention n=36
(unable to contact = 34, too busy = 1)

Follow-up

Lost to follow-up n=1
(unable to contact = 1)
Baseline Characteristics and Demographics

The mean age of participants was 18.71 (SD = 1.65) years (range = 17 to 34 years).

Demographic information and symptom scores by condition are presented in Table 1. The ethnic diversity was similar to the makeup of the university community: 57.5% self-identified as Caucasian, 25.2% identified themselves as coming from Asian descent, 7.7% from South Asian descent, and the remaining participants (9.5%) from other ethnicities (First Nations, Latino/ South American, African or African Canadian, or Other). Baseline BDI-II mean score was 20.43 (SD = 10.24), whereas baseline State and Trait scores from the STAI were 23.70 (SD = 6.38) and 24.83 (SD = 6.31), respectively.

No significant differences were found across the three conditions for age ($F[2,453] = 0.12, p = .89$), gender ($\chi^2[1,465] = 1.96, p = .38$), or ethnicity ($\chi^2[6,465] = 13.61, p = .33$). Also, no significant symptom differences were found across the three conditions for BDI-II ($F[2,450] = 1.68, p = .19$), STAI-State ($F[2,450] = 1.8, p = .16$), or the STAI-Trait ($F[2,451] = 2.28, p = .10$) scores. Mean score on the K10 was 27.28 (SD = 5.78) and the mean neuroticism score was 41.06 (SD = 5.97). These scores were normally distributed, and, because they had been used as a selection criteria, were slightly above the population mean, as was expected. Graphical representations of these data are located in Appendix D and E.
Table 1

Demographic Information by Condition

<table>
<thead>
<tr>
<th></th>
<th>CBT</th>
<th>Attentional Training</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of persons randomized</td>
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<td>154</td>
<td>158</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean (SD)</td>
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<td>18.73(1.55)</td>
<td>18.75(1.63)</td>
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<td>Gender (percentage)</td>
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<tr>
<td>Male</td>
<td>30.5%</td>
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</tr>
<tr>
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<td>69.5%</td>
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<td>73.4%</td>
</tr>
<tr>
<td>Ethnicity (percentage)</td>
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<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>57.6%</td>
<td>59.7%</td>
<td>55.1%</td>
</tr>
<tr>
<td>Asian</td>
<td>25.7%</td>
<td>22.1%</td>
<td>27.8%</td>
</tr>
<tr>
<td>South Asian</td>
<td>9.0%</td>
<td>7.1%</td>
<td>7.0%</td>
</tr>
<tr>
<td>Other</td>
<td>7.6%</td>
<td>11.0%</td>
<td>8.9%</td>
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<tr>
<td>BDI-II</td>
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</tr>
<tr>
<td>Mean (SD)</td>
<td>21.99(11.01)</td>
<td>21.16(9.87)</td>
<td>19.23(9.82)</td>
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<td>STAI (State)</td>
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<tr>
<td>Mean (SD)</td>
<td>23.74(6.55)</td>
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<tr>
<td>STAI (Trait)</td>
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<td></td>
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<tr>
<td>Mean (SD)</td>
<td>24.84(6.39)</td>
<td>25.59(6.18)</td>
<td>24.06(6.31)</td>
</tr>
</tbody>
</table>

Note: BDI-II = Beck Depression Inventory-II; STAI = State Trait Anxiety Inventory.
Attrition

The attrition rate between baseline and follow-up was 22.8%. Most of the dropouts occurred between baseline and post-intervention. Indeed, only two participants (one in the CBT and one in the attentional training conditions) left the study between post-intervention and follow-up. Thirty-eight participants withdrew from the CBT condition, 30 participants withdrew from the attentional training, and 23 participants withdrew from the attentional control condition. There was no significant difference in attrition across the three conditions, $\chi^2(2, 456) = 2.78, p = .25$.

There were few differences between participants who withdrew and those who remained in the study. The list of demographic and symptom score information for participants who withdrew or remained in the study is found in Table 2. There was no significant difference between completers and dropouts in age, $F(1, 451) = 0.034, p = .854$, or gender, $\chi^2(1, 456) = 0.58, p = .448$. However, there was a significant difference between the attrition and the completer groups in ethnicity, $\chi^2(6, 456) = 17.114, p < .01$. Follow-up analysis revealed that Caucasians were more likely to remain in the study than other participants, $\chi^2(1, 456) = 2.43, p < .05$, whereas individuals who identified themselves as South Asians were less likely to remain in the study, $\chi^2(1, 456) = 7.01, p < .01$. There was no significant difference between participants who self-identified as Asian, $\chi^2(1, 456) = 0.015, p = .90$, or as one of the other ethnicities (First Nations, Latino/ South American, African or African Canadian, or Other), $\chi^2(1, 456) = 1.55, p = .21$. Participants who withdrew were more likely to have lower scores on the BDI-II ($F[1, 451] = 5.63, p < .05$).
Table 2

Demographics of the Completer and Attrition Groups

<table>
<thead>
<tr>
<th></th>
<th>Completer</th>
<th>Dropout</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of persons</td>
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<td>101</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>18.76(1.55)</td>
<td>18.79(1.95)</td>
</tr>
<tr>
<td>Gender (percentage)</td>
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<td></td>
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<tr>
<td>Male</td>
<td>25.9%</td>
<td>29.7%</td>
</tr>
<tr>
<td>Female</td>
<td>74.1%</td>
<td>70.3%</td>
</tr>
<tr>
<td>Ethnicity (percentage)</td>
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<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>60.0%*</td>
<td>48.5%*</td>
</tr>
<tr>
<td>Asian</td>
<td>25.4%</td>
<td>24.8%</td>
</tr>
<tr>
<td>South Asian</td>
<td>6.0%*</td>
<td>13.9%*</td>
</tr>
<tr>
<td>Other</td>
<td>9.0%</td>
<td>10.9%</td>
</tr>
<tr>
<td>BDI-II</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>21.04(10.02)*</td>
<td>12.83(10.76)*</td>
</tr>
<tr>
<td>STAI (State)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>23.73(6.33)</td>
<td>23.59(6.58)</td>
</tr>
<tr>
<td>STAI (Trait)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>25.07(6.19)</td>
<td>23.96(6.68)</td>
</tr>
</tbody>
</table>

Note: BDI-II = Beck Depression Inventory-II; STAI = State Trait Anxiety Inventory. An * indicates *p < .05
but there were no significant differences across the two groups on the STAI-State ($F[1,451] = 0.03, p = .85$) or the STAI-Trait ($F[1,452] = 2.41, p = .12$).

Participation in Study

The study was designed for participants to spend seven weeks between baseline and post intervention and 15 weeks between post-intervention and follow-up. On average it took participants 7.17 ($SD = 0.58$) weeks to complete the intervention. The mean time to completion for the follow-up questionnaires was 22.14 ($SD = 0.68$) weeks after starting the baseline task and 14.96 ($SD = 0.76$) weeks after completing the post-intervention session. As participants were required to have all follow-up questionnaires completed before being administered the structured diagnostic interview, they took slightly longer to complete the final interview. On average participants completed the follow-up interview 22.87 ($SD = 2.89$) weeks after completing the baseline session and 15.70 ($SD = 2.94$) weeks after completing the post-intervention task.

Two one-way analyses of variance (ANOVA) revealed no significant differences among the intervention completion times of the CBT ($M = 7.24, SD = 0.71$), Attentional Training ($M = 7.12, SD = 0.44$), or Attentional Control ($M = 7.18, SD = 0.48$) conditions, $F(2,351) = 1.26, p = .29$. One-way ANOVA revealed no significant differences in the follow-up times (weeks from post-intervention to follow-up) between the CBT ($M = 14.90, SD = 0.94$), Attentional Training ($M = 14.98, SD = 0.59$), or Attentional Control ($M = 14.98, SD = 0.74$) conditions, $F(2,349) = 0.39, p = .68$.

Diagnostic Inter-rater Reliability
Five diagnosticians participated in data collection for this study. Inter-rater reliability was assessed for each rater by randomly selecting 10 interviews that they had conducted and having another trained diagnostician (blind to condition) rerate the recorded interview. A kappa value for Major Depressive Disorder (previous and current) and a combined kappa for all anxiety disorders were calculated. Both kappa values were excellent. The kappa coefficient for previous and current depression was .94 whereas it was .99 for combined anxiety disorders. These scores illustrate almost perfect agreement between interviewers and raters. However, it is important to note that these scores may be inflated by the relative frequency of no-diagnosis to a diagnosis being present. In the 50 cases interviewed only 22 cases had a previous or current history of depression and only 26 anxiety disorders were identified.

Efficacy Outcome Analysis

Beck Depression Inventory-II. The mean BDI-II scores at each measurement point for participants who completed the study through to the follow-up are included in Table 3. An omnibus, split-plot ANOVA comparing Condition (CBT, Attentional Training, Control) and Time (Baseline, Post-intervention, Follow-up) was conducted. Mauchly’s test indicated that the assumptions of sphericity had been violated, $\chi^2(2,344) = 13.01, p < .01$. Therefore, the degrees of freedom were corrected using the Greenhouse-Geisser estimate of sphericity ($\varepsilon = .97$). A significant main effect of Time, $F(1.93, 659.01) = 60.94, p < .001$ indicated that participants’ BDI-II scores improved overall. Levene’s Test of Equality of Error Variances was not statistically significant; thus the assumption of equality of variance was not violated. There was no significant main effect of Condition, $F(2, 342) = 60$
Table 3

**Mean and Standard Deviations of Depression and Anxiety Symptom Scores**

<table>
<thead>
<tr>
<th></th>
<th>CBT Mean (SD)</th>
<th>Attentional Training Mean (SD)</th>
<th>Control Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Baseline</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BDI-II</td>
<td>21.25(10.47)</td>
<td>22.10(9.93)</td>
<td>20.33(9.72)</td>
</tr>
<tr>
<td>DASS-21-Depression Scale</td>
<td>16.65(9.82)</td>
<td>16.18(9.74)</td>
<td>14.91(9.48)</td>
</tr>
<tr>
<td>STAI-STATE</td>
<td>23.60(6.44)</td>
<td>24.43(6.29)</td>
<td>23.21(6.24)</td>
</tr>
<tr>
<td>STAI-TRAIT</td>
<td>25.13(6.32)</td>
<td>25.69(6.22)</td>
<td>24.54(6.16)</td>
</tr>
<tr>
<td>DASS-21-Anxiety Scale</td>
<td>12.98(8.80)</td>
<td>14.00(8.10)</td>
<td>12.55(8.91)</td>
</tr>
<tr>
<td><strong>Post-Intervention</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BDI-II</td>
<td>16.04(11.44)</td>
<td>19.11(11.44)</td>
<td>17.56(10.66)</td>
</tr>
<tr>
<td>DASS-21-Depression Scale</td>
<td>10.32(9.90)</td>
<td>12.60(10.15)</td>
<td>11.42(10.11)</td>
</tr>
<tr>
<td>STAI-STATE</td>
<td>20.84(6.86)</td>
<td>22.20(6.48)</td>
<td>22.27(7.21)</td>
</tr>
<tr>
<td>STAI-TRAIT</td>
<td>22.08(6.78)</td>
<td>23.10(7.08)</td>
<td>23.52(7.12)</td>
</tr>
<tr>
<td>DASS-21-Anxiety Scale</td>
<td>6.55(8.54)</td>
<td>8.45(9.08)</td>
<td>8.05(9.03)</td>
</tr>
<tr>
<td><strong>Follow-up</strong></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>BDI-II</td>
<td>13.41(10.44)</td>
<td>17.76(11.43)</td>
<td>16.52(11.76)</td>
</tr>
<tr>
<td>DASS-21-Depression Scale</td>
<td>9.80(8.96)</td>
<td>12.73(10.91)</td>
<td>12.31(10.16)</td>
</tr>
<tr>
<td>STAI-STATE</td>
<td>21.30(5.88)</td>
<td>22.40(6.78)</td>
<td>22.08(6.43)</td>
</tr>
<tr>
<td>STAI-TRAIT</td>
<td>22.66(6.26)</td>
<td>23.61(6.71)</td>
<td>23.25(6.45)</td>
</tr>
<tr>
<td>DASS-21-Anxiety Scale</td>
<td>7.55(8.25)</td>
<td>9.20(8.15)</td>
<td>8.59(8.22)</td>
</tr>
</tbody>
</table>

Note: BDI-II = Beck Depression Inventory-II, DASS-21 = Depression Anxiety and Stress Scale-21, STAI = State Trait Anxiety Inventory.
2.36, $p = .10$, suggesting that there was no statistical difference between the averages of the three conditions. To confirm that each condition changed significantly over time follow-up t-tests were conducted (see Table 4). A significant two-way interaction of Condition by Time, $F(3.85, 659.01) = 3.15, p < .05, \eta^2_p = .82$, indicated group differences in how participants’ symptoms improved over time.\(^4\) A graphical representation of these results is presented in Figure 2. Follow-up contrasts were planned to test if there were significant differences between the groups. Initially comparisons were planned between each group; however, as the two attentional groups performed so similarly, the CBT condition was compared to the combination of the attentional conditions. This comparison was conducted because initial analyses revealed that the CBT condition was significantly different from both groups individually; as such, combining the two attentional conditions was a more parsimonious way to assess treatment efficacy.

