How Does Online Therapy Work? Exploring Skills Usage as a Mechanism of Change in Internet-Delivered Cognitive-Behavioural Therapy for Depression and Anxiety.

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Statement of Candidate

I certify that the work in this thesis entitled "How Does Online Therapy Work? Exploring Skills Usage as a Mechanism of Change in Internet-Delivered Cognitive-Behavioural Therapy for Depression and Anxiety." has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree to any other university or institution other than Macquarie University.

I also certify that the thesis is an original piece of research and it has been written by me. Any help or assistance that I have received in my research work and the preparation of the thesis itself has been appropriately acknowledged.

In addition, I certify that all information sources and literature used are indicated in the thesis.

The research presented in this thesis was approved by Macquarie University Ethics Review Committee. Approval reference numbers for the studies are as follows: Study I (5201300452), Study II (5201300812), and Study III (5201401119).

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Abstract

Major depression and generalised anxiety disorder (GAD) are common disorders that are often comorbid. Cognitive-Behavioural Therapy (CBT) is an efficacious treatment, which can be delivered online (iCBT), but little is known about its mechanism of therapeutic change. Understanding mechanisms will help improve treatment efficacy and efficiency. A core feature of CBT is teaching patients skills that promote adaptive cognitions and behaviours. However, there is limited evidence indicating that skills usage is a mechanism of change during CBT. The present thesis aims to evaluate the mechanistic role of CBT skills usage on symptoms of depression and GAD during iCBT. The aim of study one was to develop a brief questionnaire assessing CBT skills usage suitable for mechanism research. Responses from 661 participants were subjected to exploratory and confirmatory factor analysis yielding a 12-item measure of CBT skills usage, the Frequency of Actions and Thoughts Scale (FATS). In study two, the FATS was administered during an iCBT course for depression and anxiety (n = 125). Large increases in FATS scores were observed from pre-treatment to post-treatment (d = 0.90), and residualised change scores correlated significantly with residual change scores of symptoms (rs = .28 - .30). The third study utilised a randomised controlled trial investigating the causal relationship between treatment and skills usage. Results indicated that patients receiving iCBT for depression and anxiety (n = 65) reported significantly greater FATS scores (d = 0.58) at the end of treatment compared with a wait-list control group (n = 66). Mediation analysis revealed that symptom reduction was mediated by increased skills usage at the end of treatment. Study four pooled the data from studies two and three, which was used to explore predictors of skills usage. Overall, the results from this research suggest that skills usage is an important mechanism of change in iCBT for depression and GAD.

Chapter One

Introduction

Clinical depression and generalised anxiety disorder (GAD) are highly prevalent mental health conditions that cause significant distress and impairment (Kessler, DuPont, Berglund, & Wittchen, 1999; Wittchen, 2002). There is considerable evidence that structured psychotherapies, such as cognitive-behavioural therapy (CBT), are effective for treating symptoms of depression and GAD (Cuijpers, van Straten, Andersson, & Oppen, 2008; Hofmann & Smits, 2008). However, little is known about how psychotherapy works to reduce symptoms (DeRubeis, Gelfand, German, Fournier, & Forand, 2014; Gibbons et al., 2009; Kazdin, 2007; Laurenceau, Hayes, & Feldman, 2007). Understanding the processes and mechanisms that underlie psychotherapy is important for improving the effectiveness and efficiency of treatments, which will lead to better mental health outcomes (Kazdin, 2007; Nock, 2007).

According to CBT models of therapy, cognitions and behaviours are important in both the development and treatment of depressive and anxiety disorders (Driessen & Hollon, 2010; Hollon, Stewart, & Strunk, 2006). CBT can be delivered face-to-face and through the internet (Andersson & Cuijpers, 2009). A core feature of CBT is teaching patients skills that will increase the frequency of adaptive thoughts and behaviours, leading to symptom reduction (A. T. Beck, Rush, Shaw, & Emery, 1979). There is evidence that increasing skills usage is associated with reductions in depression and anxiety symptoms following CBT (e.g. Jacob, Christopher, & Neuhaus, 2011; Jarrett, Vittengl, Clark, & Thase 2011). However, the role that skills usage plays as a driver of therapeutic change in CBT is poorly understood. A better

understanding of skills usage will improve the understanding of why and how CBT leads to symptom reduction, and how psychotherapy works more generally.

The current thesis investigates the role that skills usage plays in producing therapeutic change in internet-delivered CBT (iCBT) for symptoms of depression and GAD. This thesis tests underlying assumptions of CBT by asking the following three questions: 1) Does iCBT for depression and anxiety increase the frequency of adaptive behaviours and cognitions? 2) Do increases in the frequency of adaptive behaviours and cognitions mediate treatment effects? 3) What variables predict skills usage during treatment?

1.1 Depression and General Anxiety

1.1.1 Major Depression

Major Depression, or Major Depressive Disorder (MDD), is characterised by persistent low-mood and anhedonia lasting two weeks or more that is accompanied by somatic complaints such as fatigue, impaired sleep, and irritability (American Psychiatric Association, 2013). MDD is highly prevalent and is associated with multiple problems. The National Survey of Mental Health and Wellbeing in Australia found a lifetime prevalence of a major depressive episode of 11.6% (Australian Bureau of Statistics, 2007), the National Comorbidity Survey Replication in the United States found a lifetime prevalence of MDD of 16.6% (Kessler et al., 2005), and the European Study of the Epidemiology of Mental Disorders found a lifetime prevalence of MDD of 12.8% across six European countries (Belgium, France, Germany, Italy, the Netherlands, and Spain; Alonso et al., 2004). MDD can cause severe distress and is associated with greater social impairment, lower quality of life, reduced work productivity, increased time off work (Kessler et al., 1999), and greater lifetime risk of suicide (Inskip, Harris, & Barraclough, 1998).

Sub-threshold MDD, also called *minor depression*, refers to the presence of MDD symptoms that do not meet full diagnostic criteria for MDD but are still associated with significant distress or impairment comparable to MDD (Howland et al., 2008). Subthreshold MDD is common with the National Comorbidity Survey revealing a lifetime prevalence of 10.0% in the United States (Kessler, Zhao, Blazer, and Swartz, 1997). The financial costs of minor depression are also substantial. A large population study in the Netherlands indicated that the economic cost of subthreshold depression, which was estimated at $US 160 million per one million inhabitants per year, was almost as large as the economic cost of MDD which was estimated at $US 192 million per one million inhabitants per year (Cuijpers et al., 2007). The health and economic costs of minor depression and MDD to both the individual and society are thus substantial. For the purposes of this thesis, and unless stated otherwise, the term *depression* will collectively refer to both MDD and subthreshold depression.

1.1.2 Generalised Anxiety Disorder

Generalised Anxiety Disorder (GAD) is a mental disorder characterised by excessive, uncontrollable worry and is accompanied by several somatic symptoms including muscle tension, fatigue, and restlessness (American Psychiatric Association, 2013). GAD is common with a lifetime prevalence of 5.9% in Australia (Australian Bureau of Statistics, 2007), 5.7% in the United States (Kessler, Berglund, Demler, Jin, & Walters, 2005), and an average of 2.8% across the six European countries from the European Study of the Epidemiology of Mental Disorders Project (Belgium, France, Germany, Italy, the Netherlands, and Spain; Alonso et al., 2004). People with GAD report greater social impairment, lower quality of life, reduced work productivity, more days absent from work, and greater primary care resource use (Kessler, DuPont, Berglund, & Wittchen, 1999; Wittchen, 2002; Wittchen, Carter, & Pfister, 2000).

As with MDD, GAD severity occurs along a continuum, and subclinical symptoms are also widespread and functionally impairing. A systematic review investigating the prevalence and burden of subthreshold GAD found that it was twice as prevalent as GAD, and was associated with psychosocial impairment, work impairment, and increased primary health care usage (Haller, Cramer, Lauche, Gass, & Dobos, 2014). Like depression, GAD is associated with both health and economic burden to individuals and to society.

As with *depression*, in this thesis, unless stated otherwise, the term *general anxiety* will be used to refer to the presence of GAD symptoms that are significant enough to interfere with the individual's everyday functioning to the level that it warrants clinical intervention. *General anxiety* will therefore collectively refer to clinical and subclinical levels of GAD.

1.1.3 Comorbidity of MDD and GAD

MDD and GAD share many clinical features, including somatic symptoms such as fatigue, restlessness, and sleep disturbances (Nutt, Argyropoulos, Hood, & Potokar, 2006). These two disorders have one of the highest comorbidities amongst all mood and anxiety disorders with one U.S. study reporting the lifetime comorbidity between these two disorders as 62.4% (Wittchen, Zhao, Kessler, & Eaton, 1994). Consistent with this, another study in the U.S. reported that 70% of those meeting criteria for GAD in a 12-month period had also experienced a major depressive episode during those 12 months (Kessler et al., 1999). Comorbid MDD and GAD is typically more severe than a single diagnosis of either disorder and is associated with greater personal distress, greater impairments in role functioning and social life, and greater utilisation of mental health resources (Judd et al., 1998; Kessler et al., 1999; Kessler et al., 2002; Moffitt et al., 2007; Stein & Heimberg, 2004). Cases of comorbid depression and anxiety thus represent a greater burden on both the individual and society than either disorder alone.

The presence of sub-threshold symptoms of both of these disorders is also common and is associated with significant impairment in work and social functioning (Helmchen & Linden, 2000; Katon & Roy-Byrne, 1991; Rivas-Vasquez, Saffa-Biller, Ruiz, Blais, & Rivas-Vasquez, 2004). Mixed depression and anxiety symptoms, not meeting threshold for a formal diagnosis, are likely to be more common than the occurrence of either formally diagnosed disorder on its own (for review, see Rivas-Varquez et al., 2004).

The high comorbidity between depression and anxiety, and the similarity between their diagnostic criteria in terms of symptoms and clinical presentation, suggests that they have similar underlying causal and maintenance processes (Barlow et al., 2004; Goldberg, Krueger, Andrews, & Hobbs, 2009; Mansell, Harvey, Watkins, & Shafran, 2009; Moses & Barlow; 2006). A greater understanding of the similarities and differences that underlie these disorders will allow for more effective and efficient ways to formulate treatment plans for patients experiencing symptoms of either or both disorders.

1.2 Treatment for Depression and GAD

1.2.1 Pharmacotherapy

Pharmacotherapy refers to treating disorders by administrating chemical agents (i.e. medications). There is much evidence that pharmacotherapy is effective at treating both depression and general anxiety (Bandelow et al., 2012; Bauer et al., 2007; Hoffman & Sanjay, 2008).

For depression, the effect of medications such as tricyclic antidepressants, selective serotonin reuptake inhibitors, and serotonin norepinephrine reuptake inhibitors have been studied extensively and have generally been shown to be more efficacious at reducing symptoms compared with placebo (Bauer et al., 2007; Khan, Faucett, Lichtenberg, Kirsch, &

Brown, 2012). Findings from a meta-analysis investigating the effects of antidepressants for depression found that, while medication was significantly more efficacious than a placebo control for severe symptoms, medication did not perform any better than placebo for individuals with mild to moderate symptoms (Fournier et al., 2010). It has therefore been asserted that for milder forms of depression, psychological treatments including counselling, internet guided self-help, and active psychotherapy may be more appropriate and the use of antidepressants is better reserved for more severe cases of depression (Hegerl, Schonknecht, & Mergl, 2012; NICE, 2011).

Selective serotonin reuptake inhibitors are also an effective drug for treating general anxiety (Koen & Stein, 2011), and are suitable for treating comorbid depression and anxiety (Baldwin & Polkinghorn, 2005). Other main classes of medications for anxiety are benzodiazepines and azapirones. A meta-analysis reviewing the efficacy of these two drug classes for GAD found that both were superior to placebo at reducing short-term symptoms, and both were equally efficacious (Mitte, Noack, Steil, & Hautzinger, 2005). However, these medications are not suitable as long-term treatments due to their impairing side effects (Mitte et al., 2005). As anxiety is responsive to antidepressants including selective serotonin reuptake inhibitors, serotonin norepinephrine reuptake inhibitors, and tricyclic antidepressants, these are more appropriate as first-line pharmacotherapy treatments for GAD (Baldwin & Polkinghorn, 2005; Hoffman & Mathew, 2008).

1.2.2 Psychotherapy

Psychotherapy is another common treatment method for depression and general anxiety. Psychotherapy refers to the systematic application of psychological principles for treating mental and behavioural disorders (Barlow & Durand, 2015; A.T. Beck et al., 1979; Dobson & Dozois, 2010; Ellis, 1980; Leichsenring & Leibing, 2007). Psychotherapists use a range of

different techniques to address symptoms in the short and long-term to improve quality of life. This thesis will focus on the use of psychotherapy.

There is much evidence supporting the efficacy of psychotherapy for treating depression and general anxiety (Covin, Ouimet, Seeds, & Dozois, 2008; Cuijpers & Dekker, 2005; Hofman & Smits, 2008; Knekt et al., 2008). For the purposes of the current thesis, only the major schools of psychotherapy, which have substantial evidence for their efficacy in treating depression and general anxiety, will be considered. The following section will provide a brief overview of some of these major schools in relation to treatment in adults.

1.3 Models of Psychotherapy

1.3.1 Psychodynamic Psychotherapy

Psychodynamic psychotherapy refers to models of psychotherapy based on principles derived from Freud's psychoanalytic concepts, which specify that disorder arises from unresolved, often unconscious, psychological conflict (Freud, 1916). These psychological conflicts are often attributed to unresolved emotional trauma outside of conscious awareness, which can manifest as neuroses or psychoses if left untreated (Luborsky & Barrett, 2006). The aim of psychodynamic therapy is to bring unconscious conflicts into the consciousness of patients to be psychologically processed and resolved (Barlow & Durand, 2015; Jung, 1915). This is achieved by the therapist providing interpretations of the difficulties experienced by the patient, generating insight, which helps the patient resolve the psychological conflicts, leading to recovery (Leichsenring & Leibing, 2007).

Although contemporary psychodynamic psychotherapy has largely departed from its psychoanalytic origins, many of Freud's core principles remain influential. This includes the importance of the therapeutic relationship (Bordin, 1979), the notion that psychological

mechanisms underlying disorder are largely unconscious, that disorder arises from internal conflict, and that early life traumas are important in the aetiology of mental disorder (Leichsenring & Leibing, 2007; Marmor, 1992, p 190). Many of these psychoanalytic concepts have received empirical validation and continue to inform contemporary psychodynamic psychotherapy practice (Luborsky & Barrett, 2006).

Several meta-analyses have demonstrated the efficacy of psychodynamic psychotherapy for depression and general anxiety, and some suggest that it leads to greater long-term benefit compared with other models of psychotherapy (see Shedler, 2010). Briefer versions of psychodynamic therapy have also emerged as an alternative treatment option to the traditional, longer-term, psychodynamic therapy (Driessen et al., 2010). A meta-analysis of 23 studies comparing brief psychodynamic therapy against control conditions for depression found that it resulted in large within-group effect sizes (Cohen's $d > 1.3$) and was significantly more effective compared with control conditions (Cohen's $d = 0.69$; Driessen et al., 2010). There is also evidence that brief psychodynamic therapy is effective for treating GAD (Leichsenring et al., 2009), and that these improvements are maintained for at least 12 months after treatment (Salzer, Winkelbach, Leweke, Leibing, & Leichsenring, 2011).

Brief psychodynamic therapy has also been delivered via the internet as text-based self-guided modules with online therapist contact and has been demonstrated to be efficacious for depression when compared with an active support control group (Johansson et al., 2012). It also performed as well as iCBT for GAD (Andersson et al., 2012).

1.3.2 Interpersonal Psychotherapy

According to the interpersonal psychotherapy model, depression may occur when there are disturbances in an individual's interpersonal context, including difficulties in personal

relationships or impairments in the functioning of one's role in society, such as workplace and community roles (Klerman & Weissman, 1994). Interpersonal psychotherapy therefore aims to improve patients' current interpersonal relationships and social contexts by providing a supportive therapeutic relationship and encouraging pro-social behaviours and social skills training (Klerman Weissman, Rounsaville, & Chevron, 1984; Klerman & Weissman, 1994).

Much research supports the efficacy of interpersonal psychotherapy for depression. It is superior to a placebo control and comparable to the anti-depressant imipramine in treating depression (Elkin et al., 1989). It has demonstrated efficacy in treating depressed adolescents (Mufson, Weissman, Moreau, & Garfinkel, 1999) and depressed geriatric patients (Reynolds et al., 1999). In a meta-analysis comparing different models of psychotherapy for depression, interpersonal psychotherapy reduced symptoms significantly more than six other models of psychotherapy (Cuijpers et al., 2008), though this effect was small in magnitude (Cohen's d = 0.20).

As interpersonal psychotherapy was formulated for treating depression (Klerman et al., 1984), there is much less research in the treatment of anxiety disorders, and there do not appear to be any specific interpersonal psychotherapy treatments for general anxiety. However, it has been suggested that treatment components improving interpersonal functioning would have utility for CBT treatments of GAD (Borkovec, Newman, & Castonguay, 2003; Borkovec, Newman, Pincus, & Lytle, 2002), and CBT protocols incorporating interpersonal components have been developed (Newman et al., 2011). Therefore, interpersonal psychotherapy may represent a suitable treatment for comorbid depression and general anxiety, and may contain components that add benefit for other anxiety treatments. However, there is currently a lack of evidence supporting its use as a stand-alone treatment for primary anxiety.

1.3.3 Behavioural Activation

Behavioural Activation (BA) treatments are based on behavioural models of depression that propose depression arises from a lack of positive reinforcement of rewarding behaviours from the environment (Ferster, 1973). This can be due to the environment lacking sources of positive reinforcement, the individual not possessing the behavioural repertoire to elicit the required reinforcement from the environment, or a combination of these (Ferster, 1973; Lewinsohn, 1974). BA therefore aims to facilitate patients' exposure to environments that contain more reinforcing features and teaches skills to enhance individuals' abilities to obtain positive reinforcement from their environments (Dimidjian et al., 2011; Lewinsohn, 1974; Lejeuz, Hopko, & Hopko, 2001; Mazzucchell, Kane, & Rees, 2009). As the theoretical basis of BA was developed in the context of depression (Ferster, 1973; Lewinsohn, 1974), the vast majority of BA research focuses on depression (Dimidjian et al., 2011).

Dimidjian and colleagues (2011) define BA as a brief, structured psychotherapy that aims to increase engagement in adaptive behaviours (e.g. pleasurable and/or rewarding activities), decrease engagement in maladaptive behaviours that maintain symptoms (e.g. avoidance behaviours), and to address barriers that limit access to reward or which increase the frequency of maladaptive behaviours. This is done using several techniques including, but not limited to, scheduling pleasant activities, monitoring activities and mood, and improving social interaction and problem solving skills. Although traditional theoretical models of BA largely focused on environmental factors (e.g. Ferster, 1973; Lewinsohn, 1974), an updated model integrates dispositional factors of the individual as well as cognitive processes, such as negative expectations and self-criticism, in the aetiology of depression (Lewinsohn, 1985). Despite acknowledging the importance of cognitive factors in depression, BA models maintain that techniques directly affecting behaviours and environmental reinforcement are preferable to techniques that target cognitions directly (Dimidjian et al., 2011).