Participants’ improvement was compared from baseline to post-intervention. The two attentional conditions exhibited statistically similar rates of change ($F[1,451] = 0.20, p = .65$), but the CBT condition showed significant improvement compared to these conditions ($F[1,451] = 7.40, p < .01, d = .37$). The same pattern of results was replicated with the observed improvement from baseline to follow-up. There was no statistical difference in

\(^4\) Mean split analyses were explored to establish whether baseline symptom scores affected the pattern of results. Although baseline symptom levels impacted the effect sizes they did not change the pattern of results and thus were not included in this analysis.
Table 4

Simple effects contrasts of BDI-II scores Testing for Significant Change between Baseline and Follow-up

<table>
<thead>
<tr>
<th>Condition</th>
<th>t-statistic</th>
<th>Degrees of freedom</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBT</td>
<td>7.92</td>
<td>342</td>
<td>.001</td>
</tr>
<tr>
<td>Attention training</td>
<td>4.76</td>
<td>342</td>
<td>.001</td>
</tr>
<tr>
<td>Attentional Control</td>
<td>4.24</td>
<td>342</td>
<td>.001</td>
</tr>
</tbody>
</table>
Figure 2: Beck Depression Inventory-II symptom scores across conditions at baseline, post-intervention, and follow-up.
Figure 3: Depression scale of the Depression Anxiety Stress Scale-21 symptom scores across conditions at baseline, post-intervention, and follow-up.
the rate of change between the attentional groups ($F[1, 451] = 0.30, p = .59$). In contrast, the CBT group improved to a greater extent than the other two groups over time ($F[1, 451] = 17.61, p < .001, d = .57$).

Depression Sub-Scale of the DASS-21. Mean scores on the Depression Scale of the DASS-21 across groups are also reported in Table 3 (Figure 3 illustrates these findings). A split-plot ANOVA was conducted, analysing Condition (CBT, Attentional Training, Control) by Time (Baseline, Post-intervention, Follow-up). Mauchly’s test of sphericity indicated that the assumptions of sphericity had been violated, $\chi^2(2, 342) = 12.23, p < .01$. The degrees of freedom were, therefore, corrected using the Greenhouse-Geisser estimate of sphericity ($\varepsilon = .97$). The main effect of Time was significant, $F(1.94, 662.80) = 50.43, p < .001$. Levene’s Test of Equality of Error Variances was not significant and there was no significant main effect of Condition, $F(2, 340) = 0.76, p = .47$. A significant two-way interaction of Condition by Time, $F(3.86, 656.73) = 2.95, p = .01, \varepsilon_p^2 = .78$, indicated a difference in how the three conditions improved over time.

The interaction was followed using the same contrasts as conducted on the BDI-II data. Participants’ improvement was compared from baseline to post-intervention. No significant difference, was found between the attentional conditions ($F[1, 501] = 0.01, p = .92$) but the CBT condition showed significantly greater improvement than did the other two conditions ($F[1, 501] = 12.49, p < .001, d = 0.48$). The same pattern of results was replicated for observed improvement from baseline to follow-up. The change in the attentional groups did not differ statistically ($F[1, 451] = 0.98, p = .32$), whereas the CBT
group improved more than did the other two groups from baseline to follow-up ($F[1,451] = 23.39, p < .001, d = 0.65$).

To test for the presence of baseline differences in the frequency of MDD, an analysis of participants’ recalled previous episodes of depression was conducted. The number of participants who recalled having an episode of depression during the beginning of the trial was compared cross conditions. At baseline, 15 participants in the CBT and in the attentional condition reported experiencing depression compared to 22 participants in the attentional training condition. Chi squared revealed no significant difference in the frequency of depression across conditions ($\chi^2(1, 337) = 1.64, p = .44$) at baseline.

State Trait Anxiety Inventory. To explore if the three interventions had significant effects on anxiety symptoms, two omnibus split-plot ANOVAs were conducted using the STAI scores as the dependent variable. Means and standard deviations of the STAI results are presented in Table 3. The first analysis involved a 3 X 3 ANOVA comparing Condition (CBT, Attentional Training, Control) and Time (Baseline, Post-intervention, Follow-up) for State anxiety. Again, Mauchly’s test of sphericity was significant, $\chi^2(2,344) = 7.72, p < .05$, and a Greenhouse-Geisser correction ($\epsilon = .98$) was used. There was a significant main effect of Time, $F(1.96,669.02) = 15.68, p < .001$. Across the three conditions, participants improved over time on self-reported scores of state anxiety. There was no main effect of Condition, $F(2,342) = 1.36, p = .26$, and no significant interaction between Condition and Time, $F(3.91,669.02) = 0.97, p = .421$. This information is graphically represented in Figure 4.
Figure 4: State anxiety symptom scores across conditions at baseline, post-intervention, and follow-up.
Figure 5: Trait anxiety symptom scores across conditions at baseline, post-intervention, and follow-up.
A second mixed, 3 Condition by 3 Time ANOVA was conducted on the trait anxiety scores from the STAI to determine whether Condition influenced the rate of change in trait anxiety scores. As Mauchly’s test of sphericity was again significant $\chi^2(2) = 8.95, p < .01$, a Greenhouse-Geisser correction ($\varepsilon = .98$) was used. A main effect was found for Time, $F(1.95, 668.79) = 21.70, p < .001$ but not for Condition, $F(2, 343) = 0.77, p = .46$. The interaction of Condition and Time was not significant, $F(3.89, 668.71) = 1.40, p = .24$. This information is graphically represented in Figure 5.

Anxiety subscale of the DASS-21. To test if the three interventions had differential effects on anxiety symptoms, a 3 Condition by 3 Time mixed ANOVA was conducted on the scores from the anxiety subscale of the DASS-21. Mauchly’s test of sphericity was significant, $\chi^2(2) = 9.74, p < .01$, and the Greenhouse-Geisser correction ($\varepsilon = .97$) was used. The main effect of Time was significant, $F(1.95, 663.28) = 78.14, p < .001$. However, neither the main effect of Condition, $F(2, 341) = 1.25, p = .29$ nor the Condition and Time interaction, $F(3.89, 663.27) = 0.863, p = .48$ were significant. These data are graphically represented in Figure 6.

Diagnostic outcomes

Diagnostic outcomes were based on the results of the SCID-I. A chi-squared analysis was used to determine whether there were any significant differences in diagnostic outcomes across conditions. Due to the low base rate of anxiety disorders in the sample, anxiety disorders were combined for this analysis, creating a “yes” or “no” category for the presence of any anxiety disorder. Current Major Depression was examined alone and not combined with other mood disorders (e.g., Dysthymia or
Figure 6: Anxiety scale of the Depression Anxiety Stress Scale-21 symptom scores across conditions at baseline, post-intervention, and follow-up.
Depression NOS) as these disorders were both infrequent and not a target of this intervention. In keeping with the hypotheses the frequencies of MDD and anxiety disorders were compared across conditions. There were five cases of depression in the CBT condition, 11 in the control condition, and 18 in the attentional training condition. Similarly there were 31 cases of anxiety in the CBT condition, 47 in the attentional training condition, and 42 in the attentional control condition. No significant differences were found among the three conditions (CBT, Attentional Training, Control) on diagnostic outcomes for Anxiety disorders ($\chi^2[2,347] = 1.63, p = .44$) indicating that there were no significant differences in the rate of anxiety disorders at follow-up. However, there was a significant difference in the prevalence of Major Depressive Disorder across the three conditions, $\chi^2(2,350) = 6.33, p < .05$.

Follow-up analyses followed the same model applied to earlier symptom data. First, chi-squared revealed no significant differences between the two attentional conditions on MDD diagnostic outcomes, $\chi^2(2,350) = 1.92, p = .17$. Second, a chi-squared follow-up test compared outcomes with the CBT condition to the combination of the two attentional conditions. A significant difference in the prevalence of depression across these two conditions was found, $\chi^2(2,350) = 4.06, p < .04$, suggesting that the prevalence of MDD was significantly lower in the CBT condition.

Intent to Treat Analysis

In the current study data that were lost due to attrition were replaced by estimates derived from multiple imputation (MI) procedures; ten iterations of the MI were used to generate missing data predictions. The following results represent the average of tests conducted on
the imputed data from these iterations. Means and standard deviations of the imputed data are presented in Table 5. Maximum Likelihood estimations were also generated using an independence stochastic model, and are available in Tables 6 (means and standard deviations) and 7 (inferential statistics). Both models resulted in similar patterns of significance, so only the multiple imputation results are presented in the text. A missing value analysis was also conducted on the BDI-II. Approximately 24.56% of cases had some missing data, i.e., 15.57% of the total data points were missing. For the depression scale of the DASS-21, 25.22% of cases had some missing data, which represented 15.79% of the data. On the State Trait Anxiety Inventory, 24.34% of cases had some missing data on the state scale, representing 15.64% of the total data. On the trait scale, 24.12% of cases had some missing data, which represented 15.50% of all data. Similarly, 24.78% of cases on the Anxiety index of the DASS-21 were missing some data, and 15.64% of total data were missing.

Beck Depression Inventory-II. An omnibus 3 by 3 (Condition x Time) mixed ANOVA was conducted on the imputated BDI-II outcomes. Mauchly’s test of sphericity indicated that the assumptions of sphericity had been violated, $\chi^2(2,456) = 12.63, p < .05$, and therefore degrees of freedom were corrected using the Greenhouse-Geisser estimate of sphericity ($\eta = .97$). As seen with the listwise deletion data, there was also a significant main effect of Time, $F(1.93, 867.26) = 5.07, p < .001$. The effect of Condition was not significant, $F(2,452) = 0.94, p < .41$. The two-way interaction of Condition and Time remained significant, $F(3.86, 867.26) = 3.37, p > .01$. 