In a meta-analysis investigating the efficacy of BA for depression, Mazzucchelli and colleagues (2009) identified four iterations of BA, which differed in emphasis of the therapeutic approach and the complexity of the techniques. However, regardless of the type, all BA models are centred on the notion that increasing exposure to reinforcing stimuli and reward, such as enjoyable, rewarding, and satisfying activities, is the focus of therapy (Carvalho & Hopko, 2011; Hopko, Lejeuz, Ruggiero, & Eifert, 2003; Lejuez, Hopko, & Hopko, 2001; Martell, Addis, & Jacobson, 2001). Furthermore, these four different variants of BA have been found to produce similar reductions in the magnitude of symptoms of depression (Mazzucchelli et al., 2009), and BA theorists acknowledge that the differences between BA models are minimal (Dimidjian et al., 2011).

Several meta-analyses have assessed the efficacy of BA for depression. These studies show that BA is more efficacious for reducing depression compared with no-treatment controls, some other therapeutic models, and are at least equal to cognitive therapy (Cuijpers, Andersson, Donker, & Van Straten, 2011; Cuijpers, Van Straten, & Warmerdam, 2007; Ekers, Richards, & Gilbody, 2008; Mazzucchelli et al., 2009). BA has also been used to improve general well-being in non-clinical samples (Mazzucchelli, Robert, & Rees, 2010).

There has been considerably less research investigating the efficacy of BA for treating general anxiety, however, preliminary evidence is promising. A two-group pilot trial investigating the efficacy of a BA treatment for excessive worry found that participants receiving BA had greater reductions in excessive worry and anxiety symptoms compared to a waitlist control group (Chen, Liu, Rapee, & Pillay, 2013). There have also been several case-studies demonstrating the effectiveness of BA for treating general anxiety symptoms for individuals experiencing comorbid health conditions (e.g. Hopko, Lejuez, & Hopko, 2004; Armento & Hopko, 2009).

1.3.4 Cognitive-Behavioural Therapy

Cognitive-behavioural therapy (CBT) is a generic term for treatments that incorporate cognitive and behavioural techniques in treating mental disorders. These are based on cognitive and behavioural formulations of psychopathology (A. T. Beck et al., 1979; J. Beck, 2011; Dobson, 2013; Dobson & Dozois, 2010 Hollon & A.T. Beck, 1994; Mahoney, 1988).

Modern CBT has its origins in Behaviour Therapy (BT) and Cognitive Therapy (CT). BT arose in the 1950s and 60s (Eysenck, 1960; Wolpe, 1958) as a reaction to the dominant psychoanalytic psychotherapy, which was believed to be ineffective and unscientific (Eysenck, 1952). BT models were based on learning principles pioneered by several researchers including Ivan Pavlov (1927), Hull (1943), Watson (1913) and developments in learning theory derived from both Pavlovian and operant conditioning (e.g. Hull, 1943; Skinner, 1938) (Eyesenck, 1960; Rachman, 2009; Wolpe, 1958).

Early proponents of BT, such as Wolpe (1958), were largely concerned with treating anxiety disorders (often referred to as *neuroses*). It was proposed that neuroses were produced during an anxiety-eliciting event, whereby the anxiety response becomes conditioned to other "neutral" stimuli (Wolpe, 1958, p 78). Treatment involved exposure, both real and imagined, to the feared stimuli in order to extinguish the conditioned fear responses, using techniques such as systematic desensitisation (Eysenck, 1987; Wolpe, 1958). Operant conditioning principles (Skinner, 1959), such as rewarding desirable behaviour and punishing undesirable behaviour, were also used as a form of BT (e.g. Lindsley, 1956). BT and its principles appeared efficacious in treating anxiety disorders, including phobias (Lang & Lazovik, 1963) and Obsessive-Compulsive Disorder (Meyer, 1966). However, much of the research for the efficacy of BT during this time came from case reports (e.g. Ullmann & Krasner, 1965), so caution is needed in assessing its relative efficacy to other psychotherapy treatments (Lazarus, 1971, p 16).

Cognitive models of treating depression (A.T. Beck, 1970; 1963; Ellis, 1958) were developed after the introduction of BT models. These included CT (A.T. Beck et al., 1979) and Rational Emotive Therapy (Ellis, 1962). These approaches proposed that cognitive processes were central in the aetiology and maintenance of depression, and other psychopathologies, and emphasised the important relationship between thinking, mood, and behaviour (A.T. Beck, 1970; Ellis, 1958). For example, Beck's (1963, 1964) cognitive model of depression proposed that stressful eliciting events activate negative and faulty cognitive processes, such as dysfunctional attitudes and automatic negative thinking, that bias the person to interpret information about their environment and themselves in negative and maladaptive ways. These faulty cognitive processes eventually lead the person to "spiral" into a depressive disorder (A.T. Beck, 1963). Ellis (1958) similarly proposed that neuroses are caused and maintained by irrational and illogical thinking. This includes having impossible perfectionistic expectations of one's self that could never possibly be fulfilled, such as the idea that one needs to be liked and approved of by every person they meet. The mismatch between one's expectations and reality then leads to negative self-critical thoughts, which is accompanied by "neurotic" emotions.

CT introduced techniques to assist patients to challenge and change maladaptive cognitive patterns to more realistic and adaptive patterns (A.T. Beck et al., 1979). As Beck's CT was also heavily influenced by BT (Craske, 2010; Rachman, 2015), it also incorporated a substantial behavioural component and included techniques such as graded exposure and activity scheduling (A.T. Beck et al., 1979). CBT is thus regarded as the combination of cognitive and behavioural principles, which gave rise to cognitive-behavioural formulations and treatments of disorders, including panic disorder (Clark, 1986), health anxiety (Salkolvskis & Warwick, 1986), and social phobia (Rapee & Heimberg, 1997).

There are many different forms of CBT, including CT (A. T. Beck et al., 1979), rational emotive behaviour therapy (Ellis, 1962), and cognitive behaviour modification (Meichenbaum, 1977). Dobson and Dozois (2010) assert that CBT models share three fundamental propositions: 1) cognitive activity affects behaviour, 2) cognitive activity may be monitored and altered, and 3) desired behaviour change may be affected through cognitive change. Others provide a more general definition that emphasises the cognitive roots of CBT, defining CBT as treatment comprising cognitive and behavioural techniques but being primarily derived from a cognitive formulation of psychopathology (A. T. Beck et al., 1979; J. Beck, 2010; Driessen & Hollon, 2010; Hofmann, Asnaani, Vonk, Sawyer, & Fang, 2012). Others have taken a more practical approach and defined CBT as any treatment package that utilises techniques based on learning theory (e.g. exposure) and cognitive theory (e.g. cognitive restructuring; Craske, 2010; Rachman, 2015). This latter approach, where CBT refers to any psychological treatment comprising cognitive and behavioural techniques, will be adopted for the current thesis.

In addition to sharing a theoretical basis, CBT models also share practical elements including that treatment is structured, time-limited, problem-focused/goal-orientated, and promotes active participation from patients (Craske, 2010; A. T. Beck et al., 1979; J. Beck, 2011; Dobson & Dozois, 2010). CBT also emphasises teaching skills to the patient to help them address their mental health symptoms (Dobson & Dozois, 2010). These skills include, but are not limited to, techniques for challenging and modifying dysfunctional thought processes and dysfunctional behaviour (A.T. Beck et al., 1979; Driessen & Hollon, 2010), scheduling pleasant activities, setting in place adaptive behavioural responses, and gradual exposure to avoided stimuli (A.T. Beck et al., 1979; Craske, 2010; Dobson, 2000).

CBT is an influential and extensively researched model of psychotherapy, which has considerable evidence supporting its efficacy (Butler, Chapman, Forman, & A.T Beck, 2006;

Driessen & Hollon, 2010; Hofmann, Asmundson, & A.T. Beck, 2013). Reviews of meta-analyses have found that CBT leads to greater improvements than wait-list or no-treatment control conditions for depression and anxiety disorders (Butler et al., 2006; Hofmann et al., 2012). For example, a meta-analysis by Hunot, Churchill, Silva, and Teixeira (2007) comparing CBT with wait-list and treatment-as-usual conditions for GAD, found that treatment response rates were 46% for CBT and 14% for the control conditions (see Hofmann et al., 2012). A recent meta-analysis investigating the efficacy of CBT for adult depression, found CBT leads to significant improvements in symptoms compared to control conditions, with a between-group effect size of g = 0.71 (Cuijpers et al., 2013b). A meta-analysis investigating the efficacy of CBT for pathological worry in individuals with GAD, found that it leads to significantly greater reductions in pathological worry compared to no treatment, with an average effect size of d = 1.81 (Hanrahan, Field, Jones, & Davey, 2013). In this same study, CBT was also found to be superior to non-cognitive therapy controls in reducing pathological worry, with a between-group effect size of d = 0.63; however, these control conditions were not bona fide structured therapies. Meta-analytic data has also demonstrated that CBT is effective at treating GAD compared with control conditions, with a between-group effect size of g = 0.84 and that CBT for GAD also substantially reduces depression symptoms, g = 0.71 (Cuijpers et al., 2014b).

The results of studies comparing CBT with other models of psychotherapy have been equivocal. One meta-analysis demonstrated that CBT is more efficacious for treating depression and anxiety compared with other bona-fide treatment models, including psychodynamic therapy (Tolin, 2010); the between-group effect size in this study was d = 0.28. However, other meta-analyses have found that CBT is no more or less effective at treating depression and anxiety disorders compared with other models of psychotherapy (Baardseth et al., 2013; Cuijpers et al., 2013a). The differences in these findings may be

attributable to variations in inclusion criteria the researchers set in their respective studies. For instance, Baardseth and colleagues (2013) set more stringent inclusion criteria than those employed in the Tolin (2010) study, which could account for the difference. At present, the evidence indicates that CBT is better than no treatment, and at least as good as other clinically effective treatments for depression and general anxiety.

1.3.5 Internet-Delivered Cognitive-Behavioural Therapy

CBT can be delivered via the internet for treating depression (Andersson et al., 2005; Christensen, Griffiths, & Jorm, 2004; Clarke et al., 2002; Clarke et al., 2005; Titov et al., 2010) and various kinds of anxiety disorders, including GAD (Dear et al., 2015; Johnston, Titov, Andrews, Spence, Dear, 2011; Robinson et al., 2010), social anxiety (Furmark et al., 2009; Hedman et al., 2011; Titov et al., 2009), and panic disorder (Bergstrom et al., 2010; Hedman et al., 2013; Kiropoulos et al., 2008; Klein, Richards, & Austin, 2006). iCBT can take several different forms. This includes communication between a therapist and patient through online mediums (e.g. email, and live video conferencing) and text-based materials presented through structured programs with varying levels of human-clinician involvement (Anderson, 2009; Bennett-Levy, Richards, & Farrand, 2010). The latter can be fully automated with no clinician involvement at all (Newman, Szkodny, Llera, & Przeworski, 2011). This thesis will focus mainly on the structured text-based programs. Unless otherwise specified, iCBT will refer specifically to this format.

iCBT involves transforming CBT treatment components into a program that can be delivered over the internet (Ritterband, Thorndike, Cox, Kovatchev, & Gonder-Frederick, 2009). These treatment programs, or treatment *courses*, typically involve a structured series of text-based modules and supplementary resources that teach CBT principles and skills to patients (Andersson, 2009; Andrews, Cuijpers, Craske, McEvoy, & Titov, 2010). These

courses can be delivered with or without contact from a clinician or therapist, which is usually provided via email or telephone (Andersson & Titov, 2014). iCBT courses tend to emphasise the role of the individual in engaging with the content and in initiating change, meaning that the clinician takes an adjunct role in this treatment modality (Andersson & Titov, 2014; Bennett-Levy et al., 2010). This also means that, in iCBT courses involving clinician support, the amount of time clinicians spend working with patients is significantly lower than in face-to-face CBT (Andersson et al., 2013; Titov, Dear, Johnston, & Terides, 2012). Apart from differences in the amount of clinican contact between face-to-face CBT and iCBT, the content and techniques taught to patients are derived from the same theoretical models.

Meta-analyses have demonstrated that iCBT leads to significantly greater reductions in depression (Andersson, Cuijpers, Carlbring, Riper, & Hedman, 2014; Andersson & Cuijpers, 2009; Spek et al., 2007) and general anxiety (Andrews et al., 2010; Andersson, Cuijpers, Carlbring, Riper, & Hedman, 2014; Cuijpers et al., 2014b; Reger & Gahm, 2008; Spek et al., 2007) compared to non-treatment controls. For example, Andrews and colleagues (2010) found effect sizes of g = 0.78 for depression and g = 1.12 for GAD. iCBT with clinician support generally leads to better clinical outcomes than without – also known as *self-guided iCBT* – (Gellatly et al., 2007; Richards & Richardson, 2012). A meta analysis found that guided iCBT for depression had an effect size of d = 0.78, which was significantly greater than self-guided, which had an effect size of d = 0.36 (Richards & Richardson, 2012). However, several studies have demonstrated that more recently developed self-guided iCBT interventions can lead to comparable clinical outcomes as clinician-guided iCBT (e.g. Berger, Hammerli, Gubser, Andersson, & Caspar, 2011; Berger et al., 2011; Dear et al., 2015; Titov et al., 2015b). For example, in a large RCT comparing clinician and self-guided iCBT for depression, the within-group effect size for pre-post depressive symptom change was d = 1.77

for the guided group and d = 1.50 for the self-guided group (Titov et al., 2015b); the between group difference on outcome was not statistically significant.

The magnitude of symptom reduction in iCBT is comparable with face-to-face CBT for depression and general anxiety (Andersson et al., 2014; Cuijpers, Donker, van Straten, Li, & Andersson, 2010). For example, a meta analysis comparing these modalities for depressive symptoms found a non-significant between-group effect size of g = 0.05 (Andersson et al., 2014). iCBT also has the added advantages of reducing barriers to mental health treatments, such as stigma, availability of clinicians, financial costs, and physical proximity to treatment facilities (Andrews et al., 2010; Titov, 2011). Thus, iCBT represents an efficacious and efficient treatment of depression and general anxiety that can improve access to care.

1.4 Psychotherapy Limitations

Psychotherapy has been found to be more effective at reducing depression and anxiety compared with receiving no treatment. However, rates of remission, which is the reduction of symptoms to a level that they no longer cause functional impairment, vary greatly between trials and significant proportions of patients do not remit following treatment.

A meta-analysis investigating the efficacy of psychotherapy compared with pharmacotherapy for depression found that 38% of patients treated with psychotherapy and 35% treated with pharmacotherapy were remitted after treatment (De Maat, Dekker, Schoevers, & De Jonghe, 2006). Outcome studies of CBT generally find that 50-70% of patients with MDD remit upon completing treatment (Craighead, Sheets, Brosse, & Ilardi, 2007, p293). Consistent with this, a meta-analysis revealed that 66% of patients undergoing CBT for depression remitted by the end of treatment (Cuijpers et al., 2014a).

A review of studies investigating clinically significant recovery rates of trait anxiety (measured by the State-Trait Anxiety Inventory) following psychotherapy for GAD found an average recovery rate of 40% (Fisher & Durham, 1999). It is estimated that 40-60% of GAD patients will not make significant clinical improvement after receiving CBT (Barlow, Allen, & Basden, 2007, p383). Further, a meta-analysis investigating the efficacy of cognitive therapy for pathological worry in patients with GAD found that only 57% of patients were remitted at a 12-month follow-up period (Hanrahan et al., 2013).

Although psychotherapy leads to better health outcomes for depression and general anxiety compared with no treatment, there is still much room for improving remission and recovery rates. To improve these rates, researchers are focusing on how psychotherapy works and for who it works for in order to improve the efficacy of psychotherapy (Emmelkamp et al., 2014; DeRubeis et al., 2014; Goldfried; 2013; Pachankis & Goldfriend, 2007; Kazdin, 2007, 2009; Nock, 2007; Johanson & Hogeland, 2007; Laurenceau et al., 2007).

1.5 Mechanism Research in Psychotherapy

There is considerable evidence supporting the efficacy of several types of psychotherapy for treating depression and general anxiety. However, we do not have an evidence-based explanation of the mechanism – or mechanisms – that drives therapeutic change (Kazdin, 2007; Nock, 2007; Johanson & Hogeland, 2007).

The *mechanism* of psychotherapy refers to the process of how a therapeutic intervention operates to cause change on clinical outcomes (Johanson & Hogeland, 2007; Kazdin, 2007, 2009; Laurenceau et al., 2007; Nock, 2007; Pachankis & Goldfried, 2007). Or put simply, what is psychotherapy doing that causes the patient's symptoms to reduce? As an example mechanism, Beck's cognitive model proposes that depression is caused by underlying

dysfunctional cognitive processes that predispose the individual to develop a depressive disorder following stressful events (A.T. Beck et al., 1979). Cognitive therapy is proposed to work by changing the dysfunctional cognitions to be more adaptive and functional, which in turn leads to reductions in symptoms (the cognitive mediation hypothesis) (A.T. Beck et al., 1979). This is a description of the process of cognitive therapy for depression; the mechanism of change.

Several researchers have outlined the benefits of improving our understanding of the mechanisms of therapeutic change (e.g. David & Montgomery, 2011; Kazdin, 2007; Nock, 2007; Gibbons et al., 2009). First, it allows therapists to design treatments that incorporate components that lead to the greatest amount of therapeutic change, maximising clinical outcomes and improving remission and recovery rates. It may also improve the efficiency of treatments as fewer resources would be spent on practices that have little or no bearing on clinical outcomes, saving time for therapists and consumers and money for consumers and healthcare systems. Understanding the mechanisms of change may also improve clinical training by only teaching techniques and principles that cause and facilitate maximum clinical benefit, thus spending fewer resources teaching ineffective components.

Understanding the mechanisms of therapy would also be beneficial for consumers. For example, increased understanding of mechanisms of change will facilitate clearer endorsement of appropriate treatments by governmental or psychological organisations, helping guide consumers in selecting treatment. It also has further implications for improving public funding, policy, and research regarding mental health by guiding decision-makers with empirically validated principles. As asserted by David and Montgomery (2011), a complete model of psychotherapy is one that is efficacious in practice and is based on empirically supported principles of how the therapy works. One important, and common, way of uncovering the mechanisms of change is studying the variables that mediate the relationship

between therapy and outcomes (Doss & Atkins, 2006; Emmelkamp et al., 2014; Goldfried, 2013; Kazdin, 2007, 2009; Kraemer, Wilson, Fairburn, & Agras, 2002; Laurenceau et al., 2007; Murphy, Cooper, Hollon, & Fairburn, 2009). The following section provides an introduction to methods and issues in investigating the mediators of change during psychotherapy.

1.6 Studying Mediators of Change

1.6.1 Defining a Mediator

As defined by Baron and Kenny (1986, p 1173) the term 'mediator' refers to "…the generative mechanism through which the focal independent variable is able to influence the dependent variable of interest". In other words, a mediator is a variable, M, through which variable X exerts its effect on variable Y. Consistent with this, Kazdin (2007, p 3) provides a functional definition of a mediator, describing it as "an intervening variable that may account (statistically) for the relationship between the independent and dependent variable".

In the context of this thesis, and in psychotherapy research, a mediator is a proposed variable that psychotherapy operates through to achieve its clinical effect. For example, according to cognitive models, therapy reduces depression symptoms by changing maladaptive cognitive patterns (A.T. Beck et al., 1979). In this example, the changes in the maladaptive cognitive patterns is the mediator variable (M) as this is how therapy (X) is causing depressive symptom reduction (Y).

Identifying and investigating the relevant mediators of change is an important step in understanding how psychotherapy works (Kazdin, 2007; Kraemer et al., 2002). Mediators represent constructs that can be measured and used to evaluate models of change in psychotherapy, and are therefore important for establishing an empirically-supported

explanation of the mechanism of psychotherapy (Johansson & Hoglend, 2007; Kazdin, 2007; Kraemer et al., 2002; MacKinnon, Fairchild, & Fritz, 2007; Nock, 2007).

1.6.2 Testing Mediation

Baron and Kenny (1986) described four criteria for identifying a variable as a mediator including that: 1) the independent variable should have a significant relationship with the dependent variable; 2) the independent variable should have a significant relationship with the proposed mediator variable; 3) the proposed mediator variable should have a significant relationship with the dependent variable; and 4) when controlling for the proposed mediator variable, the relationship between the independent and dependent variable should weaken. If controlling for the mediator variable reduces the relationship between the independent and dependent variable to zero, it can be argued that the mediator variable completely mediates this relationship. If controlling for the mediator significantly reduces the strength of this relationship, though does not reduce it completely, the variable is a partial mediator and implies that other mediators are involved (Baron & Kenny, 1986).

The mediation model described by Baron and Kenny (1986) has been the most influential and used mediation model in social science research (Hayes, 2013; MacKinnon et al., 2007; Shrout & Bolger, 2002). This model has however been criticised. Many researchers have asserted that the first requirement, that the independent variable be significantly related to the dependent variable, substantially reduces power to detect mediation and therefore suggest it be dropped (MacKinnon et al., 2007; Shrout & Bolger, 2002). Another limitation is that the estimation of the indirect effect, the effect that the independent variable exerts on the dependent variable through the mediator variable, is almost always non-normally distributed, meaning that significance tests of the indirect effect will be underpowered to detect mediation (MacKinnon et al., 2007; Shrout & Bolger, 2002).

These criticisms prompted the development of alternative mediation models (see Mackinnon et al., 2007 for review). One highly influential approach is to use bootstrapping (Preacher & Hayes, 2004), which involves running a large number of data simulations based on randomly sampling observations with replacement from a data set (Shrout & Bolger, 2002). Bootstrapping does not make assumptions regarding the shape of the distribution so can reliably estimate the confidence intervals of the indirect effect, addressing the power limitations faced by the Baron and Kenny (1986) approach (MacKinnon et al., 2007; Preacher & Hayes, 2004; Shrout & Bolger, 2002).

Although statistical tests of mediation are necessary in establishing a variable as a mediator of change, there are some important considerations when interpreting mediation test results. First, and as outlined by several authors (e.g. Baron & Kenny, 1986; Kraemer et al., 2002; Kazdin, 2007), it is important to demonstrate that change in the putative mediator has occurred prior to, and subsequently predicts, change in the outcome variable. This is a logical requirement as the action of the mediator needs to temporally precede the outcome it causes. Second, it is important to consider that the effects of psychotherapy may be mediated through several variables and that identifying a single mediator may not give a sufficient explanation of how psychotherapy works (Kazdin, 2007). Third, it is possible for mediators to mediate one another. For example, a patient undergoing CBT for depression, who is scheduling pleasant activities to feel better (mediator 1), may experience increases in self-efficacy as a result (mediator 2), which in turn leads to decreases in symptoms. In this example, increased self-efficacy is mediating the relationship between scheduling pleasant events and symptom reduction. And, both self-efficacy and activity scheduling are mediating the relationship between therapy and symptom reduction. Researching mediators of therapeutic change is thus a complex process. Precautions must be taken when interpreting results of statistical testing and when making inferences about the mechanisms of psychotherapy.

Work by Kazdin (2007) has been particularly influential in informing research on mechanisms of psychotherapeutic change. The following section describes Kazdin's framework for exploring mediators of change, and related issues.

1.7 Kazdin's (2007) Framework for Demonstrating Mediators of Change

Although others have put forward recommendations for investigating mediators of change, Kazdin (2007) provides a comprehensive framework, specifying seven requirements that a variable should meet to strengthen its case as a mediator of psychotherapy. These requirements should be addressed over several separate, but related, studies. The seven requirements are: strong association, specificity, consistency, experimental manipulation, time line, gradient, and plausibility or coherence. Nock (2007) outlined the same criteria for establishing mediators of change and others have put forward recommendations consistent within Kazdin's framework (e.g. Johansson & Hoglend, 2007; Lorenzo-Luaces, German, & DeRubeis, 2015; MacKinnon et al., 2007; Murphy et al., 2009; Webb, Auerbach, DeRubeis, 2012). This section provides a brief overview of these requirements.

Strong association refers to the statistical relationship between an intervention (e.g. CBT), a hypothesised mediator (e.g. decreases in dysfunctional attitudes), and an outcome (e.g. reduction in depressive symptoms). As a minimum requirement, each of these variables should have statistically significant relationships with one another.

Specificity refers to demonstrating that fewer (or ideally, one) plausible mediators account for the relationship between therapy and outcome. Ruling out plausible alternative mediators strengthens the case for a putative mediator of change and is in line with approaches to progressing science by rejecting plausible alternative theories (e.g. Popper, 1963; Platt, 1964).

Consistency refers to the basic scientific principle of replicating the effect across different contexts. Demonstrating a variable's generalisation across different populations (e.g. gender, age groups, ethnicity) and across different treatment modalities (e.g. CBT, psychodynamic therapy models) would greatly strengthen its status as a mediator of change.

Experimental manipulation refers to experimentally controlling the putative mediator to observe its effect on the outcome. This could include adding or subtracting treatment components in clinical trials to assess their impact on outcomes (Bell, Marcus, & Goodlad, 2013). Basic laboratory experiments can also be used to investigate clinical phenomena, which can inform and improve clinical interventions.

Timeline refers to the requirement that change on the proposed mediator (e.g. dysfunctional thinking) precedes then predicts change on the outcome (e.g. depression symptoms).

Gradient refers to demonstrating that change on an outcome is proportional to change of the mediator; a dose-response relationship. One limitation of the gradient criterion is that it is only relevant assuming a linear relationship exists between the mediator and the outcome (Kazdin, 2007). Change processes may be non-linear (Hayes, Laurenceau, Feldman, Strauss, & Cardaciotto, 2007). For example, moderate activation of the mediator might lead to optimal change compared with a small or large level of activation. Demonstrating that a dose-response gradient exists can provide strong support for the putative mediator, but its absence does not rule out the potential mediator variable (Kazdin, 2007).

Plausibility or coherence refers to the theoretical explanation of the mechanism and how it fits in with existing theory and research. A theory of how psychotherapy works should be consistent with other relevant findings, and be able to make predictions that can be tested and validated according to scientific methods.

The requirements proposed by Kazdin (2007) are a helpful guide toward establishing a proposed variable as a mediator of change and exploring mechanisms in psychotherapy. However, referring to these criteria as *requirements* may be inaccurate, as failing to demonstrate some of these criteria does not necessarily rule out a mediator or mechanism (Kazdin, 2007; Nock, 2007). Rather, these should be thought of as guiding principles toward potentially demonstrating or making a case for a mediator of therapeutic change.

1.8 Mediation Research in CBT for Depression and General Anxiety

Much research has been carried out investigating different mediators of therapeutic change in CBT for depression and general anxiety. This has predominately focused on cognitive changes, such as changes in dysfunctional attitudes (e.g. Quilty, McBride, & Bagby, 2008; Dozois et al., 2009; DeRubeis et al., 1990), automatic negative thoughts (e.g. Dozois et al., 2009; DeRubeis et al., 1990), metacognitive beliefs about depression and general anxiety (Dobson, 2013; Wells, 1995; van der Heiden et al., 2010), intolerance of uncertainty (Miranda, Fontes, & Marroquin, 2008; Dupuy & Ladouceur, 2008; Gentes & Meron Ruscio, 2011), and repetitive negative thinking (McEvoy, Moulds, & Mahoney, 2013; McEvoy & Mahoney, 2013). Whisman (1993), Garratt, Ingram, Rand, and Sawalani, (2007) and, Lorenzo-Luaces and colleagues (2015), extensively reviewed the evidence that cognitive change mediates symptom reduction in CBT for depression. All three concluded that, although there is evidence consistent with a cognitive mediation model, there is no firm evidence demonstrating that this is the mechanism of change in CBT. A meta-analysis of mechanisms in iCBT for emotional outcomes also found that cognitive change was correlated with symptom outcome (Muresan, Montgomery, & David, 2012). These findings suggest that face-to-face CBT and iCBT operate via similar change processes.

As noted by the authors of these studies, the majority of the research is correlational and cannot establish the proposed mediator as a causal agent of symptom reduction. Also, many of the studies do not take into account the relationship between the mediator and symptoms at the start of, or at other critical times during, treatment (Johansson & Hoglend, 2007; Kazdin, 2007; Laurenceau et al., 2007; Lorenzo-Luaces et al., 2015; Nock, 2007). This prevents conclusions regarding the process of change across therapy. In order to overcome this, studies need to measure both symptom outcomes and the mediator/s of interest, often and simultaneously – prior to treatment, several times during treatment, and after treatment (Johansson & Hoglend, 2007; Kazdin, 2007, 2009; Laurenceau et al., 2007; Nock, 2007). This will allow for more detailed observation of the relationship between outcomes and mediators. Though very few studies utilise this approach, which is likely due to them being resource intensive and placing a burden on patients (for example, requiring patients to complete large batteries of questionnaires at each session).

1.9 Increasing Skills Usage in CBT for Depression and General Anxiety

Another emerging area of mechanism research in CBT is assessing the impact of adaptive behavioural change on symptom outcomes. An essential component in CBT is to teach patients skills intended to ameliorate symptoms (A.T. Beck et al., 1979; Hundt, Mignogna, Underhill, & Cully, 2013; Jacob et al., 2011; Jarrett et al., 2011; Strunk, Hollars, Adler, Goldstein, & Braun, 2014). CBT skills are proposed to increase the frequency of patients' adaptive behaviours and cognitions reducing unrealistic beliefs and maladaptive behaviours that cause and maintain depression and general anxiety (A.T. Beck et al., 1979; DeRubeis, Webb, Tang, & A.T. Beck, 2010). CBT includes the use of cognitive techniques, such as systematically reviewing and challenging unhelpful or unrealistic thoughts, and restructuring them to be more positive or realistic (A.T. Beck et al., 1979). It also utilises

techniques that increase the frequency of adaptive behaviours, such as scheduling pleasant or helpful activities, as well as systematic exposures to negative stimuli (A.T. Beck et al., 1979; Dimidjian et al., 2011).

CBT involves allocating time between sessions for patients to practice skills, which is commonly referred to as *homework* (Kazantzis & Ronan, 2006). Research suggests that greater frequency of skills usage behaviours, higher quality of skills usage, and greater adherence to homework completion, are associated with better outcomes for depression and anxiety (Barber & DeRubeis, 2001; Hundt et al., 2013; Jarrett et al., 2011; Jacob et al., 2011; Neimeyer, Kazantzis, Lassler, Baker, & Fletcher, 2008; Rees, McEvoy, & Nathan, 2005; Strunk, DeRubeis, Chiu, & Alvarez, 2007; Thase & Callan, 2006).

Skills usage is identified as one of the fundamental factors that differentiates CBT models of therapy from other models, such as psychodynamic therapy (Blagys & Hilsenroth, 2002), and is postulated to be an important mechanism of therapeutic change (Jacob et al., 2011; Jarrett et al., 2011). It is also believed to play an important role in long-term well-being and relapse prevention in CBT for depression and anxiety (Hollon et al., 2006; Hundt et al., 2013; Strunk et al., 2007). As the skills taught in face-to-face CBT and iCBT are the same, it is likely that any therapeutic benefit derived from these techniques would be driven by similar underlying mechanisms, regardless of the format.

Two of the main skills taught in CBT are cognitive restructuring and behavioural activation (A. T. Beck et al., 1979; Jacob et al., 2011; Jarrett et al., 2011; Strunk et al., 2014). The following section will describe these two skills and review the evidence of the role these skills play in reducing depression and general anxiety.

1.9.1 Cognitive Restructuring

Cognitive restructuring is a core CBT skill taught to patients in order to change dysfunctional beliefs, making them more adaptive, realistic, and helpful (A.T. Beck et al., 1979; J. Beck, 2011; Jacob et al., 2011; Strunk et al., 2007). Cognitive restructuring involves identifying a dysfunctional or distressing thought and then challenging the thought by considering its validity. Patients can examine the validity of the thought through methods such as asking themselves why they have the thought, what evidence they have for the thought, how realistic the thought is, and how helpful is it to have the thought. This process can help patients to reject maladaptive thoughts, and change them to be more realistic and helpful, which helps to alleviate symptoms (Adler, Strunk, & Fazio, 2015; A.T. Beck et al., 1979; DeRubeis et al., 2010).

Evidence suggests that cognitive restructuring may be an important technique for treating depression and general anxiety. A meta-analysis comparing the efficacy of variants of CBT with alternative psychotherapies for several psychiatric conditions (including depression and general anxiety) found that CBT containing a cognitive restructuring component had significantly better outcomes than alternative psychotherapies (Tolin, 2010); CBT variants without a cognitive restructuring component were not more efficacious than alternative psychotherapies (Tolin, 2010).

Two single-group open trials of CBT for depression found that greater cognitive restructuring skill acquisition (Neimeyer et al., 2008), and competency (Strunk et al., 2014), predicted higher depressive symptom reduction. Greater use of this skill was also associated with better psychiatric health outcomes for individuals with depression and comorbid anxiety disorders (including GAD) in a naturalistic treatment setting (Webb, Kertz, Bigda-Peyton, & Bjorgvinsson, 2013). Greater usage of cognitive restructuring during, and at the end of, therapy was also associated with greater reductions in psychiatric symptoms for a sample of

inpatients experiencing a range of psychiatric conditions (predominately a primary mood or anxiety disorder; Jacob et al., 2011).

These studies have demonstrated a statistical relationship between cognitive restructuring and symptoms of depression and general anxiety. However, there is a paucity of research investigating cognitive restructuring as a causal mechanism of therapeutic change. Two studies have tested mediation of cognitive restructuring in psychotherapy. First, skill utilisation, which included cognitive restructuring skills among many others, was found to mediate treatment effects of CBT for depression and stress in dementia caregivers (Gallagher-Thompson, Gray, Dupart, Jiminez, & Thompson, 2008). However, the authors did not test mediation of cognitive restructuring on its own, so it is not known if cognitive restructuring played an independent role in mediation from the other skill types. Second, cognitive restructuring mediated the relationship between treatment expectancy and reduction of psychiatric symptoms in a sample of patients with major depression (Webb et al., 2013). This finding suggests that those who have greater expectations regarding the benefits of therapy engaged in greater levels of cognitive restructuring, which was associated with better outcomes in patients with major depression. This finding provides evidence of how cognitive restructuring might work in therapy, however, this forgoes the fundamental question of whether cognitive restructuring mediates the effect between treatment and outcome.

Overall, there is evidence for a statistical relationship between cognitive restructuring and symptom reduction for depression and general anxiety. However, there is no conclusive statistical evidence demonstrating that cognitive restructuring causes symptom reduction, or that it mediates symptom reduction. Furthermore, little is known about the role that cognitive restructuring plays in the process of therapy and how it works to reduce symptoms – if it does at all.

1.9.2 Behavioural Activation

As described earlier, behavioural activation describes a collection of behavioural techniques that are used in CBT, but that can also be delivered as a stand-alone treatment (BA). For this thesis, the abbreviation 'BA' will refer to the stand-alone treatment whereas 'behavioural activation' will refer specifically to the techniques. Behavioural activation involves promoting adaptive behaviours, decreasing maladaptive behaviours, and solving any problems that impede these goals (A.T. Beck et al., 1979; Dimidjian et al., 2011). Planning and scheduling activities is an important part of behavioural activation, with the emphasis being on encouraging the patient to approach rewarding environmental stimuli to improve and maintain emotional well-being (A.T. Beck et al., 1979; Carvalho & Hopko, 2011; Hopko et al., 2003; Lejuez et al., 2001; Martell et al., 2001). This involves planning and engaging in pleasurable or rewarding activities, such as spending time with friends and family, and completing important projects in spite of any symptoms. There is strong evidence for the use of behavioural activation for depression, and preliminary evidence that it is effective for anxiety symptoms; see the above section describing the BA model for more information regarding its efficacy.

Several studies have demonstrated that greater engagement in pleasurable activities (Macphillamy & Lewinsohn, 1974), and greater engagement in behavioural activation skills, are associated with better health outcomes, including lower symptoms of depression and general anxiety (Jacob et al., 2011; Kanter, Mullick, Busch, Berlin, & Martell, 2007; Manos, Kanter, & Luo, 2011). Using single case studies, Manos and colleagues (2011) found that behavioural activation skills usage preceded and predicted subsequent reduction in depression symptoms in one patient, and behavioural activation skills usage and depression reduction occurred concurrently in another patient. There are no studies specifically investigating if behavioural activation skills statistically mediate reduction of symptoms for depression and

general anxiety in CBT. More research is thus needed to understand the relationship between behavioural activation and symptom reduction.

1.9.3 Skills Usage Summary

Collectively, the evidence from these studies suggests that greater engagement in CBT skills usage is associated with more favourable clinical outcomes. This is consistent with the notion that skills usage is an important mechanism of change in CBT. However, much of this evidence is correlational. To the candidate's best knowledge, there are no Randomised Controlled Trials (RCTs) assessing the mediating role of skills usage in CBT for depression or general anxiety. Therefore, firm conclusions about the causal role of skills usage, such as cognitive restructuring and behavioural activation, in therapy are difficult to make.

Questions also remain regarding the role that different skills play in therapy, the types of skills that produce the greatest clinical outcome, and how skills vary in importance for different patients. These questions are important for both theoretical and practical reasons as they affect how depression and general anxiety are conceptualised and help to inform treatment. For example, a study comparing the behavioural skills of CBT to the full CBT package (i.e. behavioural and cognitive skills) for depressed patients found that patients receiving the behavioural components had greater reductions in dysfunctional thinking than those in the full CBT group, despite the former group not learning any skills explicitly targeting dysfunctional thinking (Jacobson et al., 1996). A similar study comparing BA, CBT, and antidepressent medications for depressed patients found that BA outperformed CBT in symptom reduction for the severely depressed subgroup of patients despite the fact that the CBT condition contained the same skills as the BA condition (Dimidjian et al., 2006). If CBT skills do cause therapeutic change, these studies suggest that skills vary in importance in terms of their efficacy and suitability for different patients. They also indicate that the

underlying processes of how skills improve symptoms are unclear. More research, utilising frameworks such as those proposed by Kazdin (2007), is required to understand the role that skills usage plays in CBT.