73
Table 5

Means and Standard Deviations for imputed data using Multiple Imputations

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>CBT</th>
<th>Attentional Training</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
</tr>
<tr>
<td>BDI-II</td>
<td>20.94(10.99)</td>
<td>21.18(9.87)</td>
<td>19.23(9.82)</td>
<td></td>
</tr>
<tr>
<td>DASS-21 Depression Scale</td>
<td>16.08(10.25)</td>
<td>15.88(9.53)</td>
<td>14.21(9.34)</td>
<td></td>
</tr>
<tr>
<td>STAI-STATE</td>
<td>23.74(6.55)</td>
<td>24.37(6.22)</td>
<td>22.99(6.33)</td>
<td></td>
</tr>
<tr>
<td>STAI-TRAIT</td>
<td>24.84(6.39)</td>
<td>25.59(6.18)</td>
<td>24.06(6.31)</td>
<td></td>
</tr>
<tr>
<td>DASS-21-Anxiety Scale</td>
<td>12.73(8.72)</td>
<td>13.13(8.27)</td>
<td>12.37(8.75)</td>
<td></td>
</tr>
</tbody>
</table>

|                        | Post-Intervention |          |                      |                  |
|                        | Mean (SD)         | Mean (SD) | Mean (SD)            |                  |
| BDI-II                 | 16.37(11.69)      | 18.23(11.35) | 16.61(10.83)          |                  |
| DASS-21 Depression Scale | 10.99(9.51)      | 12.85(9.78) | 11.56(9.57)          |                  |
| STAI-STATE             | 20.91(6.87)      | 22.28(6.61) | 21.93(7.09)          |                  |
| STAI-TRAIT             | 22.33(6.87)      | 23.08(6.95) | 23.16(7.27)          |                  |
| DASS-21-Anxiety Scale  | 6.69(8.68)       | 7.91(9.28)  | 7.87(8.99)           |                  |

|                        | Follow-up |          |                      |                  |
|                        | Mean (SD) | Mean (SD) | Mean (SD)            |                  |
| BDI-II                 | 14.12(11.07) | 17.04(11.27) | 15.67(11.72)          |                  |
| DASS-21 Depression Scale | 10.58(8.68) | 12.82(9.69) | 12.43(9.75)          |                  |
| STAI-STATE             | 21.47(5.99)  | 22.41(6.69) | 21.80(6.41)          |                  |
| STAI-TRAIT             | 22.85(6.37)  | 23.43(6.68) | 22.96(6.46)          |                  |
| DASS-21-Anxiety Scale  | 7.88(8.21)   | 8.83(8.46)  | 8.79(8.16)           |                  |

Note: BDI-II = Beck Depression Inventory-II, DASS-21 = Depression Anxiety and Stress Scale-21, STAI = State Trait Anxiety Inventory.
Table 6

*Means and Standard Deviations for imputed data using Maximum likelihood*

<table>
<thead>
<tr>
<th></th>
<th>CBT</th>
<th>Attentional Training</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Baseline</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BDI-II</td>
<td>20.96(10.98)</td>
<td>21.18(9.86)</td>
<td>19.24(9.82)</td>
</tr>
<tr>
<td>DASS-21 Depression Scale</td>
<td>16.11(10.27)</td>
<td>15.88(9.53)</td>
<td>14.15(9.34)</td>
</tr>
<tr>
<td>STAI-STATE</td>
<td>23.74(6.55)</td>
<td>24.37(6.22)</td>
<td>22.97(6.32)</td>
</tr>
<tr>
<td>STAI-TRAIT</td>
<td>24.84(6.39)</td>
<td>25.59(6.18)</td>
<td>24.09(6.32)</td>
</tr>
<tr>
<td>DASS-21-Anxiety Scale</td>
<td>12.71(8.73)</td>
<td>13.13(8.28)</td>
<td>12.36(8.74)</td>
</tr>
<tr>
<td><strong>Post-Intervention</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BDI-II</td>
<td>16.53(11.69)</td>
<td>18.59(11.57)</td>
<td>17.70(10.60)</td>
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<tr>
<td>DASS-21 Depression Scale</td>
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<td>12.26(10.12)</td>
<td>11.49(9.89)</td>
</tr>
<tr>
<td>STAI-STATE</td>
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<td>22.13(6.40)</td>
<td>22.13(7.24)</td>
</tr>
<tr>
<td>STAI-TRAIT</td>
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<td>23.15(6.86)</td>
<td>23.27(7.09)</td>
</tr>
<tr>
<td>DASS-21-Anxiety Scale</td>
<td>7.24(8.79)</td>
<td>8.20(8.98)</td>
<td>8.03(8.96)</td>
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<tr>
<td><strong>Follow-up</strong></td>
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</tr>
<tr>
<td>BDI-II</td>
<td>14.02(10.75)</td>
<td>17.30(11.46)</td>
<td>16.21(11.51)</td>
</tr>
<tr>
<td>DASS-21 Depression Scale</td>
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<td>12.36(9.91)</td>
<td>12.04(10.07)</td>
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<tr>
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<td>23.56(6.71)</td>
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<tr>
<td>DASS-21-Anxiety Scale</td>
<td>8.06(8.40)</td>
<td>9.24(8.46)</td>
<td>8.81(8.19)</td>
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</tbody>
</table>

Note: BDI-II = Beck Depression Inventory-II, DASS-21 = Depression Anxiety and Stress Scale-21, STAI = State Trait Anxiety Inventory.
Table 7

**F-statistics and p-values for Maximum likelihood data**

<table>
<thead>
<tr>
<th>BDII-II</th>
<th>Degrees of Freedom</th>
<th>F-Statistic</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

Repeated Measures ANOVA 3(Condition; Attentional training, Control, & CBT) x 3 (Time; Baseline, Post-intervention, Follow-up)

<table>
<thead>
<tr>
<th></th>
<th>Degrees of Freedom</th>
<th>F-Statistic</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condition x Time</td>
<td>3.94,893.42</td>
<td>3.11</td>
<td>.02*</td>
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<tr>
<td>Main effect-Time</td>
<td>1.97,893.42</td>
<td>41.432</td>
<td>.001**</td>
</tr>
<tr>
<td>Main effect- Condition</td>
<td>2,453</td>
<td>1.78</td>
<td>.18</td>
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**Test of Simple Effects**

<table>
<thead>
<tr>
<th>Baseline to Post-intervention Change</th>
<th>Degrees of Freedom</th>
<th>F-Statistic</th>
<th>p-value</th>
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<tbody>
<tr>
<td>Attention vs. Control</td>
<td>1,668</td>
<td>1.17</td>
<td>.34</td>
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<tr>
<td>CBT vs. Attention combined</td>
<td>1,668</td>
<td>8.82</td>
<td>.003*</td>
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<th>Baseline to Follow-up Change</th>
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<td>CBT vs. Attention combined</td>
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Table 7 continued

<table>
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<tr>
<th>Depression Subscale of the DASS-21</th>
<th>Degrees of Freedom</th>
<th>F-Statistic</th>
<th>p-Value</th>
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Repeated Measures ANOVA 3(Condition; Attentional training, Control, & CBT) x 3 (Time; Baseline, Post-intervention, Follow-up)

<table>
<thead>
<tr>
<th>Interaction-condition x Time</th>
<th>3.95,894.83</th>
<th>2.88</th>
<th>.01*</th>
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<tbody>
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<td>Main effect-Time</td>
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<td>41.50</td>
<td>.00**</td>
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<tr>
<td>Main effect- Condition</td>
<td>2,453</td>
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Test of Simple Effects

<table>
<thead>
<tr>
<th>Baseline to Post-intervention Change</th>
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<th>p-Value</th>
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<tr>
<td>Attention vs. Control</td>
<td>1, 560</td>
<td>0.74</td>
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<td>CBT vs. Attention combined</td>
<td>1, 560</td>
<td>6.31</td>
<td>.01*</td>
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<table>
<thead>
<tr>
<th>Baseline to Follow-up Change</th>
<th>Degrees of Freedom</th>
<th>F-Statistic</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attention vs. Control</td>
<td>1, 560</td>
<td>1.27</td>
<td>.21</td>
</tr>
<tr>
<td>CBT vs. Attention combined</td>
<td>1, 560</td>
<td>8.83</td>
<td>.003*</td>
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Table 7 continued

<table>
<thead>
<tr>
<th>Anxiety Subscale of the DASS-21</th>
<th>Degrees of Freedom</th>
<th>t-Statistic</th>
<th>p-Value</th>
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</thead>
<tbody>
<tr>
<td><em>Repeated Measures ANOVA 3(Condition; Attentional training, Control, &amp; CBT) x 3 (Time; Baseline, Post-intervention, Follow-up)</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interaction-condition x Time</td>
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<td>Main effect-Time</td>
<td>1.97,904.64</td>
<td>66.27</td>
<td>.001**</td>
</tr>
<tr>
<td>Main effect- Condition</td>
<td>2, 453</td>
<td>0.70</td>
<td>.51</td>
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<table>
<thead>
<tr>
<th>State Inventory from the STAI</th>
<th>Degrees of Freedom</th>
<th>F-Statistic</th>
<th>p-Value</th>
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<tbody>
<tr>
<td><em>Repeated Measures ANOVA 3(Condition; Attentional training, Control, &amp; CBT) x 3 (Time; Baseline, Post-intervention, Follow-up)</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interaction-condition x Time</td>
<td>3.97,898.53</td>
<td>1.25</td>
<td>.31</td>
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<tr>
<td>Main effect-Time</td>
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<td>16.75</td>
<td>.001**</td>
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<td>Main effect- Condition</td>
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<td>1.59</td>
<td>.21</td>
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Table 7 continued

<table>
<thead>
<tr>
<th>Trait Subscale from the STAI</th>
<th>Degrees of Freedom</th>
<th>F-Statistic</th>
<th>p-Value</th>
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Repeated Measures ANOVA 3(Condition; Attentional training, Control, & CBT) x 3 (Time; Baseline, Post-intervention, Follow-up)

<table>
<thead>
<tr>
<th>Interaction-condition x Time</th>
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<th>1.43</th>
<th>.26</th>
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<td>Main effect-Time</td>
<td>1.98,894.89</td>
<td>17.94</td>
<td>.001 **</td>
</tr>
<tr>
<td>Main effect-Condition</td>
<td>2,453</td>
<td>1.09</td>
<td>.37</td>
</tr>
</tbody>
</table>

Note: A single * denotes \( p < .05 \) while ** denotes \( p < .001 \). The significance pattern of the Maximum likelihood results mirrors that of the multiple imputation results. The exception to this is that all comparisons were significant with the maximum likelihood data.
The same tests of simple effects were conducted on the imputed BDI-II scores as were conducted on the listwise deletion BDI-II results. Participants’ improvement, from baseline to post-intervention, was compared. No significant difference was found between the attentional conditions ($F[1,657] = 0.19$, $p = .66$); however, the CBT condition showed greater improvement than the attentional conditions ($F[1,657] = 6.98$, $p < .01$). A similar pattern of results was observed in the improvements from baseline to follow-up. The change in the attentional groups did not differ statistically ($F[1,657] = 0.58$, $p = .45$); however, the CBT group improved more than the other two groups from baseline to follow-up ($F[1,657] = 19.31$, $p < .001$).

Depression Subscale of the DASS-21. An omnibus 3 Condition by 3 Time, mixed ANOVA was conducted on the multiple iteration and actual data of the depression scale of the DASS-21. Mauchly’s Test of sphericity was significant, $\chi^2(2,456) = 19.55$, $p < .001$, and a Greenhouse-Geisser correction was implemented ($\epsilon = .96$). A main effect was found for Time, $F(1.92, 862.49) = 40.65$, $p < .001$. The main effect of Condition was not statistically significant, $F(2, 452) = 0.93$, $p = .42$. In addition, a significant interaction was obtained between Time and Condition, $F(3.84, 862.49) = 2.24$, $p < .01$.

Again, the same tests of simple effects were conducted on the imputed DASS-21 scores as were conducted on the listwise deletion DASS-21 results. Participants’ improvement from baseline to post-intervention was compared. There was only one slight difference with these data compared to the earlier analyses, i.e., the difference between the attentional training and the CBT conditions from baseline to post-intervention was marginally significant ($F[1,531] = 3.34$, $p = .07$). However, to maintain consistency with
previous analysis, the attentional groups were combined. No significant difference between the attentional conditions \( F[1,531] = 0.14, p = .70 \). Participants in CBT condition, however, improved to a greater extent than those in the attentional conditions \( F[1,531] = 5.36, p < .02 \). A similar pattern of results was observed in the improvements from baseline to follow-up. The change in the attentional groups did not statistically differ \( F[1,531] = 1.43, p = .23 \) but the CBT group improved more than the other two groups from baseline to follow-up \( F[1,531] = 20.00, p < .002 \).

State Trait Anxiety Inventory. To explore the efficacy of the interventions on STAI outcomes, after accounting for attrition, two omnibus split-plot ANOVAs were conducted. A 3 by 3 ANOVA comparing Condition (CBT, Attentional Training, & Control) and Time (Baseline, Post-intervention, & Follow-up) for imputed State anxiety scores. Mauchly’s test of sphericity was significant, \( \chi^2(2,456) = 11.42, p < .05 \), and a Greenhouse-Geisser correction (\( \varepsilon = .98 \)) was used. A significant main effect was found for Time \( F(1.95, 878.07) = 20.85, p < .001 \). Neither the main effect of Condition, \( F(2,342) = 1.36, p = .26 \), nor the interaction of Condition and Time, \( F(3.90,878.07) = 1.32, p = .29 \), were significant.

A 3 (Condition) by 3 (Time) split-plot ANOVA was also conducted on the trait anxiety scores from the STAI. Again, because Mauchly’s test was significant, \( \chi^2(2,456) = 14.78, p < .05 \), a Greenhouse-Geisser correction (\( \varepsilon = .97 \)) was used. The main effect of time was significant, \( F(1.94, 874.20) = 22.20, p < .00 \); the main effect of Condition was not significant, \( F(2, 451) = 0.89, p = .45 \). There was no significant interaction between Time and Condition, \( F(3.88, 874.20) = 1.53, p = .22 \).
Anxiety Subscale of the DASS-21. To test further the efficacy of the three interventions on anxiety symptoms, a 3 by 3 omnibus ANOVA (Condition by Time) was conducted on the results from the anxiety subscale of the DASS-21. Mauchly’s test of sphericity was significant, $\chi^2(2,456) = 9.74, p < .01$, and a Greenhouse-Geisser correction ($\tilde{\epsilon} = .97$) was used. As with the STAI, there was a main effect of Time, $F(1.95, 880.12) = 93.10, p < .001$. Neither the main effect of Condition, $F(2, 452) = 0.67, p = .55$, nor the interaction of Time and Condition, $F(3.89, 880.12) = 0.88, p = .51$, were significant.

Discussion

The present study compared the efficacy of three interventions in preventing the onset and reducing the symptom severity of affective disorders. Participants completed one of three six-week interventions. Depression and anxiety symptoms were assessed at three testing intervals: baseline, post-intervention, and follow-up. The interventions consisted of an internet-delivered CBT condition (MoodGYM), an attentional training condition (a modified version of the Face-in-the-Crowd Task), and an attentional control condition (an unmodified version of the Face-in-the-Crowd Task).

The CBT and the ABM conditions were expected to outperform the active control condition at reducing both anxiety and depressive symptoms. It was also predicted that the two experimental conditions would be more effective at reducing the frequency of emotional disorders. No predictions were made regarding how the two active treatment conditions would compare.
The results demonstrated that the MoodGYM condition outperformed the attentional training and control conditions at reducing depressive symptoms, and the frequency of MDD. However, no differences were found between the attentional training and attentional control conditions. In addition, although there were overall declines in the level of anxiety symptoms in the sample, no statistically significant differences were obtained among the three groups at either the symptom or the diagnostic level. Therefore, the MoodGYM condition was the most effective intervention for depression, but all conditions were equally effective at reducing anxiety symptoms.

The results of this trial have important implications for future prevention implementation and research. The active control condition provided an effective control for placebo effects. The addition of this control condition demonstrated that the preventative effects observed in the CBT condition were valid and not simply artefacts of experimental methodology or participant bias. The intent-to-treat (ITT) analysis was also an important addition to this study, as it controls for bias from attrition, which has often been missing from prevention research. This ITT analysis replicated the differences seen between the CBT and the attentional conditions in the conventional analysis, confirming that even after accounting for attrition, the CBT condition outperformed the other two conditions at reducing depressive symptoms.

The study has are three main important findings: (1) MoodGYM outperformed the other two interventions at reducing or preventing depression but not anxiety; (2) All conditions demonstrated significant but statistically similar declines in anxiety; (3) The two attentional conditions performed identically despite the original hypothesis that the
training condition would outperform the control condition. An additional minor finding was that the two attentional groups appeared to show some decline in depressive symptoms. These results, and their implications for future prevention research, are discussed below.

Depression Outcomes

Three different analyses were conducted on the depression outcome data. At the symptom level, analyses were conducted on both the list-wise deletion data and on the combined imputed values (during the intent-to-treat analysis). As both of these analyses provided nearly identical results they are discussed together. In addition to the symptom data, the prevalence of depression was assessed at follow-up. The symptom data revealed two interesting findings. First, the CBT group outperformed the other two groups on symptom reduction. Second, the data appeared to show an overall symptom decline across conditions. Diagnostic outcomes were also collected and compared. The CBT condition demonstrated lower levels of MDD than did the rest of the sample at follow-up. Diagnostic outcome data are rarely collected on large-scale internet delivered preventions, thus, these findings have important implications for future prevention work.

The Efficacy of CBT. The main finding from the current study is that the CBT condition outperformed the other two attentional conditions on both measures of depression. These improvements were apparent at post-intervention and were maintained at follow-up. Given that the findings were replicated across two well-validated self-report measures of depression, and held in the intent-to-treat analyses, increased confidence can be placed in the reliability of the findings.
Intent-to-treat analyses are beneficial but rarely conducted in prevention research. The benefit of ITT analyses is that they account for the effects of attrition. As discussed earlier, attrition can greatly impact outcomes, particularly if attrition is not equal across conditions. For example, outcomes could be inflated significantly if participants leave one group more frequently than another because they find it aversive or unhelpful. At the other end of the spectrum, attrition can also inflate Type II error if participants leave or stop participating because they are no longer experiencing symptoms. Multiple imputation analyses were conducted to minimize the impact of attrition on both Type I and Type II error rates. These analyses established that the results of this study were not influenced by attrition.

ITT analyses are often not included in prevention work because their use is not recommended when rates of attrition and non-compliance are high. Intent-to-treat analyses are not advised when more than 20 percent of the data are missing (Armijo-Olivo et al. 2009). Thus, in many prevention studies (Spek, et al., 2008; Spek, et al., 2007), particularly internet trials (Waller & Gilbody, 2009; Warmerdam et al., 2010), the attrition rate is too high to allow appropriate ITT analyses. The current study established comparatively low attrition rates (22.8%) by using a system of regular reminders. Confirming that results were similar in both the listwise deletion and ITT analysis demonstrated that attrition did not substantially alter the outcomes of the study.

Unlike previous studies, the current findings were enhanced by the use of an active control condition. As discussed earlier, one significant limitation to the depression prevention literature has been the lack of active control conditions (Horowitz & Garber,
Thus, it is often unclear whether the observed findings were driven by placebo effects. The attentional training conditions were described to participants as possible active interventions. Interviewers and experimenters were also blind to condition; consequently, these interventions could be assumed to act as placebo controls. These conditions would control for participant and experimenter bias, as well control for other influences (such as repeat measurement and natural symptom decline).

Another important aspect of the comparative effectiveness of CBT was the notable improvement at both post-intervention and follow-up. In fact, there was marked improvement from baseline to follow-up, with relatively powerful effects $\eta^2_p = .82$ and .78 (based on the BDI-II and DASS-21, respectively). In that a partial eta squared of .26 corresponds to a large effect size (Cohen, 1973), these findings are notable. These are particularly large effect sizes when one considers that they are based on a placebo-controlled trial. Placebo-controlled trials can decrease effect sizes because active control conditions often improve more than their non-active alternatives. Therefore, a treatment condition would show less comparative improvement when matched to an active control condition rather than a non-active control (Horowitz & Garber, 2006; Jane-Llopis et al., 2003; Stice et al., 2009). Thus, the current study’s effects our powerful, given the active comparison conditions.

Lintvedt and colleagues (2013) conducted an internet administered MoodGYM prevention trial that provides a good comparison for the present study. This study had a similar population (university students) and recruitment criteria (a score above 20 on the
Kessler Distress Scale). Unlike the current study, Lintvedt and colleagues used a waitlist control condition and did not have a follow-up. Using change contrasts, as in the current study, the authors found a large effect for the comparative change from baseline to post-intervention ($d = 0.57$). The present study had slightly smaller effects at post-intervention ($d = 0.37 \& 0.48$) but similar or larger effects at follow-up ($d = 0.57 - 0.65$). In a meta-analysis of internet-delivered prevention studies, Spek and colleagues (2007) found average depression prevention effect sizes ($d = 0.27-0.32$), which were smaller than those found in the present study.

The fact that these compelling results were replicated at follow-up is particularly interesting. It is often argued that CBT treatment prevents relapse occurrence better than other interventions (Fava, Rafanelli, Grandi, Conti, & Belluardo, 1998; Jarrett et al., 2001; Paykel, 2007). Potentially, the long-term benefit seen during treatment may also be present in prevention. More research is needed, with longer-term follow-ups, to establish how long such benefits last or to ascertain if continued improvement is maintained.

Other prevention studies have demonstrated positive follow-up effects and, similarly to this study, some have found even stronger effects at follow-up than post-intervention. Kearney et al. (2009), for instance, implemented a universal CBT preventative intervention with adolescents. Although the authors did not find significant effects post-intervention, they did at follow-up. Van’t Veer-Tazelarr et al. (2009) conducted an interesting staged intervention with elderly individuals. Participants started off in a CBT-based bibliotherapy intervention and, if that was not effective, moved on to a more intense problem-solving intervention. After a year, the intervention condition was
twice as effective as the care-as-usual control. There is also some limited evidence that internet delivered interventions might perform particularly well at follow-up. Spek et al. (2007; 2008) compared internet and group administered CBT preventions. Post-intervention the two groups performed equally well, but at follow-up the internet delivered condition appeared most effective. Although this is an interesting finding, it is important to note that attrition was higher in the internet-administered group, which, as discussed earlier, could have inflated the results. Due to uneven attrition rates the loss of participants who found the intervention unhelpful, for example, would artificially increase the effect of the treatment in the condition with higher attrition.

The beneficial effects at follow-up have important implications for prevention. In contrast to treatment, where the aim is to alleviate a current illness, in prevention the aim is to prevent the occurrence of a new illness or prevent the reoccurrence of a previous one. Thus, the long-term utility of the intervention is very important. For example, the point prevalence of depression is very low compared to the prevalence of depression over a one-year period. Thus, if a preventative intervention was effective at reducing symptoms over a month period but not over the following year, it would have limited utility. Given that even further reductions in depressive symptomology were observed at the four-month follow-up, the MoodGYM in the present study intervention may have the long-term beneficial effects necessary for a successful preventative intervention.

Improvement over time in depressive symptoms. An important secondary finding from the symptom data was not that all three conditions appeared to show improvement over time. It is not known, however, what caused the comparatively smaller improvements
in the attentional groups. One possibility is that some active component of both attentional conditions could have caused this decline in symptoms. However, another hypothesis is that this symptom decline was an artifact of the study design. For example, placebo effects, repeat measurement, and a natural symptom decline in the population, are all possible explanations for the apparent symptom improvement.

Placebo effects can notably impact research outcomes (Wampold, Minami, Tierney, Baskin, & Bhati, 2005). Similarly, repeated measurement is also known to cause decreases in self-reported symptoms (Evans, Margison, & Barkham, 1998). Finally, a third possibility is that this overall decline could reflect a natural decline in depressive symptoms in the population. It is also possible that all three mechanisms contributed to the depressive symptoms decline. Participants were first and second year university students and testing periods were conducted within two-month intervals. Thus, the participants had some similar experiences over this period; for example, midterms and exams probably occurred during some or all of these intervals. Participants would also have experienced similar events specific to the time periods in question (e.g., changes in sunlight and weather). It may be that over the course of the academic year students are likely to experience some improvement in depressive symptoms. Two of these hypotheses, the natural decline in depressive symptoms and the repeat measurement hypothesis, are supported by a recent benchmarking study conducted by the author.