1.10 Instruments Measuring the Frequency of Skills Usage

To investigate the role that skills usage plays in CBT for depression and general anxiety, instruments capable of measuring the frequency of skills usage over the entire course of therapy are required. Self-report instruments measuring the frequency of adaptive behaviours, cognitions, and skills usage represent a convenient way to investigate this process (Hundt et al., 2013; Kazdin, 2007). It is important to note that instruments assessing the quantity of aversive or maladaptive behaviours (e.g. Lewinsohn & Talkington, 1979) and the quality of skills usage (see Hundt et al., 2013) exist. However, for the purposes of the current thesis, the description of instruments to measure skills usage has been limited to instruments measuring the quantity of these constructs. This section describes and critiques the available self-report measures related to the frequency of CBT-related skills usage relevant to depression and general anxiety.

1.10.1 The Behavioural Activation for Depression Scale (BADS)

The BADS (Kanter, Mulick, Busch, Berlin, & Martell, 2007) is a 25-item scale measuring the frequency of behaviours related to BA an individual engaged in over the past week. The scale is intended to measure the level of positive reinforcement the patient is exposed to as a function of approach behaviour (or avoidance). The scale uses a seven-point Likert scale from 0 = “Not at all” to 6 = “Completely”, and comprises four subscales: activation (e.g. “I engaged in a wide and diverse array of activities”), avoidance/rumination

(e.g. “I tried not to think about certain things.”), work/school impairment (e.g. “there were certain things I needed to do that I didn’t do”), and social impairment (e.g. “I did not see any of my friends”). The BADS has demonstrated sound reliability and validity (Kanter et al., 2007) and has demonstrated an acceptable factor structure (Kanter et al., 2009).

The BADS has also been shortened to a nine-item version, the *Behavioural Activation for Depression-Short Form* (BADS-SF; Manos et al., 2011), retaining some of the items related to the activation and avoidance subscales of the full measure. The BADS-SF uses the same instructions and response scale as the BADS. It is strongly correlated with the BADS and displays similarly robust psychometric properties and has the advantage of being a much shorter measure (Manos et al., 2011).

A limitation of both the BADS and the BADS-SF is that they do not measure cognitive skills usage, such as cognitive restructuring. It is a tool that is intended to measure the proposed mechanism of environmental reinforcement, which is central to BA models of therapy but not CBT models more generally. It is therefore not an appropriate tool to use (at least on its own) to investigate the role of increasing skills usage in CBT. The BADS and BADS-SF also contain items that conflate skills usage with symptoms of depression (e.g. “I spent a long time thinking over and over about my problems”), which may artificially inflate the relationship between skills usage and depression (Hundt et al., 2013).

1.10.2 The Skills of Cognitive Therapy (SoCT)

The SoCT is an eight-item measure that assesses patients’ CBT skills comprehension and use, and has demonstrated good psychometric properties (Jarrett et al., 2011). The SoCT has a five-point Likert scale to measure general frequency of CBT skills over the past month from 1 = “Never”, to 5 = “Always or When Needed”, which can be assessed by both the

patient and the therapist. Example items are "The patient [I] examined his/her [my] underlying assumptions (or schema) and how they contributed to his/her [my] depression", and "The patient [I] identified automatic negative thoughts and completed thought records". Greater CBT skills usage, as measured by the SoCT, measured at the mid- and end-points of CBT treatment for adults with depression, was associated with greater reductions in depression symptoms by post-treatment in a single group clinical trial (Jarrett et al., 2011).

A limitation of the SoCT for assessing the role of frequency of adaptive behaviours and cognitions as a mechanism of change is that the items are operationalised using technical CBT terms (e.g. "I tested negative automatic thoughts or beliefs by setting up experiments"). This wording is problematic because participants without prior exposure to CBT principles may be unfamiliar with these terms. Thus, baseline measures using the SoCT will be uninterpretable and likely invalid. This also presents a barrier to establishing temporal precedence of CBT skills to symptom change; an important requirement in mechanism research (Kazdin, 2007). It also means that the SoCT is unable to measure these constructs throughout the entire process of therapy, making it unsuitable for mechanism research.

1.10.3 The Cognitive-Behavioural Therapy Skills Questionnaire (CBTSQ)

The CBTSQ is a 16-item instrument that measures the frequency of cognitive restructuring and behavioural activation and has demonstrated good psychometric properties (Jacob et al., 2011). The CBTSQ uses a five-point Likert scale to assess how often patients are "currently" doing these behaviours from 1 = "I don't do this", to 5 = "I always do this". Example items of cognitive restructuring are "identify situations that make my symptoms worse" and "challenge my thoughts". Behavioural activation items include "plan activities for the weekends" and "engage in an activity instead of a harmful behaviour". In an intensive short-term CBT treatment program for individuals with various mental health difficulties,

skills usage, measured by the CBTSQ, increased over therapy, which was correlated with reduction of psychiatric symptoms by the end of treatment (Jacob et al., 2011). As the CBTSQ operationalises its items using non-technical language, and it is a relatively short instrument, it is suitable for measuring skills usage across the entirety of therapy.

Few limitations exist for the CBTSQ, and it has demonstrated that the skills behaviours it measures are associated with outcomes in CBT for depression and anxiety disorders (Jacob et al., 2011; Webb et al., 2013). However, as the CBTSQ combines potentially important domains of behavioural activation (e.g. activity scheduling, achieving goals, and social interactions) into one subscale, it is unable to assess the unique contributions that these domains provide to the process of therapy and clinical outcomes. To further the understanding of the role that different adaptive behaviours play in the process of CBT for depression and anxiety, we require a measure that delineates these domains. The CBTSQ also contains items that conflate skills usage with symptoms (e.g. "notice when I start to feel more distressed") (Hundt et al., 2013), which can artificially inflate the statistical relationship between the CBTSQ and measures of symptoms.

1.10.4 Competency of Cognitive Therapy Skills (CCTS)

The CCTS is a 29-item instrument, which measures cognitive therapy skills usage (Strunk et al., 2014). It uses a 7-point Likert scale to assess how often in the past two weeks the participant engaged in cognitive therapy skills from 1 = "not at all" to 7 = "completely". An example item is "At times when my mood was at its lowest, I stepped back and recognized that my self-evaluations were probably overly negative". The CCTS has preliminary evidence to support its factor structure and increases in the CCTS have been found to predict reductions in depression over treatment (Strunk et al., 2014).

The CCTS contains both cognitive and behavioural skill items but contains no clear delineation between these skill domains. The exploratory factor analysis carried out by the authors of the CCTS suggested a one-factor solution, but this may be due to the behavioural skills being underrepresented in the item pool; only two of the 29 items clearly measure behavioural activation. This means that the CCTS is unable to assess how different types of skills contribute to clinical outcomes. As the CCTS conflates cognitive and behavioural skills, many items contain multiple clauses that need to be satisfied, which leads to complex and multifaceted items (e.g. "Rather than letting a challenge overwhelm me, I imagined how to break the challenge down, developed a plan, and worked on it step-by-step"). Furthermore, as acknowledged by the authors, the sample size of 66 patients limits the reliability of using exploratory factor analysis, for which at least five participants per item is generally recommended (Floyd & Widaman, 1995).

1.10.5 Cognitive and Behavioural Response to Stress Scale (CB-RSS)

The CB-RSS is a nine-item measure of cognitive and behavioural skills in relation to stressors (Miner et al., 2015). It uses a seven-point Likert scale to assess the frequency of skills usage when faced with a stressor over the past month from 0 = "Never" to 6 = "Always". Each item also has a seven-point Likert scale assessing how helpful the individual found the skill, from 1 = "Not at all helpful" to 7 = "Extremely Helpful", or 0 = "N/A/ Didn't do this last month". An example of a cognitive skill question is "how often did you take a moment to figure out what you were feeling?" and an example of a behavioural skill question is "how often did you plan (and do) activities you knew you would enjoy?". Exploratory and confirmatory factor analysis has been used to validate the factor structure of the CB-RSS, and higher scores are associated with improvements in depression symptoms, positive affect, perceived stress and coping self-efficacy (Miner et al., 2015).

A unique strength of the CB-RSS is that it uses non-technical language to operationalise skills usage and it does not assume that the individual is involved in therapy. This feature helps broaden the applicability of the measure to a variety of different research questions.

The CB-RSS contains a few minor limitations. As with the CBTSQ, the CB-RSS combines various domains of behavioural activation into one subscale, limiting its ability to explore the contributions on outcome from these domains. It also assesses skills usage within the past month, which is a relatively long timeframe in the context of mechanism research (Kazdin, 2007); the interplay between skills usage, symptom reduction, and other variables, may not be captured precisely within this time range.

1.10.6 Skills Usage Instrument Summary

Multiple instruments to assess skills usage in CBT exist. These have varying strengths and have each contributed to understanding the role that skills usage plays in the process of CBT. In light of reviewing these measures, new instruments to build upon previous research and further explore skills usage as a mechanism should meet the following criteria: 1) covers both cognitive and behavioural skills; 2) should utilise non-technical language to describe skills; 3) should not assume that participants are currently or have previously been engaged in treatment; 4) assesses skills usage within a relatively recent timeframe (e.g. within the past week); and 5) should explore a variety of skills domains.

1.11 General Summary

CBT can be effective for symptoms of depression and general anxiety. However, the mechanisms underlying symptom reduction are less well understood. Understanding the mechanisms of change have several benefits for improving clinical outcomes and efficiency

of treatment delivery. Adaptive behavioural change, such as increasing the frequency of skills-based behaviours, is an important part of CBT and is associated with reductions in symptoms. However, no research has utilised controlled designs to examine if CBT causally increases skills usage, and if increased skills usage statistically mediates symptom change. Research investigating the role of skills usage in CBT will improve understanding of the mechanisms of clinical change.

Several instruments measuring CBT skills usage exist and have improved our understanding of this area. However, despite their strengths, these instruments contain several limitations that reduce their utility in mechanism research. New instruments addressing these limitations will improve our understanding of the role that skills usage plays in therapy.

1.12 The Current Thesis

1.12.1 Aims

The purpose of the current thesis is to explore the role that CBT skills usage plays in iCBT for depression and general anxiety. The goal of undertaking this research is to contribute to the understanding of the mechanisms of change that underlie CBT for these disorders. Current measures of skills usage are somewhat limited in their utility for mechanism research and there are a lack of controlled clinical trials investigating skills usage in treatment.

1.12.2 Planned Studies

The first aim of this thesis is to create a new self-report instrument that measures the frequency of CBT skills usage. Study I (Chapter Two) describes the creation of this instrument, called the Frequency of Actions and Thoughts Scale (FATS), including item

development, exploring and confirming underlying factor structures, and a preliminary analysis of its validity. Study II (Chapter Three) describes a single-group open trial in an iCBT course for treating depression and general anxiety, where the FATS was administered regularly throughout treatment to further assess its validity and reliability in a treatment sample.

The second aim of this thesis is to explore the role that skills usage plays in iCBT for depression and general anxiety. Study II (Chapter Three) also contributes to this aim by providing preliminary evidence on the relationships between skills usage and clinical outcomes in treatment. Study III (Chapter Four) describes a two-group RCT, comprising a treatment group and wait-list control group, exploring the relationship between treatment and skills usage. It also explores if skills usage, measured by the FATS, statistically mediates the effects of treatment on clinical outcomes. To further examine these processes, Chapter Five explores variables that may predict skills usage using data from the previous studies.

Chapter Two

Study I: Development and Preliminary Psychometric Assessment of a Measure of CBT Skills Usage Frequency

Material from this chapter appears in the following publication:

Terides, M. D., Dear, B. F., Karin, E., Jones, M. P., Gandy, M., Fogliati, V. J., ... & Titov, N. (2016). The frequency of actions and thoughts scale: development and psychometric validation of a measure of adaptive behaviours and cognitions. *Cognitive Behaviour Therapy*, 1-21.

And was presented as part of a conference presentation:

Terides, M. D., Titov, N., & Dear, B. F. (2014). *Skills practice as a mechanism of change in internet-delivered cognitive behavioural therapy.* 37th National Conference of the Australian Association for Cognitive and Behaviour Therapy, Fremantle, Australia.

2.1 Introduction

A core feature of CBT involves teaching patients skills to reduce symptoms (Hofmann et al., 2012; Hundt et al., 2013). Two core skills in CBT are cognitive restructuring and behavioural activation (A.T. Beck et al., 1979; Hollon et al., 2006; Jacob et al., 2011). Cognitive restructuring is the mental process of assessing and challenging the validity of thoughts and beliefs, with the aim of making them more realistic and adaptive (A.T. Beck, 1970). Behavioural activation involves increasing contact with positive reinforcement from the environment (Lewinsohn, 1974) through scheduling and performing activities that provide intrinsic reward, such as accomplishing meaningful goals, participating in pleasant activities, and engaging in positive social interactions (Dimidjian et al., 2011).

Research indicates that CBT skills usage is associated with reductions in symptoms of depression and general anxiety (Hundt, Calleo, Williams, & Cully, 2015; Jarrett et al., 2011; Jacob et al., 2011; Miner et al., 2015), and reductions in relapse (Strunk et al., 2007). However, there is little empirical evidence confirming the causal relationship between skills usage and symptom reduction during treatment, or describing the mechanism of how skills usage causes change (Hundt et al., 2013). A better understanding of the relationships between skills usage and symptom reduction would contribute to our understanding of how CBT reduces symptoms.

The existence of a patient self-report measure for assessing CBT skills usage and adaptive behaviours would facilitate research investigating skills usage as a mechanism of therapeutic change. Ideally, such a measure would not assume previous or current engagement in treatment and would distinguish between various skill and behavioural domains (e.g. activity scheduling, rewarding behaviours, and social behaviours) to assess if their importance varies for different patients (Hundt et al., 2013). It should also be brief and contain easily understood items (Clark & Watson, 1995), which would facilitate multiple administration of

the instrument across therapy, which is an important feature for mechanism research (Kazdin, 2007).

Hundt and colleagues (2013) reviewed the available CBT skills usage measures for depression and identified three promising instruments: the Behavioural Activation for Depression Scale – Short Form (BADS-SF; Manos et al., 2011); the Skills of Cognitive Therapy (SoCT; Jarrett et al., 2011); and the Cognitive Behavioural Therapy Skills Questionnaire (CBTSQ; Jacob et al., 2011). Following that review, and after the studies of the current thesis were underway, two other measures, the Competencies of Cognitive Therapy Scale (CCTS; Strunk et al., 2014) and the Cognitive and Behavioural Response to Stress Scale (CB-RSS; Miner et al., 2015), were developed. Each of these instruments measures frequencies of specific CBT skills, has demonstrated acceptable psychometric properties, and indicates that increased skills usage is associated with better symptom outcomes.

While each has strengths and has contributed to understanding the role of CBT skills usage in treatment, these measures each have some important limitations that restrict their utility in mechanism research for CBT. The BADS-SF measures the frequency of behavioural activation, but does not assess cognitive skills of CBT. Many items of the SoCT contain technical terms (e.g. “thought records” and “behavioural experiments”), which are not easily understood outside of or before treatment. The CBTSQ measures behavioural activation and cognitive restructuring, but a review of the items indicates that it assumes engagement in therapy and some items conflate symptoms with skills usage (Hundt et al., 2013).

The CCTS has a strong focus on cognitive skills, but does not delineate cognitive and behavioural skills. Although an exploratory factor analysis of the measure was promising, conclusions about the utility of the measure are limited by the small sample size (n = 66). And at 29 items, with an additional therapist rating component, it is a potentially labour-intensive instrument to administer on a frequent basis. The CB-RSS was designed with the intention of

being short and easy to understand (Miner et al., 2015) and does not assume engagement in therapy. The CB-RSS addresses many of the existing limitations in the pre-existing measures, but does not specifically assess cognitive restructuring.

This chapter describes a study developing and validating a new measure, the *Frequency of Actions and Thoughts Scale (FATS),* designed to assess the frequency of CBT skills usage. Consistent with the criteria noted above, the aim was to make the FATS a brief and easily administered self-report measure suitable for frequent administration and containing non-technical language. This study, and Study II in the following chapter, follow recommendations for developing psychological measures, which includes using a strong conceptual formulation for item development (Clark & Watson, 1995), establishing factorial validity (Floyd & Widaman, 1995), and establishing construct validity through testable hypotheses (McDowell, 2006).

Items were generated to assess cognitive restructuring, behavioural activation, and adaptive behaviours, which a community sample responded to in an online survey. Responses were analysed to assess factor structure, reliability, and validity of the FATS. As we planned to generate items relating to adaptive CBT skills, we hypothesised that the FATS would be negatively correlated with symptoms of depression and general anxiety, and would be positively correlated with life satisfaction and behavioural activation. We also hypothesised that the clinical subgroup of the sample would report lower FATS scores than the non-clinical subgroup.

2.2 Method

2.2.1 Participants and Procedure

Participants were recruited from across Australia through our university-based mental health clinical trials research website (www.ecentreclinic.org). This website provided information about the study and invited potential participants to provide consent and participate. Consenting participants provided demographic details and completed online questionnaires (described below). Inclusion criteria were: 1) Australian resident; and 2) 18 years of age or older. There were no exclusion criteria.

A total of 768 participants consented to participate in the study and started the questionnaires. A total of 661 (86.1%) participants completed all the questionnaires, and were included in the analysis. The 661 participants had a mean age of 47.2 years (*SD* = 17.3) ranging from 18 to 93 years, and predominately identified as female (*n* = 475, 71.9%). The majority of participants were 'Australian or New Zealander' (68.4%), followed by 'European' (12.9%), 'North American' (7.4%), 'Asian' (3.9%), and 7.4% identified their ethnicity as 'other'. Forty-six percent of participants were in a registered marriage, 26.8% were single, and 12.1% were in a de facto relationship. Fifty-three percent of participants reported a university degree as their highest education qualification.

Analysis of completer data revealed that 450 (68.1%) participants had previously accessed mental health treatments and that 231 (34.9%) were currently using medication for mental health problems. Using clinical cut-points, 355 (53.7%) participants reported clinically significant depression symptoms (indicated by a PHQ-8 total score of 10 or higher), 334 (50.5%) reported clinically significant anxiety symptoms (indicated by a GAD-7 total score of 10 or higher), 275 (41.6%) patients reported clinically significant symptoms of both depression and anxiety, and 247 (37.4%) reported no clinically significant symptoms (i.e. had scores of nine or lower on both the PHQ-8 and GAD-7).

2.2.2 Questionnaire and Item Generation

The questionnaire was designed to measure the frequency of adaptive cognitions and behaviours representing the CBT principles of cognitive restructuring and behavioural activation. These domains were chosen as they represent core theoretical aspects of CBT and have evidence supporting their potential importance relating to symptom reduction. We named this questionnaire the *Frequency of Actions and Thoughts Scale* (FATS). Participants were asked how often they performed these behaviours over the past week using a 5-point Likert scale ranging from *0 = "Not at all"; 1 = "1 or 2 days"; 2 = "Half the days"; 3 = "More than half the days"; and 4 = "Everyday"*. Higher scores represented greater engagement in CBT skills.