Benchmarking studies have been used previously to add a comparison condition to a study that has already been conducted (Weersing & Weisz, 2002). This benchmarking study was designed to mirror the current study as closely as possible. Participants were
recruited from the same population, a year later, and met the same inclusionary criteria as the current study (see Appendix F for demographic information). The sample was limited to first and second-year university students. Participants were required to be fluent in English, between the ages of 18-64, have access to an internet connected computer, and score above 35 on the NEO-FFI neuroticism scale or above 22 on the K10. Participants were assessed using the same symptom measures, at the same time intervals. Thus, they were assessed at baseline, eight week post-intervention (although no intervention was applied), and a follow-up delivered 22 weeks after baseline measurement.

In the benchmarking study participants showed a similar pattern of symptom decline as seen in the attentional conditions (see Figure 7 and 8). Although there are important differences between the two samples (e.g., they are different maturational cohorts) the findings help to elucidate what might have driven the observed symptom decline in depression. As the benchmarking study did not include an intervention, participants would not have expected to improve over time; thus, any observed change in this study would be more likely to be caused by repeated measurement or natural symptom decline in the population than a placebo effect. As there was no significant difference between the rate of change in the benchmarking study and the rate of change in the attentional conditions (BDI- $F[1,500] = 0.04, p = .85$ & DASS-21 – $F[1, 526] = 1.90, p = .17$), it might be inferred that the change observed in the attentional conditions was due to repeat measurement or a natural symptom decline in the sample, rather than the placebo effect or an active ingredient of the intervention. The benchmarking study does not preclude the presence of placebo or active beneficial effect in the attentional conditions.
Figure 7: Beck Depression Inventory-II symptom scores across conditions compared to the Benchmarking study at baseline, post-intervention, and follow-up.
Figure 8: Depression scale of the Depression Anxiety Stress Scale-21 symptom scores across conditions compared to the benchmarking study at baseline, post-intervention, and follow-up.
However, it is unlikely that the additive contribution of placebo or beneficial effects is large enough to be statistically significant.

Diagnostic Outcomes

The CBT condition not only showed substantial symptom decline at follow-up but also differences in the prevalence of depression. The CBT condition had a significantly lower rate of depression at follow-up than the rest of the sample. As the diagnosis of depression was only made at follow-up, it is theoretically possible that the difference in depression prevalence also occurred at baseline. However, two results contradict this hypothesis. First, symptom scores were not significantly different at baseline and, even if such differences were significant, the CBT condition was the most symptomatic condition at baseline. Symptom measures such as the BDI-II were designed to measure depressive symptoms to help identify patients with the disorder (Beck et al., 1996), thus symptom differences should correspond with diagnostic differences.

Second, to establish the likelihood of baseline differences in the diagnostic frequency of depression an additional analysis was conducted. During the follow-up diagnostic interviews participants were queried about previous depressive episodes, with a particular focus on the last six months. Previous episodes, along with approximate start and end dates were recorded. By comparing these answers to participants’ study start dates it was possible to determine whether they had experienced an episode of depression at baseline. No significant differences across conditions at baseline were found.
The strength of this evidence is somewhat reduced by the possibility of recall bias since participants were asked to recall events from the past. The ideal methodology would have been to interview participants twice but the time constraints of the study precluded this possibility. With this limitation acknowledged, the combined findings of no differences in symptoms or recalled occurrence of depression at baseline suggest that the diagnostic differences seen at follow-up are likely driven by the interventions rather than by chance.

In sum, based on the present findings, it is most probable that the CBT intervention reduced the frequency of depression in the sample. This finding is particularly important in that it adds to the symptom reduction findings. Although many studies have only examined symptom reduction as an outcome (Lintvedt, et al., 2013; Vazquez, et al., 2013; Vazquez, et al., 2012) the primary aim of prevention is to prevent the onset of the targeted disorder (i.e., MDD). Diagnostic interviews are time consuming to conduct. Moreover, as diagnosis is a dichotomous variable (unlike symptom measurement), larger sample sizes are needed to detect diagnostic differences. Thus, many researchers opt to use symptoms as an outcome measure, particularly in large, internet-delivered trials. Importantly, by using both symptom and diagnostic measures, the current study was able to establish efficacy at both levels.

Anxiety Symptoms

Unlike the findings for depression, no between group differences were found in anxiety. An overall decline in anxiety was observed across all anxiety measures and across all conditions. This is an interesting finding, particularly because the attentional
training and attentional control conditions continued to perform identically. This was unexpected as the attentional control was thought not to affect anxiety symptoms. After discussing the possible causes and clinical significance of the decline in anxiety the results are compared to the previously mentioned benchmarking study.

Decline in Anxiety Symptoms. Although there was a decline in anxiety symptoms on both the STAI and the Anxiety subscale of the DASS-21 the symptom change was notably larger on the DASS-21 than on the STAI. The symptom change observed on the STAI was quite small (approximately a 5% decline over time). Although this change may have been statistically significant, it is unlikely to be clinically significant. In contrast, the symptom decline was more notable on the anxiety scale of the DASS-21, in which anxiety symptoms showed a 32-42% decline (depending on condition). This is probably a more clinically significant change, given that participants moved from the “moderate” anxiety range (10-14) to the “mild” (8-9) or “normal” (0-7) range (Lovibond & Lovibond, 1995).

A differential level of decline on the STAI and the DASS-21 is not entirely surprising as they may measure different aspects of anxiety. The STAI consists of indices of both state and trait anxiety. Trait anxiety is believed to be a more stable index compared to the state measure, which is thought to be more transient, and better for measuring within-session changes in anxiety. The state scale is more sensitive to the current environment. In the present study, participants completed all questionnaires on the internet; thus, there was considerable variability in their environment as they were completing this measure. Given this background variation in environment the state inventory may be an unreliable measure of changes in anxiety symptomatology. For these
reasons the state scale is less responsive to changes in overall anxiety symptomatology, over several months, which was the aim of the present study.

The trait scale also has some limitations. The trait scale has recently been criticized as not being a valid measure of anxiety but, more accurately, a measure of negative affect (Bados, Gómez-Benito, & Balaguer, 2010; Caci, Baylé, Dossios, Robert, & Boyer, 2003). Potentially, negative affect is a more stable trait that is difficult to modify with brief interventions. Example questions on the trait inventory are “I am content; I am a steady person”, and “I worry too much over something that really doesn’t matter”. These questions ask individuals to reflect on their pathological state more generally, prompting participants to draw from experiences over their life span, or at least the last few years. Therefore, the trait scale may not be sensitive enough to the changes that occurred over the last several months.

In the DASS-21, the authors attempted to maximize discriminant validity with the three measures (Depression, Anxiety, & Stress). The Stress Subscale was designed to measure a third construct highly related to negative affect (Gloster et al., 2008). Thus, the trait scale of the STAI should correspond better with the stress scale of the DASS-21 than with the anxiety scale. The anxiety scale of the DASS-21 was designed to capture autonomic arousal, psychological hyperarousal, and the subjective feeling of fear (Gloster et al., 2008). The Anxiety scale of the DASS-21 closely correlates with anxiety symptoms

5 In the present study, the State scale corresponded better with the Stress scale of the DASS-21 than the Anxiety scale.
in Panic Disorder whereas the Stress Scale corresponds more to Generalized Anxiety Disorder symptomatology (Brown, Chorpita, Korotitsch, & Barlow, 1997). It may be that participants experienced a change in one of the anxiety constructs and not the other.

Unlike with depression, the different anxiety scales may well be measuring different components of anxiety. The state scale of the STAI measures transient elements of anxiety that are probably too sensitive to environmental factors to be reliable in the current study. The trait inventory correlates strongly with neuroticism. Neuroticism may be less modifiable during such brief interventions and the trait scale may be less sensitive to short-term change than other measures of anxiety. In contrast, the DASS-21 anxiety scale measures autonomic arousal, psychological hyperarousal, and subjective feelings of fear. These symptoms may be more sensitive to short-term change, which may explain why participants exhibit a larger degree of change on this measure. Thus, the variable level of anxiety symptom decline may be partially explained by the fact that the three anxiety scales measure different aspects of anxiety.

Rationale for Anxiety Symptom Decline. There was a notable decrease in anxiety symptoms on the DASS-21 anxiety scale across all three conditions. Two possible reasons may be suggested: (1) all groups caused a similar improvement in anxiety symptoms; or (2) the symptom reductions seen were a function of the study (i.e., placebo effect, repeat measurement, and natural symptom decline in the population). The benchmarking study referenced earlier also explored how anxiety symptoms changed over the course of an academic year. Figure 9 displays the performance of the benchmarking group compared to the three study conditions on the DASS-21. All three conditions show
Figure 9: Anxiety scale of the Depression Anxiety Stress Scale-21 symptom scores across conditions compared to the benchmarking study at baseline, post-intervention, and follow-up.
more improvement than was demonstrated in the benchmarking study ($F[1,756] = 6.64, p < .01$). Although there are limitations to using a benchmarking group instead of a waitlist comparison group, these findings do suggest that all three conditions may have had an impact on anxiety. Given the results of the benchmarking study, the observed changes in anxiety symptoms across conditions was probably attributable to some active component of the interventions or to placebo effects. It is difficult to ascertain which of these explanations accounts for the observed changes. As the control condition performed as well as the other conditions, placebo driven changes appear, at first glance, to be the most likely explanation. However, numerous recent studies have demonstrated that internet delivered attentional training and attentional control conditions both reduce anxiety symptoms (Boettcher, Hasselrot, Sund, Andersson, & Carlbring, 2014; Carlbring et al., 2012; Neubauer et al., 2013).

Enock, Hofmann, & McNally (2014) conducted an attentional bias modification trial to treat Social Anxiety Disorder. The intervention was delivered to participants using a smart phone (or similar technology) application, over the course of four weeks. During this trial, in contrast to many other ABM research trials, a waitlist group was included along with the two attentional conditions. The authors found no treatment differences between the two attentional conditions, both of which showed medium to large treatment effects; however, both groups significantly outperformed the waitlist condition. Similar to the current trial, it is impossible to determine whether these improvements were driven by some shared active component of the intervention or by placebo effects.
It is not possible to rule out the role of placebo effects but, for the beneficial intervention hypothesis to hold, it must be possible for the attentional control condition to improve symptoms. Although initially it was thought that completing the attentional control condition would not affect symptoms it may indeed have had some influence on attentional control, which, in turn, improved symptoms. Attentional control is a broad category referring to the ability of the central executive to control the allocation of attention.

Although the control condition does not directly target a bias, it may improve attentional control with repeated practice. By spending extended periods of time practising inhibiting and shifting attention (components of attentional control needed to complete the Face-in-the-Crowd Task), participants may have improved their overall attentional control. This explanation directly relates to the theorized mechanism of attentional training. Attentional training was thought to alter current attentional biases, i.e. to change the biased way individuals attended to information in their environment. Conceivably, these biases occur due to difficulties with attentional shifting (which drives attentional engagement) and inhibition (which enables prolonged engagement and impaired disengagement). Thus, it is possible that improving an individual’s ability to control his or her attention (improving attentional shifting and inhibition) results in changes in attentional biases.

An improved ability to control one’s attention may cause the intended changes in the associative system. In the previously presented example, a socially anxious individual was more likely to notice individuals staring at him or her and less likely to notice individuals not doing so. This resulted in the individual believing that he or she was
constantly being stared at. With better control of attention, although the individual might first notice an individual looking at him or her, he or she would be better able to continue looking around and notice other disconfirmatory evidence. Impaired attentional control enables attentional biases to alter the way the environment is perceived, whereas improved attentional control allows individuals to assess their environment accurately. Thus, the common mechanism of action for both attentional interventions may have been improvements in attentional control rather than the creation or extinction of a particular bias per se. Clearly, more research in this area is necessary before what might be causing the symptom reduction can be understood.