Forty items were generated in total. See Appendix 2B for these items. These were guided by literature searches of CBT and behavioural activation skills usage, theoretical considerations of skills usage and adaptive behaviours in CBT, existing measures of skills usage (e.g. Manos et al., 2011; Jacob et al., 2011; Jarrett et al., 2011), clinical opinion by the researchers, and from questions previously piloted by the candidate's research team (unpublished). These items had face validity for representing the core constructs of cognitive restructuring (10 items) and several domains of behavioural activation and adaptive behaviours including activity scheduling (nine items), pleasurable and rewarding activities (10 items), and social interactions (11 items).

The candidate and his two supervisors systematically reviewed the 40 items to check that they conceptually represented the core aspects of cognitive restructuring and behavioural activation. Both supervisors are clinical psychologists who have extensive experience with CBT interventions. Inclusion in the final item list required consensus among the three judges that items conceptually represented the constructs of interest. Eleven items were removed due

to lack of consensus, leaving a total of 29 items. The 11 items removed were items: 3, 4, 5, 13, 16, 17, 23, 27, 37, 38, and 40 from Appendix 2B. These items were removed as they did not represent the core aspects of cognitive restructuring or behavioural activation, or because they were deemed redundant as other similar items were more appropriate. The remeaining 29 items were further reviewed by three registered psychologists with training in CBT, one clinical trials analyst, and a clinical psychology doctoral student, to ensure that the items represented the constructs of interest and that they were easily understood. All 29 items were retained after this process. The domains of cognitive restructuring, activity scheduling, and rewarding activities were each represented by seven items, eight items represented social interactions.

2.2.3 Other Measures

Patient Health Questionnaire 8-Item Scale (PHQ-8; Kroenke & Spitzer, 2002)

The PHQ-8 is an eight-item scale measuring the occurrence of DSM-IV-congruent depressive symptoms over the past two weeks using a four-point Likert scale ranging from *0* ("Not at all") to *3* ("Nearly every day"). Higher scores indicate greater symptom severity (Kroenke et al., 2009). A total score of ≥ 10 indicates current clinical depression. The PHQ-8 has good internal consistency and is sensitive to change (Kroenke, Spitzer, Williams, & Lowe, 2010). Cronbach's alpha in the present study was .88.

Generalized Anxiety Disorder 7-Item Scale (GAD-7; Spitzer, Kroenke, Williams, & Lowe, 2006)

The GAD-7 is a seven-item scale measuring the occurrence of general anxiety symptoms over the past two weeks using a four-point Likert scale ranging from *0* ("Not at all") to *3* ("Nearly every day"). The GAD-7 is sensitive to DSM-IV-congruent GAD, social phobia, and panic disorder, and increasing scores indicate greater severity of symptoms with a total score range of zero to 21 (Dear et al., 2011; Kroenke et al., 2010; Lowe et al., 2008). A total score of ≥ 10 indicates current clinical anxiety and a score of 15 or greater indicates severe anxiety symptoms. The GAD-7 has been shown to demonstrate sound psychometric properties, correlating strongly with other validated measures of anxiety (e.g. the Beck Anxiety Inventory), having reliable internal consistency and factorial validity (Spitzer et al., 2006). Cronbach's alpha in the current study was .90.

Satisfaction With Life Scale (SWLS; Diener. Emmons, Larsen, & Griffin, 1985)

The SWLS is a five-item scale measuring attitudes towards life satisfaction using a seven-point Likert scale ranging from *1* ("Strongly disagree") to *7* ("Strongly agree"). Scores range from five to 35, with higher scores indicating greater life satisfaction. The SWLS has demonstrated good psychometric properties, including a two-month test-retest reliability of .82, consistently high item-total correlations, reliable factor structure, positive associations with measures of good psychological health (e.g. self-esteem), and negative associations with mental health symptoms (Diener et al., 1985; Pavot, Diener, Colvin, & Sandvik, 1991). The SWLS has been used extensively as a measure of life satisfaction within the context of mental health research, and normative data indicates that clinical populations report lower SWLS scores than the general population (see Pavot & Diener, 2008); further adding to the construct validity of the measure. Cronbach's alpha of the SWLS in the current study was .91.

Behavioural Activation for Depression Scale – Short Form (BADS-SF; Manos et al., 2011)

The BADS-SF is a nine-item scale that measures behavioural activation. It measures the frequency of approach and avoidance behaviours over the past week using a seven-point Likert scale ranging from *0* ("Not at all") to *6* ("Completely"). Avoidance items are reverse scored, so a total higher score indicates greater frequency of behavioural activation. The BADS-SF has good psychometric properties and predicts depressive symptomology (Manos et al., 2011). Cronbach's alpha in the current study was .81.

2.2.4 Statistical Analyses

Data from participants who completed the questionnaire (N = 661) were used in the analysis. Confirmation of the factor structure was sought by a two-step approach of first exploring the factor structure using exploratory factor analysis (EFA), then confirming the factor structure using confirmatory factor analysis (CFA), as recommended by Floyd & Widaman (1995). The sample was randomly split into two groups using the SPSS 'select random cases' function. A larger group in the EFA was sought to explore the factor structure, so the groups were split with approximately 67% of participants (n = 451) allocated to group one, and the remaining participants (n = 210) to group two. Using the general convention of having at least five participants per item for EFA, the sample size was adequate for this analytical approach (see Floyd & Widaman, 1995), and is comparable (e.g. Jacob et al., 2011; Manos et al., 2011), or much larger (e.g. Strunk et al., 2014), to other similar studies. Chi square analyses and ANOVAs revealed no significant differences in demographic data or symptom scores between the two groups (*ps* > .05*).*

First, maximum likelihood EFA in SPSS 21 was performed on the data from group one. As CBT skills are related constructs (Jacob et al., 2011), we expected the factors to be non-

orthogonal, so employed an oblique factor rotation method (direct oblimin). All factor loadings reported are after rotation, and loadings of at least .4 were considered to be substantive (e.g. Jacob et al., 2011).

Methods to determine the number of factors to retain can often lead to different outcomes. It is therefore recommended to use multiple criteria to determine the number of factors to retain (Henson & Roberts, 2006). Our approach was to use a combination of a priori theory, statistical methods, and interpretability of the EFA results to make a questionnaire that was theoretically sound and relevant to clinical application. This approach is consistent with that proposed by Henson and Roberts (2006). To determine the number of factors to extract, using data from group one, we ran a general EFA to observe the scree plot (Cattell, 1966), a parallel analysis (Horn, 1965), and used a priori theoretical considerations to interpret the factor structure. Items with loadings of less than .4 on any factor, or items with loadings of ≥.4 on multiple factors were removed (e.g. Jacob et al., 2011).

Parallel analysis compares the eigenvalues of factors from a real data set with those from an equivalent random data set. A factor is considered significant if its eigenvalue is greater than the eigenvalue derived from the random data. Parallel analysis is regarded as one of the most accurate methods of factor retention (Zwick & Velicer, 1986). In the current study, the parallel analysis generated 1000 parallel data sets, using the 95th percentile of eigenvalues generated (Hayton, Allen, & Scarpello, 2004), and utilised random permutations of our data set. There is much debate among experts as to whether principal component analysis or principal axis factoring should be used for the parallel analysis. We followed the advice from Hayton and colleagues (2004) to use principal component analysis, being that the random data generated from the parallel analysis are free from measurement error, making principal component analysis suitable for parallel analysis.

In step two, data from group two were used to confirm the factor structure from the EFA using maximum likelihood CFA in SPSS AMOS 21. Four estimates of model fit were used: CMIN/DF (or χ^2/degrees of freedom), the Tucker Lewis Index (TLI), the Comparative Fit Index (CFI), and the Root Mean Square Error of Approximation (RMSEA). A CMIN/DF of less than two (Schermelleh-Engel, Moosbrugger, & Muller, 2003), TLI and CFI scores ≥ .95, and RMSEA scores of ≤ .06, indicate acceptable model fit (Hu & Bentler, 1999). These four indices are appropriate for assessing model fit in CFA (Floyd & Widaman, 1995; Hu & Bentler, 1999; Schermelleh-Engel et al., 2003) and have been used in other studies developing similar questionnaires (e.g. Jacob et al., 2011; Kanter et al., 2007).

Data from the entire sample (N = 661) were used to assess internal consistency through Cronbach's alphas and inter-item correlations, and correlations between the FATS and other outcome measures were calculated to assess construct validity. A one-way ANOVA was used to assess between-group FATS scores between the clinical (PHQ-8 and GAD-7 scores both ≥ 10) and non-clinical subgroups (PHQ-8 and GAD-7 scores both ≤ 9).

2.3 Results

2.3.1 Item Screening

Descriptive data were obtained from the whole sample (N = 661) for the 29 items to explore normality. One social interaction item was found to be kurtotic (SPSS kurtosis statistic = 3.91), so was removed. All other items were consistent with a normal distribution in terms of skewness and kurtosis. In the general EFA, the remaining 28 items produced a Keiser-Meier-Olkin test of sampling adequacy of .92, and a significant Bartlett's test of sphericity (χ^2 = 5795.77, df = 378, p < .01), indicating that the data were suitable for factor analysis.

2.3.2 Factors

Results from the general EFA yielded a scree plot suggesting three significant factors while the parallel analysis suggested four significant factors. We therefore ran EFAs extracting three and four factors. The factors in the four-factor model each had at least four items loading substantively on them (≥ .4) without any significant cross-loadings, facilitating interpretation. Eigenvalues for the three factor-models were 9.54, 1.94, and 1.67, respectively, which explained 46.95% of the total variance. Eigenvalues for the four-factor model were 9.71, 1.96, 1.74, and 1.38, respectively, which explained 52.79% of the total variance. As our aim was to create a measure that differentiated domains of skills usage, the four-factor model was selected.

The model accounted for 52.79% of the total variance. The factors were interpreted as representing: 1) cognitive restructuring (34.67% of variance); 2) social interactions (6.99% of variance); 3) rewarding behaviours (6.21% of variance); and 4) activity scheduling (4.93%). These factors mapped on to the four a priori CBT-related skills and behaviours, representing related but distinguishable aspects of CBT skills. The factor loadings for these items are displayed in Table 2.0.

Table 2.1
EFA Pattern Matrix Results

Item	Cognitive Restructuring	Social Interactions	Rewarding Behaviours	Activity Scheduling
Change your thinking to be more realistic and helpful?	.79	-.02	-.11	.08
Stop yourself from thinking unhelpful or unrealistic thoughts?	.78	.07	-.01	.02
Reframe a negative situation into a more positive one?	.74	-.09	-.04	.07
Talk yourself out of negative thinking?	.70	-.04	-.08	.05
Keep a realistic perspective on things?	.58	-.07	.16	-.03
Accept a situation for what it is?	.51	-.01	.19	-.09
Plan or organise to solve a problem?	.35	-.06	.28	.07
Make yourself do something because you knew it would be beneficial in the end?	.34	-.12	.13	.18
Review or set goals for the next week?	.33	.01	.25	.19
Praise yourself when you did something well?	.31	-.14	.23	.17
Talk about your day with a friend or a family member?	.03	-.93	-.02	-.14
Have a meaningful conversation with someone?	.00	-.83	.10	-.07
Talk with a friend or family member on the phone?	.03	-.49	-.07	.18
Send a personal email or text message to someone?	.09	-.43	.03	.16
Go out for a walk with friends or family?	-.01	-.23	-.02	.19
Work on a project that was meaningful to you?	.09	-.09	.81	-.14
Do something that was very satisfying for you?	.05	-.17	.72	.03
Do a hobby or personal interest on your own?	-.09	.11	.49	.19
Try learning something new?	.19	.03	.41	.12
Work on a project with other people?	.15	-.08	.34	-.04
Plan a pleasant activity to make you feel better?	.08	-.05	.07	.75

Plan to do something to motivate yourself?	.31	-.01	-.07	.64
Plan something to look forward to?	.23	-.04	.09	.53
Aim to spend time with positive people?	.16	-.19	-.03	.51
Do something you enjoy doing?	.11	-.07	.31	.42
Do a hobby or pleasurable activity with others?	-.02	-.17	.18	.31
Read, listen, or watch something you found amusing?	.02	-.04	.22	.29
Spend time outside?	-.08	-.17	.16	.28

Note. Factor loadings are reported after rotation.

2.3.3 Item Reduction

We removed items that did not load substantively (≥ .4) on any factors. Ten items were removed this way. We performed another EFA extracting four factors on the remaining 18 items. Each factor had at least three items that loaded substantively on them and there were no significant cross-loadings. Interpretation of the factors was consistent with the previous four-factor EFA. Three items are sufficient to operationalise a factor (Russell, 2002), and Monte Carlo simulations have demonstrated that three indicators (i.e. items) per factor do produce reliable estimates in factor analysis provided the sample size is 200 or greater (Marsh, Hau, Balla, & Grayson, 1998). As we intended to create a brief measure and the sample was sufficiently large, three items per factor were retained.

Items were selected based on the strength of their factor loadings and consensus amongst the researchers that they represented the core aspects of the factors. The top three loading items per factor were retained. This left a total of 12 items to form a questionnaire

with four subscales (3 items per subscale). Factor loadings from the pattern matrix for the remaining items are shown in Table 2.1.

2.3.4 Confirmation of Factor Structure

Group two (n = 210) was used to perform CFA to confirm the factor structure of these 12 items. We specified four latent variables each containing the three observed variables and error terms, and factors were allowed to covary with one another. The results of the CFA were: *CMIN/DF* = 1.80, *TLI* = .95, *CFI* = .96, and *RMSEA* = .06. All standardised factor loadings were statistically significant (ps < .01) and ranged from .35 to .93.

As the results of the EFA also suggested a three-factor model, a CFA extracting three factors was also conducted to compare the fit statistics with the four-factor model. Using the same steps for item reduction described above, three latent variables were specified with three items loading on to each. The results of the CFA were: *CMIN/DF* = 2.23, *TLI* = .93, *CFI* = .95, and *RMSEA* = .08. These results suggest that the data is better characterised by a four-factor model.

2.3.5 Internal Consistency

Cronbach's alphas and average inter-item correlations (AIC) were calculated for each of the four factors on the entire sample (N = 661): *Factor 1*: cognitive restructuring, α = .83, AIC = .62; *Factor 2*: social interactions, α = .75, AIC = .50; *Factor 3*: rewarding behaviours, α = .74, AIC = .49; *Factor 4*: activity scheduling, α = .74, AIC = .62. Cronbach's alpha for the total FATS scale was .86, and the AIC was .34.

Table 2.2
EFA Pattern Matrix Results

FATS item	Cognitive Restructuring	Social Interactions	Rewarding Behaviours	Activity Scheduling
Stop yourself from thinking unhelpful or unrealistic thoughts?	**.81**	.09	.03	.00
Change your thinking to be more realistic and helpful?	**.76**	-.01	.11	-.12
Reframe a negative situation into a more positive one?	**.74**	-.08	.05	-.08
Talk about your day with a friend or a family member?	.01	**-.92**	.02	.08
Have a meaningful conversation with someone?	.03	**-.80**	-.10	.04
Talk with a friend or family member on the phone?	-.01	**-.47**	.04	-.22
Work on a project that was meaningful to you?	.09	-.10	**-.77**	.06
Do something that was very satisfying for you?	.04	-.18	**-.73**	-.07
Do a hobby or personal interest on your own?	-.02	.09	**-.48**	-.11
Plan a pleasant activity to make you feel better?	-.02	-.03	-.14	**-.77**
Plan to do something to motivate yourself?	.13	.02	.01	**-.76**
Aim to spend time with positive people?	.04	-.16	-.02	**-.60**

Note. Factor loadings are reported after rotation.

2.3.6 Construct Validity

The total FATS score was calculated by summing the scores on each of the 12 items. The total score is proposed to reflect general engagement in CBT skills usage. Using the whole sample, an EFA extracting one factor was run on the 12 items to assess this proposal. An EFA was selected over a CFA as CFA frequently results in poor fit with item-level data where a factor has a moderate number of items (at least five items) loaded onto it (Floyd & Widaman, 1995). Eleven items loaded >.4 on the single factor, and one item loaded >.3,

Table 2.3
Means and Standard Deviations of Measures for the Overall Sample and for the Clinical and Non-Clinical Groups

	Means (Standard Deviation)			
Measure	Overall (n = 661)	Clinical (n = 275)	Non-Clinical (n = 386)	Significance Testing Between Groups
FATS: Total	17.68 (9.12)	14.36 (7.90)	20.05 (9.20)	$F = 68.82_{1, 659}$, $p < .001$
Cognitive Restructuring	4.22 (2.97)	3.31 (2.55)	4.87 (3.09)	$F = 46.86_{1, 659}$, $p < .001$
Social Interactions	5.87 (3.19)	5.02 (3.10)	6.47 (3.12)	$F = 35.02_{1, 659}$, $p < .001$
Reward Behaviours	3.83 (3.09)	2.89 (2.77)	4.49 (3.15)	$F = 45.72_{1, 659}$, $p < .001$
Activity Scheduling	3.77 (2.97)	3.14 (2.70)	4.22 (3.07)	$F = 21.87_{1, 659}$, $p < .001$
PHQ-8	10.49 (6.10)	16.05 (3.77)	6.53 (3.98)	$F = 959.03_{1, 659}$, $p < .001$
GAD-7	9.75 (5.82)	15.06 (3.39)	5.97 (3.91)	$F = 966.02_{1, 659}$, $p < .001$
SWLS	17.62 (8.02)	13.98 (7.09)	20.22 (7.64)	$F = 113.68_{1, 659}$, $p < .001$
BADS-SF	25.22 (9.36)	19.09 (7.05)	29.58 (8.30)	$F = 289.60_{1, 659}$, $p < .001$

Note. FATS = Frequency of Actions and Thoughts Scale (total score); PHQ-8 = Patient Health Questionnaire – 8-item; GAD-7 = Generalized Anxiety Disorder 7-item; BADS-SF = Behavioural Activation for Depression Scale – Short Form; SWLS = Satisfaction With Life Scale. The Clinical subgroup had scores on both the PHQ-9 and GAD-7 of ≥10. The Non-Clinical subgroup had scores on both the PHQ-9 and GAD-7 of <10.

generally supporting this proposal. A CFA of the single-factor model was also run. The results of this CFA were: *CMIN/DF* = 7.56, *TLI* = .57, *CFI* = .65, and *RMSEA* = .18.

The subscales were calculated by summing their respective three items. The mean scores and standard deviations for these and the outcome measures for the overall sample are reported in Table 2.2. The correlations between the FATS, its subscales, and the outcome measures are shown in Table 2.3.

We also sought to explore whether FATS scores differed as a function of clinically significant symptoms. We ran one-way ANOVAs to see if FATS scores were significantly different between the clinical and non-clinical participants in our study. Participants were coded as 'clinical' if they had both a PHQ-8 and GAD-7 total score of ≥ 10 (n = 275), the remaining 386 participants were coded as 'non-clinical'. Analyses revealed that the non-clinical group had significantly higher mean scores on the FATS (subscales and total), BADS-SF, and SWLS. See Table 2.2 for means, standard deviations, and significance tests on outcome measures of the clinical and non-clinical subgroups.

2.4 Discussion

We explored and confirmed a set of 28 items for factors relating to CBT skills usage to develop a new 12-item measure, the FATS. Preliminary evidence supported a four-factor structure representing different aspects of CBT skills interpreted as: cognitive restructuring, social interactions, rewarding behaviours, and activity scheduling. Results also provided preliminary support for the construct validity of the FATS.

Cronbach's alphas for the total FATS and its subscales were in acceptable ranges for scale development (Clark & Watson, 1995). The average inter-item correlations for the total score and two of the subscales were in the optimal range of .15 to .50 (Clark & Watson, 1995), however the cognitive restructuring and activity scheduling subscales were slightly outside this range at .62 each.Given that the subscales are designed to measure specific skills, it should be expected that average inter-item correlations for the subscales would be in the higher end (Smith, McCarthy, & Anderson, 2000; Clark & Watson, 1995). Furthermore, the average inter-item correlation for the total FATS measure was .34, suggesting that the scale comprises items reflecting a range of specific but related skills.

Consistent with other research, the factors were positively correlated with each other (e.g. Jacob et al., 2011). As hypothesised, the FATS, along with its individual subscales, had negative correlations with symptoms of depression and general anxiety, and FATS total and subscale scores were also significantly greater in the non-clinical subsample compared with the clinical subsample. These findings are consistent with evidence that greater CBT skills usage is associated with reduced symptoms (Adler et al., 2015; Hundt et al., 2015; Jacob et al., 2011; Jarrett et al., 2011; Miner et al., 2015 Strunk et al., 2014). Consistent with this, FATS scores were positively correlated with life satisfaction and behavioural activation. These findings provide preliminary evidence for the construct validity of the FATS and its subscales.

The CFA of a single-factor model yielded poor fit statistics, which may question the validity of having a total FATS score. Though it is commonly acknowledged that, when using item-level data, factors with even a moderate number of indicators (five or more) can result in poor model fit (Floyd & Widaman, 1995). It is important to note that the results of the single-factor EFA support having a total FATS score as well as the reliability and AIC, which were in optimal ranges, and the total FATS was associated with significantly lower symptoms, suggesting it is clinically meaningful to have a total score.

In relation to the existing measures of skills usage, the FATS demonstrates some notable differences. We found evidence for multiple factors, as well as a single general factor, for the FATS. However, instruments such as the SoCT (Jarrett et al., 2011) and the CCTS (Strunk et al., 2014) were better characterised by a single factor representing general CBT skills usage. Our emphasis was to separate the cognitive and behavioural domains of skills usage, whilst still acknowledging their intrinsic relationship, so an instrument with multiple subscales was conducive to our overall aims. This is consistent with the CBTSQ (Jacob et al., 2011) and the BADS-SF (Manos et al., 2011), which both contain several factors relating to different aspects of skills usage that can be combined to represent an overall skills usage score.

An important limitation to note in the current study is that, although a significant proportion reported clinically significant symptoms, a purely clinical sample was not used and it is unknown how many participants were engaged in psychological treatment. It is therefore critical to assess the performance of the FATS in clinical samples engaged in treatment, and this was the aim of Study II (Chapter Three).

Although completion of the online questionnaire was relatively high, 14% of participants did not complete it. It is important to note that we do not have any data to indicate the reasons for drop out or if the participants who dropped out are characteristically different from completers. As 65% of the non-completers did not provide any data specifically for the FATS item pool, and completion was otherwise high, it was decided to not impute missing data as this can artificially inflate existing patterns in the data by basing imputations on the observed findings from other participants.

A potential weakness of the FATS is that it does not assess patients' competence in using skills, which is a predictor of symptom improvement and relapse prevention (Barber & DeRubeis, 1992; Barber & DeRubeis, 2001; Strunk et al., 2007). However, assessment of competence is time consuming and currently requires evaluation by a clinician, which is inconsistent with the aims of the FATS as a brief, easily administered measure. Furthermore, research has consistently shown that frequency of skills usage is a reliable predictor of symptom reduction (Hundt et al., 2013).

Table 2.4
Correlations Between the FATS and its Subscales with Other Measures

	FATS	Cognitive Restructuring	Social Interactions	Rewarding Behaviours	Activity Scheduling	PHQ-8	GAD-7	BADS-SF	SWLS
FATS	1								
Cognitive Restructuring	.74**	1							
Social Interactions	.72**	.34**	1						
Rewarding Behaviours	.71**	.36**	.33**	1					
Activity Scheduling	.81**	.53**	.46**	.44**	1				
PHQ-8	-.41**	-.32**	-.35**	-.30**	-.26**	1			
GAD-7	-.35**	-.29**	-.24**	-.30**	-.20**	.76**	1		
BADS-SF	.55**	.41**	.44**	.41**	.37**	-.71**	-.61**	1	
SWLS	.50**	.33**	.43**	.35**	.36**	-.57**	-.44**	.64**	1

**. Correlation is significant at the 0.01 level (2-tailed).
Note. FATS = Frequency of Actions and Thoughts Scale (total score); PHQ-8 = Patient Health Questionnaire – 8-item; GAD-7 = Generalized Anxiety Disorder 7-item; BADS-SF = Behavioural Activation for Depression Scale – Short Form; SWLS = Satisfaction With Life Scale.

Another potential limitation of the FATS is that it might simply be reflecting symptom severity (Hundt et al., 2013; Manos, Kanter, & Busch, 2010). The items of the FATS were designed to not conflate skills usage with symptoms and to generally reflect active goal-directed behaviours. However, it is still possible that greater skills usage could be a result of symptom reduction. For example, the individual might be engaging in more social interactions because their mood has lifted. Future research will be required to assess if the FATS is assessing skill usage as a useful process to address symptoms. It should also be aknowledged that measures like the FATS assess within-patient changes across treatment; the FATS is not designed to assess changes that occur during therapy sessions. Within-session changes are important as they can lead to or influence changes in mediator variables, such as skills usage, or symptom reduction. If skills usage is found to be an important mechanism of change, it will also be important to understand the within-session factors that can best facilitate increased skills usage to improve symptom outcomes.

Finally, shorter instruments, such as the FATS, have the benefit of being less burdensome on patients, but at the expense of reducing the instrument's content coverage (Smith et al., 2000). Our aim was to create a simple and short instrument that could be administered multiple times during treatment. Although the items selected for the FATS represent the core aspects of the skills, the FATS lacks the depth of other measures with more items, such as the CCTS. Instrument selection for future research trials should be guided by the aims of researchers and feasibility.

Skills usage is an important aspect of CBT treatments for depression and general anxiety, and is proposed to reduce symptoms. This study developed a new brief measure of skills usage, the FATS, and results supported the factor structure and preliminary validity for this measure. The FATS builds upon the strengths of existing measures of skills usage for

CBT (e.g. Jacob et al., 2011; Jarrett et al., 2011; Manos et al., 2011), but addresses some important shortcomings. The FATS measures cognitive and behavioural skills usage, and operationalises these skills in non-technical language. It also includes subscales covering different behavioural domains, including social interactions and meaningful activities, which are not covered in existing measures. At 12 items, the FATS is a relatively short instrument and is able to be administered multiple times during therapy, which is an important methodological requirement in mechanism research (Kazdin, 2007; Laurencreu et al., 2007).

As the FATS does not use CBT-specific language, it can also be used to investigate the role of skills usage in other models of psychotherapy. This could help shed light on questions regarding the role of common factors and specific techniques in psychotherapy (see Tschacher, Junghan, & Pfammatter, 2014). Furthermore, as the FATS does not contain items that assume the participant is in active treatment, it can be administered in non-clinical settings. This can be useful for investigating the role that these adaptive behaviours and cognitions play in general well-being, and the role they may play in preventing mental disorders. The FATS is therefore a promising measure to investigate CBT skills usage as a mediator of therapeutic change in psychotherapy. However, additional research is needed to further establish the validity of the measure in a treatment group.

Appendix 2A

Frequency of Actions and Thoughts Scale (FATS)

In the past week how often did you:

(0=not at all; 1= one or two days; 2=half the days; 3=almost every day; 4=every day)

1. Change your thinking to be more realistic and helpful?
2. Reframe a negative situation into a more positive one?
3. Stop yourself from thinking unhelpful or unrealistic thoughts?
4. Talk about your day with a friend or a family member?
5. Have a meaningful conversation with someone?
6. Talk with a friend or family member on the phone?
7. Work on a project that was meaningful to you?
8. Do something that was very satisfying for you?
9. Do a hobby or personal interest on your own?
10. Aim to spend time with positive people?
11. Plan a pleasant activity to make you feel better?
12. Plan to do something to motivate yourself?

Subscale scoring: Sum each of the items on their respective subscales to give an indication of how often participant is engaging in that skill domain. Sum all 12 items to give an indication of overall skill usage. Higher scores indicate greater frequency of skills usage.

4 subscales:

- Cognitive restructuring (items 1, 2, 3)
- Social interaction (items 4, 5, 6)
- Rewarding behaviours (items 7, 8, 9)
- Activity scheduling (items 10, 11, 12)

Appendix 2B

The 40 items generated for the FATS questionnaire item pool.

1. Talk about your day with a friend or a family member?
2. Have a meaningful conversation with someone?
3. Attend a community or neighbourhood event?
4. Arrange to see friends?
5. Socialise with positive people?
6. Do exercise with other people?
7. Go out for a walk with friends or family?
8. Work on a project with other people?*^
9. Do a hobby or pleasurable activity with others?
10. Talk with a friend or family member on the phone?
11. Send a personal email or text message to someone?
12. Praise yourself when you did something well?
13. Reflect on the things you are grateful for?
14. Talk yourself out of negative thinking?
15. Keep a realistic perspective on things?
16. Allow yourself to be less than perfect?
17. Be kind to yourself?
18. Accept a situation for what it is?
19. Stop yourself from thinking unhelpful or unrealistic thoughts?
20. Change your thinking to be more realistic and helpful?
21. Reframe a negative situation into a more positive one?
22. Make yourself do something because you knew it would be beneficial in the end?
23. Plan or stick to an exercise routine
24. Aim to spend time with positive people?
25. Plan a pleasant activity to make you feel better?
26. Plan to do something to motivate yourself?
27. Do physical activity to be healthy?
28. Plan something to look forward to?
29. Do something you enjoy doing?
30. Plan or organise to solve a problem?
31. Review or set goals for the next week?
32. Work on a project that was meaningful to you?
33. Do something that was very satisfying for you?
34. Try learning something new?
35. Spend time outside?
36. Read, listen, or watch something you found amusing?
37. Go for a walk on your own?
38. Exercise on your own?
39. Do a hobby or personal interest on your own?
40. Do work or chores around where you live (e.g. house, apartment, etc)?

Chapter Three

Study II: Evaluation of the Psychometric Properties of the FATS in a Treatment Sample: A Single-Group Open-Trial of Internet-Delivered Cognitive-Behavioural Therapy for Depression and General Anxiety Symptoms

Material from this chapter appears in the following publication:

Terides, M. D., Dear, B. F., Karin, E., Jones, M. P., Gandy, M., Fogliati, V. J., ... & Titov, N. (2016). The frequency of actions and thoughts scale: development and psychometric validation of a measure of adaptive behaviours and cognitions. *Cognitive behaviour therapy*, 1-21.

3.1 Introduction

In Study I (Chapter Two), we developed a measure of CBT skills usage, the FATS. Results supported the factor structure of the FATS and there was preliminary evidence supporting its construct validity. To further establish the psychometric properties of the FATS, it was necessary to administer the FATS in a treatment sample. This chapter describes a single-group open trial of an online CBT course where the FATS was administered during treatment.

In the present study, we aimed to assess the factor structure, validity and test-retest reliability of the FATS and its subscales in a treatment sample. We planned to administer the FATS weekly to individuals with symptoms of depression and general anxiety participating in iCBT. It was hypothesised that FATS scores would be greater at the end of treatment and that changes in the FATS would be negatively correlated with changes on symptom outcomes and positively correlated with changes in behavioural activation over treatment.

To assess the construct validity of the FATS subscales, we measured trait forms of two emotion regulation strategies: cognitive reappraisal (thoughtfully reevaluating a situation to reduce its emotional impact), and emotional suppression (purposefully inhibiting overt emotional responses) (Gross & John, 2003). We hypothesised that the cognitive restructuring subscale would correlate stronger with cognitive reappraisal than would the social interactions, activity scheduling, and rewarding behaviours subscales. As an indication of its discriminant validity, we hypothesised that the FATS and its subscales would not correlate with emotional suppression. We also hypothesised that the activity scheduling and cognitive restructuring subscales of the FATS would correlate the strongest with the behavioural activation and cognitive restructuring subscales of the CBTSQ, respectively, at post-treatment.

This trial was registered with the Australian and New Zealand Clinical Trials Registry: ACTRN12614000596606.

3.2 Method

3.2.1 Participants

Participants were Australian residents seeking online treatment for symptoms of depression, general anxiety, or both. Potential participants received information about the study and an iCBT course, the *Wellbeing Course* (Titov et al., 2013), through our research website (www.ecentreclinic.org) where they could apply online.

Inclusion criteria were: 1) ≥ 18 years; 2) residing in Australia; and 3) experiencing clinically significant levels of anxiety (GAD-7 total score ≥ 5) or depression (PHQ-9 total score ≥ 5). Exclusion criteria were: 1) severe depression (total PHQ-9 score ≥ 23) or suicidal ideation (a score of 3 on question 9 (suicidal ideation) of the PHQ-9); 2) experiencing an active psychotic episode; 3) currently engaging in regular (fortnightly or more frequent) CBT; and 4) if on medication for anxiety or depression, not having been on a stable dose for at least one month prior to the study's commencement.

Successful online applicants were telephoned to confirm inclusion criteria. A total of 189 people started an online application, of which 51 (27.0%) were unsuccessful. Of these 51 excluded applicants: 24 (47.1%) did not complete the application process; eight (15.7%) were engaged in regular CBT; six (11.8%) reported symptom scores below the cut-off; six (11.8%) chose to withdraw their application; five (9.8%) reported severe levels of depression or suicidal ideation; one (2.0%), who was on medication for anxiety/depression, was not on a stable dose; and one (2.0%) was unable to meet the timeframe for the course.

One-hundred-and-thirty-eight applicants made a successful application. Thirteen of these participants (9.4%) failed to complete the pre-treatment questionnaires and were excluded. This left a total of 125 participants in the study. Participants had a mean age of 42.7 years (*SD* = 10.9) ranging from 21 to 68 years, and predominately identified as female (*n* = 99, 79.2%). Seventy (56.0%) participants reported a university degree as their highest qualification. At application, 78 (62.4%) participants were above the clinical cut-point for depression (PHQ-9 total score ≥ 10), and 80 (64.0%) were above the clinical cut-point for anxiety (GAD-7 total ≥ 10).

3.2.2 Measures

The same measures for depression, anxiety, and satisfaction with life, described in Study I (Chapter Two), were used in Study II. However, instead of the PHQ-8, the PHQ-9 (Kroenke & Spitzer, 2002), which contains the PHQ-8 items and one additional item relating to suicidal ideation, was used.

As we were interested in investigating weekly symptom change, we asked participants to answer the PHQ-9 and GAD-7 items "over the past week" instead of "over the past 2 weeks". We also used the measure developed in Study I (Chapter Two), the FATS. Cronbach's alphas were calculated for the FATS and its subscales: total = .80, cognitive restructuring = .89, social interactions = .69, rewarding behaviours = .72, and activity scheduling = .71. Cronbach's alphas for the other measures were: PHQ-9 = .83, GAD-7 = .89, and SWLS = .89.

Behavioural Activation for Depression Scale (BADS; Kanter et al., 2007)

The BADS is a 25-item scale measuring behavioural activation engaged in over the past week. The scale uses a seven-point Likert scale ranging from *0* ("Not at all") to *6* ("Completely"). The BADS covers behavioural activation, avoidance/rumination, work/school impairment, and social impairment, covering a wider range of behavioural domains than the BADS-SF. Negative items are reverse-scored and items can be summed to give a measure of general activation. Higher scores indicate greater behavioural activation. The BADS has demonstrated sound reliability and validity (Kanter et al., 2007), and has demonstrated an acceptable factor structure (Kanter, Rusch, Busch, & Sedivy, 2009). Cronbach's alpha for the BADS in the current study was .88.

Sheehan Disability Scale (SDS; Sheehan, 1983)

The SDS is a three-item scale of impairment in work, social, and family life functioning, due to disease – symptoms of anxiety and depression in this study. It uses an 11-point scale ranging from *0* ("not at all") to *10* ("extremely"), with greater scores indicating greater levels of impairment. The three items can be summed to provide a measure of global impairment due to symptoms. The SDS has demonstrated good internal consistency and construct validity (Leon et al., 1997). Cronbach's alpha in the current study was .80.

Emotion Regulation Questionnaire (ERQ; Gross & John, 2003)

The ERQ is a 10-item scale comprising two subscales: one measuring trait cognitive reappraisal (six items), the other, trait emotional suppression (four items). Participants use a seven-point Likert scale to rate how much a statement about emotion regulation applies to them, from *1* ("Strongly disagree") to *7* ("Strongly agree"). This measure has demonstrated

acceptable psychometric properties (Gross & John, 2003). In the current study, Cronbach's alpha for the reappraisal subscale was .86 and for the suppression subscale was .76.

Cognitive-Behavioural Therapy Skills Questionnaire (CBTSQ; Jacob et al., 2011)

The CBTSQ is a 16-item questionnaire that measures the CBT skills of cognitive restructuring (nine items) and behavioural activation (seven items). Participants rate how often they currently use these skills on a five-point Likert scale from *1* ("I don't do this") to *5* ("I always do this"). Higher scores indicate greater engagement with these skills. The CBTSQ was found to have an acceptable model fit, was sensitive to treatment, and predicted treatment outcome in a psychiatric population (Jacob et al., 2011). Cronbach's alpha in the current study for the behavioural activation subscale was .80, and for the cognitive restructuring subscale was .89.

3.2.3 Procedure

Participants accessed the Wellbeing Course through our research clinic's website (www.ecentreclinic.org). The Wellbeing Course is an eight-week self-guided iCBT course for depression and anxiety, consisting of five lessons teaching psychoeducation (lesson one); and skills for managing the cognitive (lesson two), physical (lesson three), and behavioural (lesson four) symptoms of general anxiety and depression and relapse prevention (lesson five). Each lesson was accompanied by supplementary homework exercises, resources, and case stories. All materials were presented in a text-based format, with images of individual case examples throughout. Details about the Wellbeing Course are included in Table 3.1. Screenshots of the course materials are included in Figures 3.1 to 3.5.

All questionnaires were completed online. Participants completed the PHQ-9, GAD-7, FATS, BADS, SDS, and SWLS at pre-treatment, post-treatment, and at three-month follow-up. The PHQ-9, GAD-7, and FATS were also administered weekly throughout the eight-week course. The ERQ was completed at pre-treatment and the CBTSQ was completed at post-treatment.