Strengths

The present study provides a significant contribution to the prevention literature. As discussed earlier, few prevention studies have incorporated a placebo control condition; thus the researchers were unable to rule out placebo effects as an explanation for their findings. By using a placebo control group (the attentional control condition), this trial was able to establish the efficacy of MoodGYM for preventing depression over and above the influences of placebo effects.

Another significant limitation to previous prevention research, particularly internet delivered trials, has been the high rate of attrition (Waller & Gilbody, 2009) and the fact that this rate of attrition was not always accounted for in outcome analysis. Often attrition rates were so high that it was not possible to use statistical methods (intent-to-treat analyses) to account for the effects of attrition. The combination of an experimental design aimed at reducing attrition, including a rigorous reminder system, and the use of
intent-to-treat analysis allowed the present study to establish that the experimental outcomes were not influenced or driven by attrition.

Previous internet-delivered prevention studies have often focused on symptom outcomes rather than diagnostic outcomes, probably because of the difficulty of collecting accurate diagnostic data from large samples. Studies with smaller sample sizes have collected diagnostic outcome data but the power to examine diagnostic outcomes is often limited. The relatively large sample size included in this study provided enough power to reveal differences in diagnostic outcomes measured at follow-up. Retrospective analysis on the probability of depressive episodes at baseline provided evidence that the observed prevention of depression by the CBT intervention was not due to uneven depression rates at baseline.

Previous prevention research has demonstrated that both indicated and selective designs could be effective methods of exploring prevention outcomes. However, each of these methods has different advantages and disadvantages. Indicated trials (trials that recruit participants based on the presence of subthreshold symptoms) are well researched and give investigators enough power to detect effects statistically. However, indicated trials run the risk of being mild treatment exercises rather than true prevention studies, because they target symptomatic individuals. In contrast, selective trials, which recruit participants based on disorder risk factors, provide the opportunity to recruit at-risk participants as well as participants who are not currently demonstrating problematic symptoms. Thus, selective interventions can establish sufficient power to detect outcomes while including participants with a wider range in symptoms. However, because few
selective trials have been conducted, this recruitment strategy is not as well established. By using a mixed indicated and selective design, this study was able to include individuals who were currently mildly symptomatic as well as those who were at risk for depression or anxiety. The design was able to incorporate increased base-rates of depression and anxiety in the sample so that differences were detectable at the diagnostic level. However, it also established that these findings were still significant with individuals who were experiencing relatively mild symptoms. In fact, an exploratory mean split analysis (see footnote 4) revealed that although the effect size was smaller for less symptomatic individuals, the pattern of significance remained the same. These findings suggest that future research studies may explore the use of vulnerability factors in their recruitment criteria.

The need for emotional disorder prevention is substantial. As discussed earlier, anxiety and depression are prevalent disorders, with high emotional and financial costs. This is particularly true in undergraduates, for whom the combination of age and life events places them at high risk for psychopathology. Treatment options are often limited, insufficient, ineffective, or not accessed. Van Voorhees and colleagues (2011) discussed the need for depression prevention across the life span and suggested implementing a behavioural vaccine strategy. Behavioural vaccines have been paralleled, analogously with the more common pharmaceutical vaccines. These are behavioural interventions that act preventatively and can be applied over the course of the life span. A classic example of a repeated behavioural vaccine is hand washing in hospitals, which prevents cross
contamination. Perhaps one day the integration of CBT will be as commonplace as hand washing.

A tool such as MoodGYM is an excellent candidate for a behavioural vaccine. MoodGYM had a large effect on reducing depressive symptoms, and is easily accessed and re-accessed. MoodGYM could be delivered to a group of individuals over the internet, as was done in this study. The long-term effectiveness may be maintained, or boosted, by having participants periodically revisit (a possibly shortened version of) MoodGYM. MoodGYM also performed better than the benchmarking study at reducing anxiety symptoms; although at this point it is unclear if these improvements were due to placebo effects. These findings suggest that MoodGYM is effective at reducing depression and may be effective at reducing anxiety symptoms. An intervention that can reduce both types of symptoms and is easily accessible is a strong candidate for testing as a behavioural vaccine. A follow-up study could potentially explore the long-term effects of MoodGYM and determine the effectiveness of booster sessions.

Limitations

Although this study has numerous strengths a number of limitations warrant mention. The waitlist comparisons considered during the Discussion came from a benchmarking study rather than a waitlist concomitant with the three interventions. A simultaneous waitlist condition providing the same external factors as the intervention conditions would help establish whether attentional training interventions have a causal effect in the observed reduction of anxiety symptoms. A more established control condition known not to influence outcome would be a preferred manipulation to a waitlist
control in this respect. For instance, a journaling or information provision condition that included a treatment rationale, could have accomplished this goal while also controlling for placebo effects. Such a condition could establish whether the effects of MoodGYM are actually transdiagnostic rather than specific to depression.

The attentional control condition was intended to act as an active control condition. However, as discussed earlier, recent research has suggested that this condition and the attentional training condition have similar effects and may share a common mechanism of action. Although this condition still acted as an effective comparison condition for depression (as it only mildly effected depressive symptoms), it is unclear how effective it was for anxiety. This finding presents an interesting avenue for future research; i.e., exploring what might be the active mechanisms of attentional training, and also how these mechanisms impact anxiety and risk for developing increased anxiety or pathological levels of anxiety.

Another disadvantage of this study was that the SCID was not conducted at baseline. Although participants were interviewed about previous anxiety and depression this data collection method is subject to participant recall bias. A preferable method would collect diagnostic information at baseline, post-intervention, and follow-up. However, due to the sample size and the speed of data collection this was not feasible for the current study.

Use of longer-term follow-up periods would improve the design of this study. Regular yearly follow-ups would provide information about the extended efficacy of the trial needed, if, for example, MoodGYM were to be considered as a behavioural vaccine.
Although the fact that the improvements held and even increased at a four-month follow-up suggests that benefits may be sustained beyond the intervention period, it would require a multi-year study to know if such gains are maintained over longer periods.

Implications

The current study has important implications, which, in part, define the next-steps for prevention research. Important questions include how results might translate into primary prevention implementation, and what these results suggest about the mechanisms underlying these interventions. Results from the present study suggest that MoodGYM is a superior option for primary prevention when compared to the attentional interventions, given that it performed identically to the attentional conditions across anxiety measures and outperformed them on depression outcomes.

The results of this study are important in a consideration of the future applications of MoodGYM in prevention. Given the performance of MoodGYM in reducing depressive symptoms, and the risk of future disorder onset, it is a valuable prevention tool (even if it proves ineffective for anxiety prevention). Given that MoodGYM outperformed the benchmarking study at reducing anxiety symptoms, it can be inferred that it would outperform a waitlist condition had one been included. However, even if MoodGYM outperformed a waitlist control, without an active control condition it would not be possible to rule out the role of demand characteristics (i.e., placebo effects and participant biases). Thus, the current study was unable to establish if MoodGYM itself, or/and associated placebo effects, were responsible for the observed reduction in anxiety symptoms.
Without demonstrating that MoodGYM outperformed an active control for both anxiety and depression, it is unclear whether MoodGYM is a transdiagnostic intervention. However, the present findings do suggest that MoodGYM may act transdiagnostically, and, that it is certainly deserving of further exploration. Ideally, future research can compare MoodGYM to an active control to mitigate participant bias and enable researchers to quantify placebo effects.

The present study suggests that MoodGYM is an effective intervention for the prevention of Major Depression (if not anxiety) in an at-risk undergraduate sample. The nature of the sample is important. Youth, including undergraduate students, are in a critical period of development, at risk for the first onset of affective conditions. This study did not establish whether the observed effects would generalize to other populations. Although this investigation explored only one population, MoodGYM has been found effective in other populations, including teens (O'Kearney, Gibson, Christensen, & Griffiths, 2006; O'Kearney, Christensen, & Griffiths, 2009) and general adult samples (Lintvedt et al., 2013), suggesting it might be effective for a range of individuals.

Although this sample was limited to first- and second-year undergraduate students with specific risk factors (elevations in general distress and neuroticism), participants were highly variable in other characteristics. Recruitment was open to a broad age range. Participants were allowed to engage in other interventions during the study (e.g., psychotherapy or psychopharmacology), and were not excluded based on pre-existing conditions of prior treatment history (psychotherapy or pharmacotherapy). This broad recruitment strategy allowed for a wide range of participant involvement, which presents a
feasible model for a university wide implementation. For example, in a university-wide prevention strategy, recruiters would likely be unable to ascertain past pathology of students or limit an available resource based on student age. Although in the current study recruiting based on heightened risk of psychopathology was necessary to generate sufficient power with a limited sample size, this may not be a requirement for a mass university application.

Although the current study only established the effectiveness of MoodGYM in at-risk students, there is no reason to suppose it would be detrimental to not at-risk students; indeed, it may even be beneficial. Thus, if MoodGYM was made available to all undergraduate students (for example, as an extra credit activity in a first-year course), it would likely benefit some students and might be educational for others. In addition, the large sample size resulting from the implementation of MoodGYM in a university wide mental health program would likely provide the statistical power necessary to assess its efficacy even without the sample being limited to at-risk participants.

Given its effectiveness and ease of implementation, MoodGYM appears to be a compelling option for a university-wide prevention application. The required investment from a university perspective is relatively low (e.g., some organizational and student time investment). The rate of affective disorders is high in university students (Bayram & Bilgel, 2008), and many students, particularly those from low socio-economic backgrounds or from minority groups (Eisenberg, Golberstein, & Gollust, 2007), do not access mental health resources. Given the prevalence of mental health concerns, and
barriers to treatment, effective primary prevention appears particularly important in undergraduate students.

Not only does the current study have implications for the direct implementation of MoodGYM, it also poses interesting theoretical questions. As discussed earlier, participants in the CBT condition showed improvements in both depression and (some measures of) anxiety. However, although the attentional conditions produced smaller changes in depression than did the CBT condition, all conditions brought about statistically significant changes in anxiety. Without a waitlist control condition to establish the natural decline of symptoms in both samples it is difficult to compare the CBT condition’s impact on anxiety and depression. It may be that MoodGYM is equally effective for depression and some types of anxiety. In contrast, it appears that the attentional training conditions may be more effective for anxiety symptoms than depression.

It is possible that the two condition’s differential affect on depression may be related to their underlying mechanisms of action. It is possible that attentional biases, or the specific biases altered in the current study, are not transdiagnostic, and, rather play a larger role in anxiety than depression. As discussed earlier, the attentional biases seen in anxiety often include two types of bias (rapid engagement and impaired disengagement) whereas the attentional bias seen in depression is predominantly characterized by impaired disengagement. It is possible that the current attentional tasks were better at improving the components of attention involved in controlling rapid engagement (e.g., attentional shift) than the components involved in disengagement (e.g., attentional inhibition). As rapid
engagement is predominantly seen in anxiety, this might account for the differences in performance across the two symptom clusters (i.e., anxiety and depression).

Another explanation for the differential performance is that attentional biases play a larger causal role in anxiety than in depression. It may be that the attentional biases seen in depression are simply by-products of the disorder rather than causal or propagating mechanisms. Thus, if attentional biases play a larger role in anxiety, then shifting them would have a disproportionate effect on anxiety symptoms. Another possibility is that the attentional biases observed in depression are more difficult to shift through attentional training and thus the task was more effective for anxiety than depression because it was better able to shift the biases predominantly seen in anxiety (i.e., early engagement).

The current study did not include tools to explore the specific types of biases that were altered. Future research may explore what effects the repeated completion of the Face-in-the-Crowd Task (both the modified and original versions) has on specific attentional biases. Such research could help to elucidate the role of changes in the associative system in the prevention and treatment of anxiety and depression. As discussed earlier, the dot-probe task can measure attentional biases at specific points in the attentional window. Although the specificity of the dot-probe task was not ideal for a transdiagnostic training program, it would be useful for exploring the biases altered during the Face-in-the-Crowd-Task. A dot-probe task, with trials of varying intervals, could be completed with the aim of measuring a variety of biases. For example, rapid engagement is often observable at 300ms while delayed disengagement is commonly observable by 1000ms (Mogg, Bradley, & Williams, 1995). By having participants complete this dot-
probe task before and after the repeated completion of the Face-in-the-Crowd Task it would be possible to establish what changes had occurred.