3.2.4 Statistical Analysis

SPSS AMOS 21 was used to carry out a CFA, which replicated the CFA performed in Study I (Chapter Two). As a preliminary indication of factorial invariance, CFA was used to test configural invariance of the four-factor model between the community sample from Study I and the clinical sample in Study II. This assesses the equivalence of the factor structure between the two different samples. Failure to demonstrate factorial invariance would suggest that the FATS is measuring different factors between a community and clinical samples. Cheung and Rensvold (2002) recommended an RMSEA of $\leq .05$ as an indicator of configural invariance.

SPSS 21 was used to conduct mixed linear models analyses to assess changes in FATS, PHQ-9, GAD-7, SDS, SWLS, and FATS subscales scores across pre-treatment, post-treatment, and 3-month follow-up. The mixed linear model analyses specified time as a fixed effect and participant as a random effect, used an autoregressive covariance structure, and maximum likelihood estimation (e.g. Titov et al., 2015a). The mixed linear models were also specified to perform pairwise comparisons to follow up significant main effects.This approach is consistent with an intention-to-treat analytic approach under the assumption that data is missing at random. Estimated marginal means based on the mixed linear models are reported. Effect sizes (Cohen's d) for statistically significant within-group changes were

calculated. Power analysis using GPower 3.1 suggested that a sample size of 90 would be sufficient to detect a two-tailed within-group effect size of $d = 0.3$ with alpha set at .05 and 80% power.

Correlations between the FATS and other measures at pre and post-treatment, and correlations between pre-post residual change scores were also calculated using observed data to assess the construct validity of the FATS and its subscales. Residualised change scores better handle measurement error for repeated administration of instruments, and individual differences at pre-treatment compared with raw change scores (Steketee & Chambless, 1992). Residualised change scores were calculated by regressing post-treatment scores on pre-treatment scores (e.g. Strunk et al., 2014). Correlations between FATS scores at the assessment and pre-treatment periods were used to assess test-retest reliability.

3.3 Results

3.3.1 Clinical Cut-Point

The percentage of participants meeting clinical cut-points was calculated again at pre-treatment to address regression to the mean. Sixty-five (52.0%) participants were above the clinical cut-point for depression and 69 (55.2%) were above the clinical cut-point for general anxiety.

3.3.2 Confirmation of Factor Structure and Configural Invariance

Model fit statistics for the CFA were: *CMIN/DF* = 1.47, *TLI* = .94, *CFI* = .96, and *RMSEA* = .06. All standardised factor loadings were statistically significant (*ps* < .01) and ranged from .42 to .89. The configural invariance test produced an RMSEA of .03.

3.3.3 Lesson Completion

By the end of the eight-week iCBT course, 125 (100.0%) participants had accessed lesson one, 119 (95.2%) had accessed lesson two, 109 (87.2%) had accessed lesson three, 103 (82.4%) had accessed lesson four, and 90 (72.0%) had accessed all five lessons.

3.3.4 Questionnaire Completion

All 125 participants provided pre-treatment data in week one prior to accessing treatment. Weekly questionnaire completion rates were: week two, 111 participants (88.8%); week three, 99 (79.2%); week four, 93 (74.4%); week five, 106 (84.8%); week six, 92 (73.6%); week seven, 91 (72.8%), and week 8, 51 (40.8%). One-hundred-and-nine (87.2%) participants completed the post-treatment questionnaires, and 100 (80.0%) completed the three-month follow-up questionnaires. See Figure 3.6 for mean change scores on the FATS, PHQ-9, and GAD-7 during treatment.

3.3.5 Changes in FATS and Subscales

Mixed linear models analyses revealed main effects for time for the total FATS ($F_{2, 219}$ = 67.39, $p < .01$) and the cognitive restructuring ($F_{2, 219}$ = 67.39, $p < .01$), social interactions ($F_{2, 219}$ = 67.39, $p < .01$), rewarding behaviours ($F_{2, 219}$ = 67.39, $p < .01$), and activity scheduling ($F_{2, 219}$ = 67.39, $p < .01$) subscales. Pairwise comparisons showed that mean total FATS and subscales scores were significantly higher at post-treatment and 3-month follow-up compared with pre-treatment (*ps* < .01). There were no significant differences between post-treatment and 3-month follow-up for total FATS or subscales scores (*ps* > .05). Table 3.2 contains estimated marginal means and standard deviations of the FATS at these times.

3.3.6 Changes on Outcomes

Mixed linear models analyses showed significant main effects of time for the PHQ-9 ($F_{2, 206} = 40.92$, $p < .01$), GAD-7 ($F_{2, 203} = 57.81$, $p < .01$), SDS ($F_{2, 219} = 36.66$, $p < .01$), and the SWLS ($F_{2, 213} = 26.07$, $p < .01$). Pairwise comparisons revealed significantly lower means for the PHQ-9, GAD-7, and SDS at post-treatment and follow-up compared to pre-treatment ($ps < .01$). Comparisons revealed significantly greater scores on the SWLS at post-treatment and follow-up compared to pre-treatment ($ps < .01$). The differences between post-treatment and follow-up scores were not significant for any of the measures ($ps > .05$). See Table 3.2 for estimated marginal means and standard deviations of outcome measures.

3.3.7 Construct Validity of FATS

Pre to post treatment residual change scores for the FATS and its subscales, PHQ-9, GAD-7, BADS, SDS, and SWLS were calculated, and correlations between these scores were calculated. These are shown in Table 3.3.

The trait measure of cognitive reappraisal of the ERQ positively correlated significantly with the FATS subscales of cognitive restructuring ($r = .46$, $p <.01$) and activity scheduling ($r = .29$, $p < .01$), but was not significantly correlated with social interactions ($r = .10$, $p = .92$) or rewarding behaviours ($r = .08$, $p = .37$) Trait emotional suppression was not significantly correlated with cognitive restructuring ($r = -.09$, $p = .32$), social interactions ($r = -.10$, $p = 28$), or rewarding behaviours ($r = -.11$, $p = .21$), but had anegative correlation with the activity scheduling subscale ($r = -.18$, $p < .05$). Correlations between FATS scores and the cognitive restructuring and behavioural activation subscales of the CBTSQ were calculated at post-treatment and are shown in Table 3.4.

Table 3.1
Lesson Content, Homework Tasks, and Additional Resources of the Wellbeing Course

Lesson	Weeks to complete lesson	Primary content	Lesson summary/ homework tasks	Additional resources
1	1	Education about the general prevalence and symptoms of depression and anxiety. Introduction of a CBT model and explanation of the functional relationship between physical, cognitive, and behavioural symptoms. Instructions for identifying symptoms and how symptoms interact.	Exercises for identifying symptom cycles	- Sleep management - What to do in a mental health emergency
2	2	Introduction to the basic principles of cognitive restructuring and importance of managing thoughts to manage depression and anxiety. Instructions for monitoring and challenging thoughts related to anxiety and low mood.	Exercises for cognitive restructuring and thought challenging	- Structured problem solving - Worry time - Challenging beliefs
3	1	Introduction to the physical symptoms of hyper-arousal and hypo-arousal and their relationship to depression and anxiety. Instructions about controlling physical symptoms using strategies such as controlled breathing and scheduling pleasant activities.	Exercises for controlled breathing and behavioural activation	- Risk calculation, coping calculation, and shifting attention - Effective communication skills
4	2	Introduction to the behavioural symptoms of depression and anxiety. Explanation of avoidance and safety behaviours and their relationship to ongoing symptoms. Instructions for graded exposure for safely confronting fears and increasing activity levels.	Exercises for graded exposure and using stepladders	- Assertive communication
5	2	Information about the occurrence of lapses and the process of recovery from depression and anxiety. Information about the signs of relapse and managing lapses. Instructions for creating a relapse prevention plan.	Exercises for creating relapse prevention plans	-

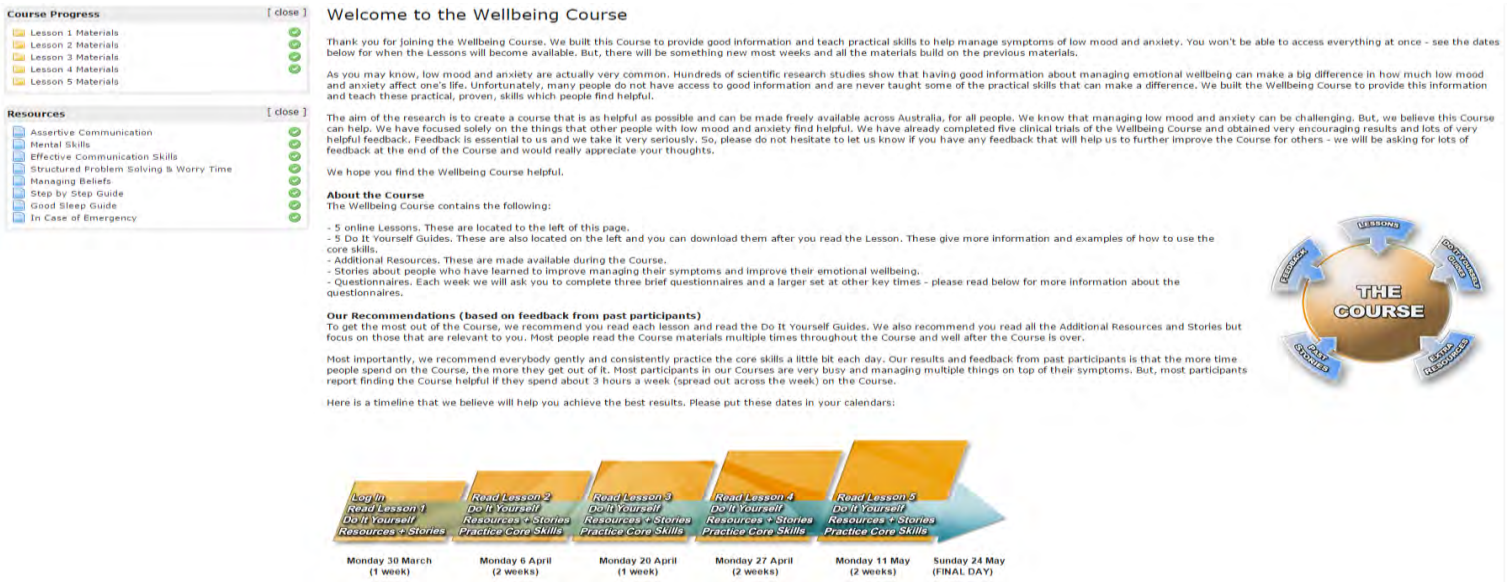


Figure 3.1. The navigation page for the Wellbeing Course.

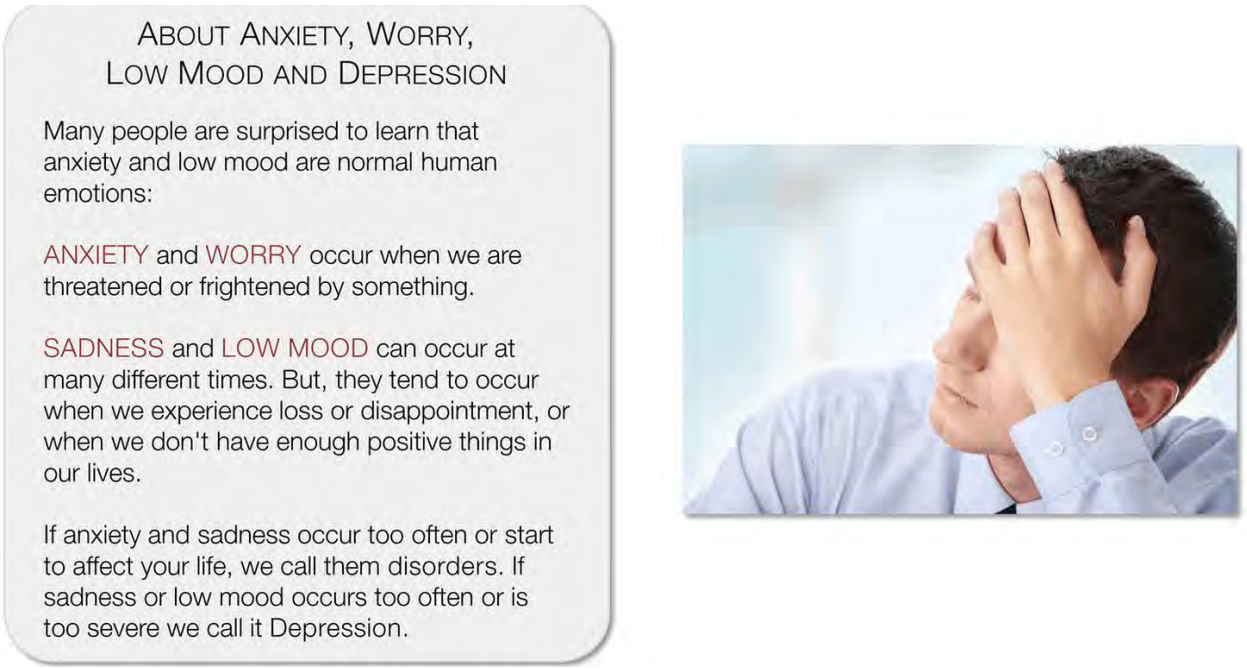


Figure 3.2. Slide describing anxiety and depression from Lesson 1.

I started to try to write down when I noticed negative thoughts. I started with one thought I always had ...

STEP 1: Recognise the Thought

- *I am worthless*

STEP 2: Examine the Thought

- The first thing I realised was that I was exaggerating... I wouldn't really call anyone worthless.
- And, I realised that while I wasn't good at everything, I was good at many things (e.g. being a good father, friend and partner)

STEP 3: Do Something Helpful

- So I challenged this thought by reminding myself that I am good at many things
- I told myself that 'I'm not feeling good in one part of my life, but other things are actually going well'.
- I would then DO SOMETHING HELPFUL, like phone a friend, because I knew this would help my mood.

JENNIE, 33 YEARS OLD

LESSON 2

Hi everyone.

I could identify with lots of the thoughts that Glenn and Jo had. I cried when I realised the kinds of things I have been saying to myself. A lot of my thoughts are like:

- I'm a loser
- I will end up lonely and sad all my life
- I'm useless at things

I've been working on the thought challenging. It's harder than I thought it would be. Imagining I am helping a friend challenge their own thoughts helped me to be more practical. It seemed easier to pretend I was helping someone else.

I can see that my thoughts are more negative when I am feeling stressed at work, or when I'm worrying about my Mum. The thought challenging is helping stop me from getting too down. I can see that this is something I really need to work on and I can see how it can help me in the future. I have written down some of the challenges that made me feel better, and I keep them in my purse. These include:

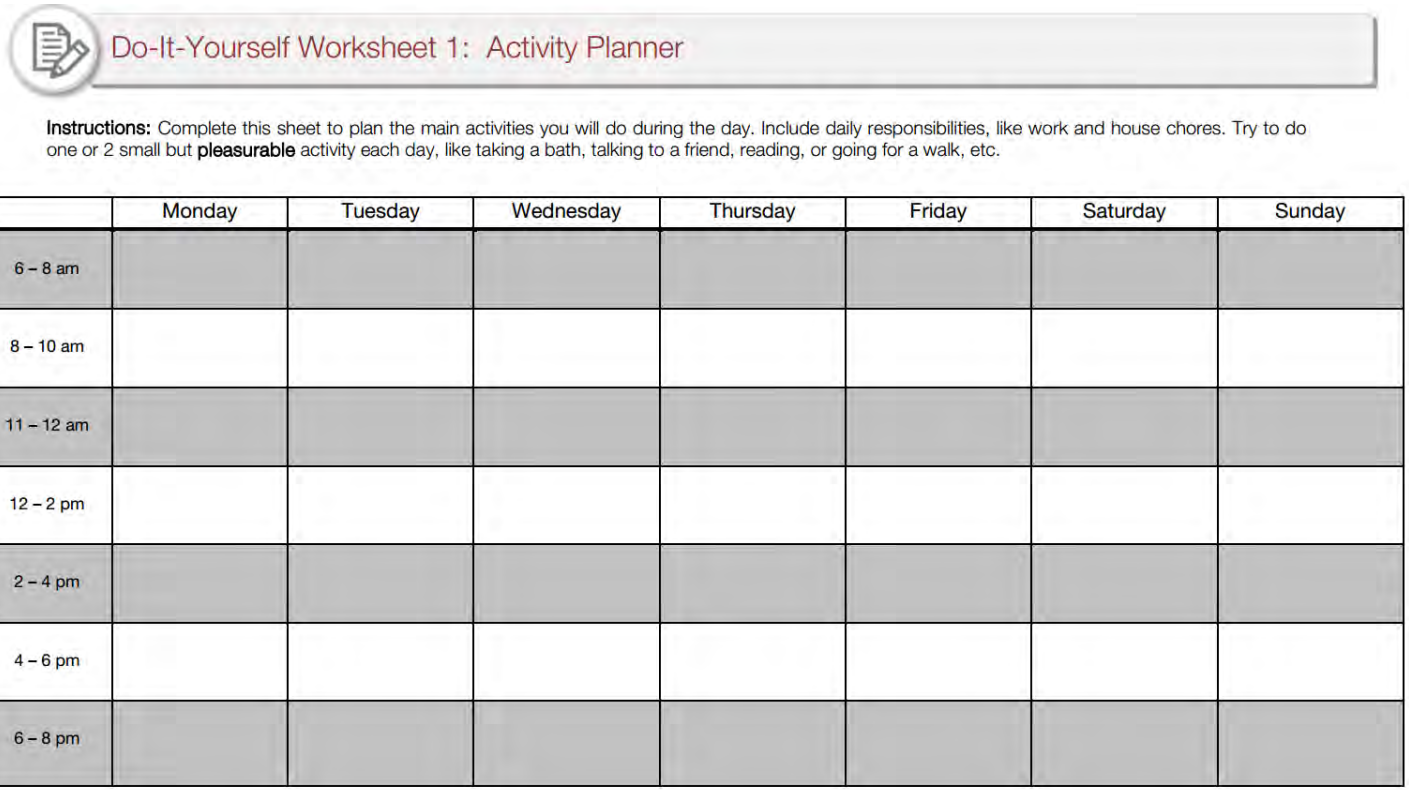
- What is really the evidence against it?
- What would I say to someone else?
- What will I think looking back at this situation in 1 week's time?
- What will I think looking back at this situation in 1 month's time?
- What will I think looking back at this situation in 1 year's time?

(These last few help me to put it all in perspective and stay grounded)

Good luck to you all this week.

Jennie

Figures 3.3 and 3.4. Case examples of how to apply cognitive restructuring skill from Lesson 2 (left) and from the additional Stories resource (right).



Do-It-Yourself Worksheet 1: Activity Planner

Instructions: Complete this sheet to plan the main activities you will do during the day. Include daily responsibilities, like work and house chores. Try to do one or 2 small but **pleasurable** activity each day, like taking a bath, talking to a friend, reading, or going for a walk, etc.