In contrast to the findings with anxiety, only the CBT condition appeared effective at reducing or preventing depressive symptoms. As CBT is theorized to act on the rule-based system while attentional training is theorized to work through changes in the associative system, it might be hypothesized that changes in the rule-based system are uniquely important in depression. This is only theoretical speculation, however, because no changes in the rule-based system were explored or established during this trial. Nevertheless, given that one of the theorized causal mechanisms of CBT is changing the rule-based system, and that no change was observed with the task thought to be targeting the associative system (attentional training), it might be inferred that changes in the rule-based system account for the changes seen in the depression group.

A number of studies have documented the ability of CBT to implement changes in the rule-based system (for a review see Dozois, 2014). For example, Dozois and colleagues (Dozois, Bieling, et al., 2009) found that when cognitive therapy combined with pharmacotherapy was compared to pharmacotherapy alone, only the combined group showed changes in cognitive organization. This finding suggests that while both interventions may result in changes at the symptom level, cognitive therapy results in deeper structural change. This deeper structural change is one hypothesized reason why relapse rates are significantly lower in individuals treated with CT or CBT than in those who are treated with pharmacotherapy alone (Fava, Rafanelli, Grandi, Conti, & Belluardo, 1998; Jarrett et al., 2001; Paykel, 2007). Most of this research has been conducted with
CBT delivered in person rather than over the internet. Research has demonstrated that MoodGYM can alter dysfunctional attitudes (Lintvedt et al., 2013); however, change in dysfunctional attitudes was also found in the pharmacotherapy control in the study by Dozois, Bieling, et al. and may be a by-product of symptom remission. Future research should explore if MoodGYM can cause deeper changes in cognitive organization, and if these changes correspond to better treatment/prevention outcomes.

The roles of the associative and rule-based systems are even less clear in the anxiety findings. As discussed earlier, without including a control condition, which accounts for placebo effect, it is impossible to ascertain if the changes seen in anxiety were due to the active ingredients of the delivered interventions or to placebo effects. However, making the assumption that these changes were not simply due to demand characteristics in the population (something that could be established with a better control condition) the theorized role of the associative and rule-based systems can be explored. If assumed that the change observed is due to the interventions, and the interventions acted through their theorized mechanisms, it could be concluded that targeting either the rule-based or the associative system is equally effective in anxiety. If this is true, particularly for anxiety and not depression, this would be an interesting finding and potentially a profitable area for further research. Such research could simultaneously measure changes in the rule-based and associative systems to establish if these two interventions were acting through their theorized mechanism of action. Such research may help establish the causal role of biases in both the associative system and the rule-based system in anxiety.

Future Research
Although the current study does provide some answers it also poses a number of interesting questions and directions for future research. As addressed above, exploring the causal mechanisms in attentional training and MoodGYM is an avenue for future research. Another potentially important avenue is exploring the effective implementation of MoodGYM on a larger scale. Although the present sample size was relatively large, future research could deliver MoodGYM to a larger cohort of university students. For example, in collaboration with a university administration, it might be possible to have all at-risk incoming students participate in a MoodGYM intervention. This would provide a much larger sample size. Replication of the present findings with a larger cohort would confirm MoodGYM’s efficacy for depression prevention and allow the exploration of its impact on related problems such as stress generation (Hammen, 1991). Repeating the MoodGYM condition and comparing it with an active control condition might also help clarify MoodGYM’s impact on anxiety symptoms and diagnostic outcomes, helping thereby to establish whether MoodGYM actually acts as a transdiagnostic intervention.

The current study was an efficacy and effectiveness hybrid trial. Efficacy trials are designed to test the efficacy of an intervention (i.e., they are rigorously controlled and participants not compliant with the intervention are often removed from further analysis). Effectiveness trials are designed to ascertain how effective an intervention is in a ‘real world’ setting. In this study participants were not excluded based on how much time they spent engaging in MoodGYM or if they had high error rates (consistent with random face selection) on the attentional tasks (as they might have been in an efficacy trial). However,
participants were reminded regularly about the necessary tasks, and were required to visit the MoodGYM logon page once a week or complete the attentional tasks.

The developers of MoodGYM have explored its effectiveness for users who visit the site over the internet (Christensen, Griffiths, & Korten, 2002), but further effectiveness trials are still necessary. Effectiveness trials establish that the intervention in question is effective under uncontrolled conditions, or under the conditions in which it would be implemented for usual use. Effectiveness trials are often implemented after efficacy trials have demonstrated the efficacy of an intervention. Although, MoodGYM’s effect on anxiety is still questionable, its effect on depression has been established by this and other prevention trials (Lintvedt et al., 2013; O’Kearney et al., 2009). The next research step may be to establish the effectiveness of this intervention on a larger scale. For example, employers could adopt such an intervention and provide interested employees paid time within their workweek to complete the intervention.

Effectiveness trials go hand in hand with cost-effectiveness analysis studies. Given that MoodGYM halved the rate of depression in the current study, it may prove to be a highly cost effective intervention. Previous studies have demonstrated the cost effectiveness of prevention (Lynch, et al., 2005; Smit, et al, 2006), and other researchers have explored the cost-effectiveness of internet delivered treatment (Warmedam, Smit, van Straten, Riper, & Cuijpers, 2010). However, little research has explored the cost-effectiveness of internet delivered prevention. It is to be hoped that the present study and the studies cited will encourage employers, university, and public health officials to adopt and evaluate MoodGYM prevention programs.
Summary

The present prevention trial established that MoodGYM is effective at preventing Major Depression. The trial strengthened the findings of other depression prevention studies by establishing that the prevention effects attributed to the CBT intervention were not driven by placebo or biased by attrition. MoodGYM’s impact on anxiety is still questionable, because it is unclear whether the anxiety symptom reduction, seen across all conditions, was driven by placebo effects or maturational change. Future research in this area is needed to establish MoodGYM’s ability to act transdiagnostically and to ascertain its long-term impact on depression. The attentional control and the attentional training conditions performed similarly, as observed in recent research. Further exploration is necessary to establish whether this performance is driven by improvements in attentional control or by placebo effects. The attentional conditions may have had a positive effect on anxiety; however, they did not appear to have had a beneficial impact on depression. Thus the results of this study clearly indicate that attentional conditions are not candidates for transdiagnostic prevention. These findings have important implication for future prevention research and implementation.


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Appendices

Appendix A: Letter of Information and online consent for screening survey.

Consent for the Western Prevention Study Screening

Dr. David Dozois and Rebecca McDermott

Department of Psychology,

University of Western Ontario

You are asked to participate in a research study conducted by Rebecca McDermott and supervised by Dr. David Dozois. This survey should only take 5 to 10 minutes to complete. It will contain some short questions about you and your experiences. This survey is intended to let us know whether you would be a good fit for our study. There are no known risks or benefits to this study. However, as thank you for your participation you will be entered into a draw to win 100 dollar gift cards.

The data collected through this online questionnaire will only be used for research purposes. All your data will be kept confidential and we will not release your information to any third party. This study has been reviewed and received ethics clearance through the Health Science Research Ethics Board. If you have questions about your rights as a
research subject, you should contact the Director of the Office of Research Ethics at XXX@uwo.ca or (519) XXX-XXXX.

By entering your information below and clicking ok, you are indicating that you have read the above information and that you consent to participate in this survey. If you have any questions please feel free to contact Rebecca McDermott, M.Sc., PhD Candidate in Clinical Psychology (email: westernpreventionstudy.gmail.com) or Dr. David Dozois (email: XXX@uwo.ca).

Name

Email
You are asked to participate in a research study conducted by Rebecca McDermott and supervised by Dr. David Dozois. This experiment will take approximately eleven hours over the course of 6 months. During the first eight weeks you will complete questionnaires and an online activity every week. During the first and the eighth session you will be asked to complete a number of questionnaires, which will ask you questions about your personal experiences, feelings, and emotions. These questions are not meant to be invasive, and if you do not feel comfortable answering any of the questions please leave them blank. During sessions two through seven you will also be asked to complete a computer task over the Internet. This may involve responding to the type of facial expression demonstrated or involve reading information and completing questionnaires. Four months after you completed the study you will be contacted again and asked to complete another set of online questionnaires and an in-person or telephone interview.
There are no known risks to this study. By completing this study participants may or may not experience a positive increase in mood or may experience fewer symptoms consistent with affective disorders. There is no direct benefit to the participant for participating in this study. You will be compensated with approximately 10 dollars for every hour of participation in this study and you will likely receive 130 dollars in total at study completion. You are entitled to this compensation even if you do not complete the study, and you will be compensated for the amount of time you were enrolled. The compensation for the study will be broken down as follows: session 1, and follow-up: $20 each and session 1-7: $10 each. However, if you prematurely withdraw from the study it will be your responsibility to contact your study coordinator and arrange to pickup your compensation. Financial compensation will normally be delivered when you complete your final interview at the end of the study or you can pick it up in person if you decide to withdraw from the study prematurely.

If for any reason, you wish to withdraw from the experiment, you may do so at any time during the experiment. You may also remove your data from the study for any reason, before analysis is performed, without any consequences. Confidentiality will be respected. All data will be used strictly for experimental purposes, and will only be available to researchers directly involved in the project. The data will be stored securely and your individual data will never be released or published without your permission, or as required by law. Your data will otherwise be destroyed five years after publication.

In addition to collecting data through online questionnaires and tasks and through in-person interviews we will also collect information on your academic performance
through the Western University’s registrar. This information will strictly be used for research purposes and will not be released to any other third party. You will complete a separate consent form to release this information and you are still able to participate in this study and deny us access to your academic information. Thus consent to participate in this study and consent to release your academic records are separate acts.

This study has been reviewed and received ethics clearance through the Health Science Research Ethics Board. If you have questions about your rights as a research subject, you should contact the Director of the Office of Research Ethics at XXX@uwo.ca or XXX-XXXX.

By clicking the box bellow you are indicating that you have read the above information and that you consent to participate in this study. If you have any questions please feel free to contact your research coordinator (XXXXXXX@uwo.ca) or Rebecca McDermott, M.Sc., PhD Candidate in Clinical Psychology (email: XXX@uwo.ca) or Dr. David Dozois (email: XXX@uwo.ca).
The main goal in running this study was to assess the effect of our three different conditions on preventing depression/anxiety symptoms. You were placed in one of three conditions: cognitive behavioural therapy, attentional training, or a control condition.

In the cognitive behavioural therapy (CBT) condition you would have completed the online program called MoodGYM, which is an online program developed by researchers at the Australian National University. It contains five different modules. Participants in this condition completed one module per week and then on the sixth week of intervention they completed a review session. MoodGYM covers some basic components of CBT including changing thinking, changing behaviours, assertiveness, and self-esteem training. CBT is a well-accepted treatment for depression and anxiety disorders. MoodGYM has been found affective at treating mild depression and anxiety disorders.
symptoms (Christensen, Griffiths, & Jorm, 2004; Christensen, Griffiths, & Korten, 2002).
This program is freely available online and any interested party may access it at

In the attentional training condition participants completed an attentional training
task developed by Montreal based researchers (Dandeneau & Baldwin, 2004: Dandeneau,
Baldwin, Baccus, Sakellaropoulo, & Pruessner, 2007). During this task participants
identify the happy face among an array of negative faces. The task is based on the
knowledge that individuals who experience anxiety and depression are more likely to
attend to negative information. This task is designed to modify these attentional biases by
training individuals to attend to the happy faces. Attentional training has been shown to
be effective at reducing anxious and depressive symptoms (Amir, Beard, Burns, &
Bomyea, 2009; Wells & Beevers, 2010) and to reduce stress (Dandeneau et al., 2007).
Participants in this condition completed this task on a biweekly basis for six consecutive
weeks.

In the control condition participants completed a task very similar to the attentional
training condition. However, instead of only identifying the positive face, they also spent
half their time identifying the negative faces. This is a well-established methodology for
measuring attentional biases (Hansen & Hansen, 1988) and it is not thought to alter an
individual’s attention bias or harm the individual in anyway. Like participants in the
attentional training condition, participants in this condition also completed this task on a
biweekly basis.
All participants also completed some questionnaires that asked questions about symptoms consistent with anxiety and depression. We also asked you to complete some questions about thoughts that you were experiencing, which have been shown to be related to depression. Every week you also completed a questionnaire about the negative life events that you experienced. In addition, today you also completed an interview, which we administered to determine the frequency of depression and anxiety disorders in the participants completing this study. This interview is only meant for the purposes of this study. Because licensed health professionals did not conduct the interviews, they are unable to provide a diagnosis. However, if you believe that you are suffering from depression or an anxiety disorder please see the resources listed below.

All of the data that you provided for this study are kept strictly confidential, and the results will only be presented openly in terms of group data (i.e., thesis defence, conferences presentations, peer-reviewed publications). All data will be kept in a secured area. If you have any other questions regarding the experiment, please do not hesitate to contact me (Rebecca McDermott; XXX@uwo.ca).

Participants dealing with problematic mood (e.g., persistent sad mood) and/ or suicidal thinking are strongly encouraged to speak with a mental health professional. For example, students at UWO are offered free psychological counselling at the Student Development Centre. You may also speak directly with Dr. David Dozois (519-661-2111, ext. XXXX; XXXX@uwo.ca). Other resources and self-help references are provided below.
Researcher: Rebecca McDermott, M.Sc., PhD Candidate in Clinical Psychology

Email: XXX@uwo.ca

Advisor: Dr. David Dozois

Email: XXX@uwo.ca

If you have questions about your rights as a research subject, you should contact the Director of the Office of Research Ethics at XXX@uwo.ca or 661-3036.

Self-Help References:

If you would like to look up some good self-help books on changing negative thinking, please see:


Services Available to Students

There are several ways in which students can access psychological or psychiatric help both on campus and within the City of London, Ontario. If you are feeling depressed or anxious or feel that you could benefit from some individual assistance, the following information may be of use to you.

The Student Development Centre at the University of Western Ontario
• Individual counselling and crisis appointments are available for UWO students. To make an appointment you can call 661-3031, or you can make an appointment in person at the Reception Desk, Room 235 located within SDC, University Community Centre Room 210.
• More information about the services offered at SDC can be found at http://www.sdc.uwo.ca/

Student Health Services Counselling Centre

• The Student Health Services Counselling Centre provides individual counselling for students.
• The Counselling Centre can be reached at (519) 661-3771 and is located in Room 11, (Lower Level) University Community Centre
• The Counseling Centre is open Monday to Friday 8:30 a.m. - 4:30 p.m., and will be closed whenever the University is closed.
• More information about the Counseling Centre can be found at http://www.shs.uwo.ca/counselling/index.htm

London & District Distress Centre

• This is a 24-hour Distress Help Line: (519) 667-6711.
• Each problem is handled in an atmosphere of confidentiality, anonymity & impartiality. You do not have to give your name nor does the service use call display; they will not try to identify the caller.

London Mental Health Crisis Service

• 24-hour Crisis Help Line: (519) 433-2023
• Walk-in help is available at the Crisis Centre at 862 Richmond Street, London
• Hours of operation are Monday to Friday - 2 p.m. to 10 p.m.; Saturday, Sunday and Holidays - 6 p.m. to 9 p.m.

Addiction Services of Thames Valley

• Addiction Services of Thames Valley is located at 200-256 Pall Mall Street, London and can be contacted at (519) 673-3242 ext. 222 or kmeyer@adstv.on.ca
• Service is available to any resident of Middlesex, Elgin or Oxford County.
• Provide support to persons who are concerned about substance use and/or problem gambling.
• Hours of operation in London are Monday to Friday - 8:30 a.m. to 4:30 p.m. (closed 12 until 1 p.m. each day).
Emergencies After Hours

- If you are in distress during an after-hours time, please go to the nearest hospital emergency room.
- On Campus: University Hospital: (519) 663-3197, 339 Windermere Road
- South London: Victoria Hospital: (519) 685-8500, 800 Commissioners Road East
- North London: St. Joseph's Hospital: (519) 646-6100, 268 Grosvenor Road

Referrals to Other Resources

- Family physicians can provide you with counselling services, and can make referrals to other community resources as needed.
- Specialized services for emotional and interpersonal problems are available, however, a referral from a physician is often necessary.

We hope that this information is helpful to those who need it.

If you are suffering from distress, we encourage you to seek help from an appropriately qualified individual or service centre. Please contact a University or Community Agency that can help you, or to speak with a physician who can refer you to the appropriate agency.
Appendix D: Histogram of responses on the Kessler Distress Scale

Mean = 27.56
Std. Dev. = 5.792
N = 447
Appendix E: Histogram of responses on the NEO-FFI neuroticism scale

Mean = 41.06
Std. Dev. = 5.972
N = 440
Appendix F: Demographics of the Benchmarking Study sample.

Demographic Information

Number of persons randomized 92

Age
Mean (SD) 18.54(0.97)

Gender (percentage)
Male 32.6%
Female 67.4%

Ethnicity (percentage)
Caucasian 56.5%
Asian 26.1%
South Asian 8.7%
Other 8.7%

BDI-II
Mean (SD) 21.99(11.01)

STAI (State)
Mean (SD) 23.74(6.55)

STAI (Trait)
Mean (SD) 24.84(6.39)

Note: BDI-II represents the Beck Depression Inventory-II while STAI represents the State Trait Anxiety Inventory.
Appendix G: Ethics approval

ROMEO - Researcher Portal General Info

File No: 102864
Title: The Western Prevention Study (Symptom Reduction and Prevention of Affective disorders) Start Date: 23/10/2012
End Date: 30/09/2014
Keywords:

Project Members

Principal Investigator

Prefix: Prof.
Last Name: Dozois
First Name: David
Affiliation: Schulich School of Medicine and Dentistry\Psychiatry Rank: Professor
Gender: Unspecified
Email: XXX@uwo.ca
Phone1: 519-679-2111 xXXX
Phone2:
Fax: 519 850-2554
Mailing Address: SSC
Institution: Western University
Country: Canada
Comments:

Others

Attachments

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<th>Last Name</th>
<th>First Name</th>
<th>Affiliation</th>
<th>Role In Project</th>
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<td>PhD Student</td>
<td>McDermott</td>
<td>Rebecca</td>
<td></td>
<td>Research Support Staff</td>
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Description

File Name

Version Date

102864 Dozois Western Protocol et al.pdf
Electronic
19/08/2012

Paper
19/08/2012

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Appendix H: Curriculum Vitae

Rebecca McDermott, M.Sc.
Curriculum Vitae

EDUCATION

In Progress

Doctor of Philosophy, Clinical Psychology
The University of Western Ontario
Research Advisor: David Dozois, Ph.D., C.Psych.
Dissertation: The Western Prevention Study: A Transdiagnostic, Affective Disorder Prevention Trial

2011

Master of Science, Clinical Psychology
The University of Western Ontario
Research Advisor: David Dozois, Ph.D., C.Psych.
Thesis: The Causal Role of Attention Bias in Depressive Symptomatology

2009

Bachelor of Science, Psychology, Honours Degree with Distinction
McMaster University
Research Advisor: Scott Water, Ph.D.
Thesis: Using the SNARC Effect to Explore Implicit Access of Spatially-Represented Magnitude Information

TEACHING AND SUPERVISION EXPERIENCE

Teaching Assistantships

- Introductory Psychology – Western University (2010-present)
  - Head TA
- Research Methods and Analysis – Western University (2009-2010)
  - Tutorial instructor
- Introductory Psychology – McMaster University (2007-2009)
  - Tutorial instructor
- Introductory Biology – McMaster University (2007)
  - Tutorial instructor

Supervisory Roles

- Honours Thesis Research Advisor, The University of Western Ontario (2012-2013)
  Project Title: The Role of Life Events, Stress Reactivity, and Negative Automatic Thoughts on Depression
- Research assistant supervision: Supervised 9 research assistants working on four different research projects
PUBLICATIONS AND PRESENTATION

Peer-Reviewed Journal Articles


Invited Book Chapters


Conference Presentations

![Image of a document page]


**Other Professional Presentation**

- **McDermott, R.** (2015). Integrating DBT Skills Training into Trauma Treatment. Talk presented at the Royal Ottawa Hospital, Psychology Grand Rounds.
- **McDermott, R.** (2015). Youth eMental Health: Integrating mental health into your practice. Talk presented at the Royal Ottawa Hospital, Youth Psychiatry Rounds.

**Awards**

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<td><strong>Ontario Graduate Scholarship</strong> (2011 –2012) – Awarded by the province of Ontario, $1,500</td>
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<td><strong>SSHERC Joseph-Armand Bombardier Canada Graduate Scholarship</strong> (2010 – 2011) – Awarded to successful applicants in the master’s program in the social sciences or humanities at a Canadian University, $17,500</td>
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<td><strong>Ontario Graduate Scholarship</strong> (2010 –2011) – Awarded by the province of Ontario, $1,500 (declined)</td>
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<td><strong>NSERC Undergraduate Student Research Award</strong> (2009) – Award based on academic merit and research potential that funds undergraduate students for a summer research position, $6,500</td>
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<tr>
<td><strong>NSERC Undergraduate Student Research Award</strong> (2008) - Award based on academic merit and research potential that funds undergraduate students for a summer research position, $8,000</td>
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<td><strong>The Achievement Award of Excellence</strong> (2008) Undergraduate award based on academic merit and community contribution, $800</td>
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<td><strong>The Dr. Larry Hooker Scholarships</strong> (2008) Undergraduate Scholarship based on academic merit, $2000</td>
</tr>
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<td><strong>The Psychology Society Prize</strong> (2008) Award for the highest session average in the biopsychology program, $150</td>
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- Biology Certificate of Excellence (2007) Award for achievement as a Biology peer mentor (Tutorial leader)
- The Biology Achievement Award (2006) Award for outstanding academic achievement in introductory biology, text book ~ $150
- The McMaster Honor Award Level II (2005 – 2006) Entrance scholarship awarded for academic merit, $2,000

Research Grants

- Academic Development Fund (Major Grants Competition), New Research and Scholarly Initiative Awards: “Symptom reduction and prevention of affective disorders” (Dozois, D. J. A. [principal investigator], McDermott, R. [co-investigator]) - $137,891.00 awarded in 2012 to cover a period of one year.
- Canada Post Foundation for Mental Illness and Mental Health Grant, “The Wait-List Clinic (WLC) at Canadian Mental Health” (Otchet, F. [principal investigator], McDermott, R. [co-investigator]) - $63,000 awarded in 2012 to cover a period of one year.

PROFESSIONAL SERVICE

Professional Association Memberships
- Association of Cognitive Behavioural therapy, Student member (2012-present)
- Canadian Psychological Association, Student Affiliate (2010–present)
- London Regional Psychological Association, Student Affiliate (2013-present)

Committee Memberships
- Clinical Student Advisory Committee (2011–Present): Responsibilities included organizing and evaluating a series of seminars and workshops for clinical psychology graduate students, faculty, and adjuncts; liaising between faculty and students; and welcoming and orienting new students to the clinical program.
- Adjunct Advisory Committee (2013–Present): Evaluate adjunct faculty candidates for adjunct status and renewal as well as provide feedback on the clinical area annual retreats.
- Advocacy Through Action (2009–2013): A student-run organization that strives to bring psychology the community of London, Ontario, through an annual series of public lectures on various topics relating to mental health and well-being.

Editorial Experience
- Manuscript Reviewer, Abnormal Psychology (2011)