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
6 – 8 am							
8 – 10 am							
11 – 12 am							
12 – 2 pm							
2 – 4 pm							
4 – 6 pm							
6 – 8 pm							

Figure 3.5. Activity planner resource from Lesson

3.3.8 Test-Retest Reliability

There were significant positive correlations between the assessment and pre-treatment periods for the total score of the FATS (r = .75, p <.001), and the cognitive restructuring (r = .55, p <.001), social interactions (r = .66 p <.001), rewarding behaviours (r = .70, p <.001) and activity scheduling (r = .67 p<.001) subscales. There was an average of 18.96 days (SD = 7.29) between when participants completed application and pre-treatment questionnaires.

3.4 Discussion

Study II further explored the psychometric properties of the FATS using data from participants in a self-guided iCBT course for depression and general anxiety. The CFA suggested acceptable model fit, replicating the results in Study I and extending them to a treatment sample. The test of configural invariance also supports the equivalent factor structure of the FATS between the community sample from Study I and the clinical sample in this study.

The iCBT course used in this study, the Wellbeing Course, had a relatively high level of lesson completion, which suggests a high level of acceptability and engagement from participants (Andrews, Cuijpers, Craske, McEvoy, & Titov, 2010). The high questionnaire completion also indicates that weekly administration of the FATS is tolerable for participants engaged in treatment. The one exception was the lower questionnaire completion in the final week of the course (week-8). This may be due to the absence of new materials released in that week. The high levels of post-treatment and 3-month follow-up questionnaire completion suggests that the low week-8 questionnaire completion was not due to participants' disengagement with the research trial. However, it should be noted that reasons for questionnaire non-response were not assessed throughout the trial.

As hypothesised, scores on the FATS and its subscales increased significantly from pre-treatment to post-treatment, and these changes were maintained at 3-month follow-up. This result indicates that CBT treatment is associated with an increase in skills usage, contributing to the criterion validity of the FATS. This finding is consistent with other research that CBT-based interventions are associated with increases in skills usage (Hundt et al., 2015; Jacob et al., 2011; Jarett et al., 2011; Manos et al., 2011; Strunk et al., 2014; Webb et al., 2013). Large and significant reductions in symptoms of depression and general anxiety were also found, which is consistent with evidence that iCBT treatments in general are efficacious (Andersson & Titov, 2014).

As hypothesised, the FATS residual change scores were negatively correlated with symptom residual change scores of depression, general anxiety, and disability, and positively correlated with residual change scores of behavioural activation and life satisfaction. These results support the notion that CBT skills-related behaviours are associated with positive emotional health (Hundt et al., 2013) and support the concurrent and convergent validity of the FATS.

Consistent with hypotheses, the cognitive restructuring subscale of the FATS had the largest correlation with trait cognitive reappraisal at pre-treatment. No other subscales had a significant relationship with trait cognitive reappraisal, with the exception of the activity scheduling subscale having a positive correlation. As hypothesised, the cognitive restructuring and activity scheduling subscales of the FATS each had the strongest correlation with the cognitive restructuring and behavioural activation subscales of the CBTSQ at post-treatment, respectively.

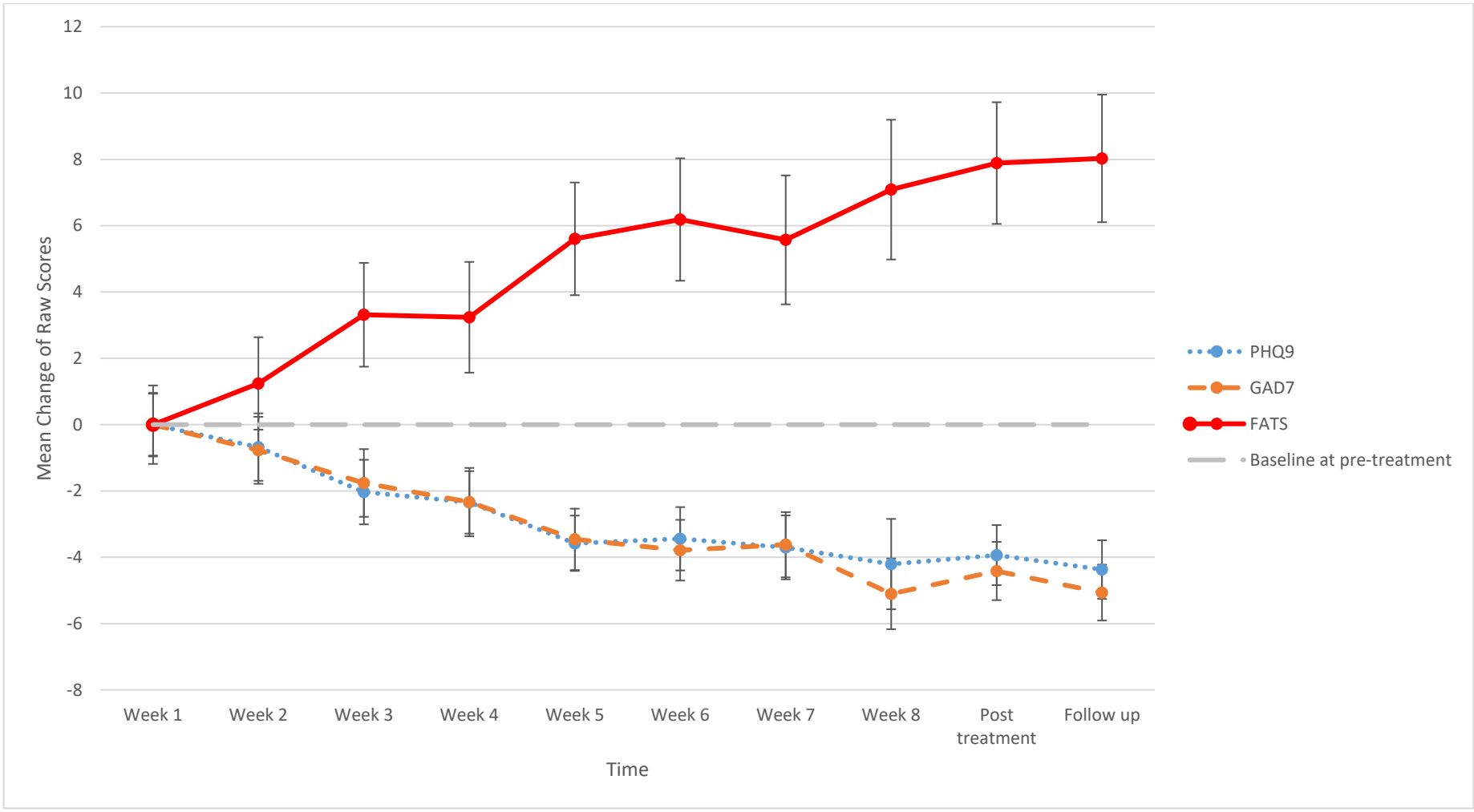


Figure 3.6. Observed mean change scores on FATS, PHQ-9, and GAD-7 from pre-treatment. Error bars represent 95% confidence intervals.

Table 3.2
Estimated Marginal Means (Standard Deviations) and Effect Sizes (95% Confidence Interval) of Outcome Scores at Pre-Treatment, Post-Treatment, and 3-Month Follow-Up

	Pre-Treatment	Post-Treatment	3-Month Follow-Up	Pre to Post Effect Sizes	Pre to Follow-up Effect Sizes
PHQ-9	10.56 (4.81)	6.77 (5.14)	6.45 (5.25)	0.76 (0.50 – 1.02)	0.82 (0.56 – 1.07)
GAD-7	10.81 (4.81)	6.55 (5.14)	6.00 (5.25)	0.86 (0.59 – 1.11)	0.96 (0.69 – 1.21)
SDS	15.25 (6.82)	9.88 (7.38)	9.08 (7.49)	0.76 (0.50 – 1.01)	0.86 (0.60 – 1.12)
SWLS	16.25 (7.83)	19.57 (8.16)	20.29 (8.16)	0.42 (0.16 – 0.66)	0.51 (0.25 – 0.76)
FATS					
Total	16.01 (8.39)	23.79 (8.83)	23.97 (8.94)	0.90 (0.64 – 1.16)	0.92 (0.65 – 1.18)
Cognitive Restructuring	3.78 (2.80)	6.64 (3.02)	6.28 (3.02)	0.98 (0.72 – 1.24)	0.86 (0.60 – 1.11)
Social Interaction	4.64 (2.80)	6.00 (2.91)	6.33 (2.91)	0.48 (0.22 – 0.73)	0.59 (0.34 – 0.84)
Rewarding Behaviours	3.50 (2.91)	5.42 (3.13)	5.64 (3.13)	0.64 (0.38 – 0.89)	0.71 (0.45 – 0.96)
Activity Scheduling	4.01 (2.68)	5.76 (2.80)	5.74 (2.91)	0.64 (0.38 – 0.89)	0.62 (0.36 – 0.87)

Note. FATS = Frequency of Actions and Thoughts Scale; PHQ-9 = Patient Health Questionnaire-9 Item; GAD-7 = Generalized Anxiety Disorder- 7 Item; BADS = Behavioural Activation for Depression Scale; SDS = Sheehan Disability Scale; SWLS = Satisfaction With Life Scale

Table 3.3
Correlations between Pre-Post Residual Change Scores of the FATS and its Subscales with Pre-Post Residual Change Scores on Outcomes

(n = 109)	PHQ-9	GAD-7	BADS	SDS	SWLS
FATS Total	-.30**	-.28**	.32**	-.26**	.23*
Cognitive Restructuring	-.21*	-.21*	.22*	-.14	.21*
Social Interactions	-.30**	-.25*	.29**	-.28**	.35**
Rewarding Behaviours	-.11	-.16	.21*	-.15	-.02
Activity Scheduling	-.25**	-.20*	.29**	-.28**	.13

*Correlation is significant to the .05 level (2-tailed). **Correlation is significant to the .01 level (2-tailed).
Note. FATS = Frequency of Actions and Thoughts Scale; PHQ-9 = Patient Health Questionnaire-9 Item; GAD-7 = Generalized Anxiety Disorder- 7 Item; BADS = Behavioural Activation for Depression Scale; SDS = Sheehan Disability Scale; SWLS = Satisfaction With Life Scale.

Table 3.4
Correlations between the FATS and its Subscales with a Measure of Skills Usage at Post-Treatment

(n = 109)	CBTSQ-BA	CBTSQ-COGRES	CBTSQ
FATS	.59**	.56**	.64**
Cognitive Restructuring	.35**	.52**	.49**
Socal Interactions	.51**	.33**	.46**
Rewarding Behaviours	.40**	.44**	.47**
Activity Scheduling	.63**	.48**	.61**

**Correlation is significant to the .01 level (2-tailed).
Note. FATS = Frequency of Actions and Thoughts Scale; CBTSQ-BA = Cognitive-Behaioral Therapy Skills Questionnaire-Behavioural Activation Subscale; CBTSQ-COGRES = Cognitive-Behavioural Therapy Skills Questionnaire-Cognitive Restructuring Subscale; CBTSQ = Cognitive-Behavioural Therapy Skills Questionnaire (total score).

The results indicate a broad demarcation between the cognitive restructuring subscale and the more behavioural subscales of the FATS, contributing to their construct validity and further justifying the division of the FATS into subscales.

The total FATS score and the subscales, with the exception of a negative correlation with the activity scheduling subscale, had no significant correlations with a trait measure of emotional suppression. As emotional suppression is not conceptually related to the constructs measured by the FATS, this finding generally supports its discriminant validity.

The results indicated that residual changes on the FATS subscales were generally associated with changes on symptom outcomes. The only exception to this was the rewarding behaviours subscale, which did not have a significant relationship with any of the outcome measures. Overall, these results are promising, but more research is required to explore the relationships between the FATS and clinical outcomes.

The test-retest reliability of the FATS and its subscales is typical for measures of skills usage frequency. For example, the test-retest reliabilities of both subscales of the BADS-SF were r <.60 (Manos et al., 2011), and was .67 for the SoCT (Jarrett et al., 2011).These scores are generally lower than other psychological measures, whichmay be due to the fact that the frequency of skills usage behaviours represents state (not trait) characteristics (Manos et al., 2011).

An important limitation of this study was the absence of a control group for comparison. We therefore cannot conclude that iCBT increased FATS scores and reduced symptom scores. Using a single-group design, we are also unable to determine if increased skills usage mediates the effect of iCBT on symptoms. Another important observation is that although skills usage frequency increased, it is unknown if participants were performing the

skills competantly. Patients may be performing the skills but if they are not doing them effectively or at the appropriate times the benefits may be suboptimal.

Future research should further investigate the role of increased skills usage frequency as a mediator of therapeutic change. This can be done by employing a randomised controlled trial (RCT) design, which includes a control group in order to perform mediation analysis. This would provide a greater understanding of the role that skills usage behaviours play in the process of therapy. Investigating the link between the quality of skills usage and symptom outcomes will also provide greater understanding of the relationship between skills usage and symptom outcomes. Future studies utilising the FATS and measures of skills use competancy may also help strengthen the validity of the FATS.

The current study tested a new measure of CBT skills usage, the FATS, to assess its psychometric properties in a sample receiving treatment for depression and general anxiety symptoms. The FATS demonstrated acceptable factor structure and results supported its construct validity in a treatment sample. To further our understanding of the role of skills usage, research utilising RCT designs are needed to investigate if skills usage mediates symptom reduction.

Chapter Four

Study III: Does Skills Usage Mediate Reductions in Depression and General Anxiety Symptoms? A Randomised Controlled Trial of iCBT and mediation analysis

Material from this chapter appears in the following article currently under review:

Terides, M. D., Dear, B. F., Fogliati, V. J., Gandy, M., Karin, E., Jones, M. P., & Titov, N. (submitted). Increased Skills Usage Mediates Symptom Reduction in Internet-Delivered Cognitive-Behavioural Therapy for Depression and Anxiety. *Behaviour Research and Therapy.*

And was presented as part of two conference presentations:

M.D. Terides, B.F. Dear, V.J. Fogliati, M. Gandy, N. Titov. (2016). *Cognitive behavioural therapy skills usage as a mechanism of change for internet-delivered Cognitive-behavioural therapy for symptoms of anxiety and depression*. 8th Scientific Meeting of the International Society for Research on Internet Interventions, Seattle, USA.

M.D. Terides, B.F. Dear, V.J. Fogliati, M. Gandy, N. Titov. (2016). *Adaptive behaviours and skills usage as a mechanism of change for internet-delivered Cognitive-behavioural therapy for symptoms of anxiety and depression*. 8th World Congress of Behavioural and Cognitive Therapies, Melbourne, Australia.

4.1 Introduction

Clinical and subclinical symptoms of depression and general anxiety are prevalent, highly comorbid, and can cause significant impairment to individuals (Kessler et al., 2002). CBT is efficacious for treating depression and anxiety (Butler et al., 2006; Hofmann et al., 2012) and also increases life satisfaction (Hofmann, Wu, & Boettcher, 2014; Oei & McAlinden, 2014). Despite evidence for its efficacy, the mechanisms underlying CBT are poorly understood. Establishing an empirically supported model of how CBT works will further improve the effectiveness and efficiency of treatment, leading to better outcomes for patients (Kazdin, 2007).

In Study I (Chapter Two), we developed a brief instrument of CBT skills usage for mechanism research, the FATS. The FATS demonstrated acceptable preliminary psychometric properties and was successfully administered to an active treatment sample undergoing iCBT for symptoms of depression and general anxiety. The results of Study II (Chapter Three) suggested that iCBT is associated with increases in skills usage and that these changes are associated with decreases in symptoms and increased life satisfaction. However, we require further evidence that iCBT causes increases in skills usage and that these changes statistically mediate improvements.

A recent RCT evaluating an automated, email-based, six-week intervention promoting helpful behaviours demonstrated their importance in alleviating depression (Morgan, Mackinnon, & Jorm, 2013). The emails promoted positive and rewarding activities, as well as general healthy behaviours, such as healthy diet and getting sufficient sleep. The results showed that increased frequency of these behaviours was associated with reductions in symptoms and that use of the helpful behaviours statistically mediated symptom reductions.

However, the mediating role of CBT skills usage has not been explored in structured iCBT interventions for symptoms of depression and general anxiety. This is likely a result of

the difficulties of designing such experimental mechanism studies (Kazdin, 2007), which includes a lack of convenient self-report instruments, measuring CBT skills usage, that can be feasibly administered at all key times (i.e. pre-treatment, during treatment, and post-treatment) of clinical trials (Miner et al., 2015; Terides et al., 2016).

This study, Study III, used a two-group, active treatment versus waitlist control group, RCT design to investigate if iCBT increases the frequency of skills usage and if increased frequency of skills usage mediates improvements in symptoms and life satisfaction at the end of treatment. It was hypothesised that participants in the active treatment group would report greater reductions in symptoms and greater increases in CBT skills usage frequency and life satisfaction compared with the waitlist control group. It was also hypothesised that higher CBT skills usage would statistically mediate symptom reduction and increased life satisfaction.

4.2 Method

4.2.1 Design

The design of the current study was a CONSORT-revised compliant RCT comparing two parallel conditions: 1) an active iCBT treatment group, and 2) a deferred-treatment waitlist control group. This study was registered prospectively in the Australian New Zealand Clinical Trials Registry, under trial identification 'ACTRN12615000112561'.

4.2.2 Participants

Participants in this study were Australian residents seeking online treatment for symptoms of anxiety, depression, or both. Potential participants received information about the study, which involved a trial of the *Wellbeing Course* (Dear et al., 2015; Titov et al.,

2015b), for treating anxiety and depression through our research website (www.ecentreclinic.org). Interested applicants were able to provide online consent and make an online application.

Inclusion criteria for this study were: 1) 18 years of age or older; 2) A resident of Australia; and 3) experiencing at least clinically mild levels of anxiety (GAD-7 total score ≥ 5) or depression (PHQ-9 total score ≥ 5). Exclusion criteria were: 1) reporting severe symptoms of depression (total PHQ-9 score ≥ 23), suicidal ideation (a score of 3 on question 9 (suicidal ideation) of the PHQ-9), or a recent suicide attempt; 2) experiencing an active psychotic episode; 3) currently engaging in regular (fortnightly or more frequent) CBT; and 4) if on medication for anxiety, depression, or both, not having been on a stable dose for at least one month prior to the commencement of the study.

Successful online applicants were telephoned to confirm inclusion criteria and were administered the Mini International Neuropsychiatric Interview Version 5 (MINI; Sheehan et al., 1998) to determine the proportion of the sample meeting diagnostic criteria for a major depressive episode (MDE) and GAD. A total of 261 individuals applied to participate in the study. One-hundred-and-forty-eight were successful and were randomly allocated to one of the two groups. See Figure 4.1 for participant flow chart. See Table 4.1 for demographic information of the sample.

4.2.3 Randomisation

A permuted block randomisation sequence was used, utilising blocks of eight (four treatment group, four control group), through the website www.randomizer.org. Applicants were assigned their random group allocation when they first applied online for the research trial, however, both the experimenters and the applicants were blinded to this allocation.

Group allocation was revealed to both the experimenters and the participants upon the participant's successful completion of the application process and being accepted into the research trial.

Table 4.1
Demographic Characteristics of the Participants

	Group		
	Treatment (n = 65)	**Waitlist control** (n = 75)	**Significance**
Gender			
Male	7 (11%)	18 (25%)	$\chi^2(2, N = 140) = 4.16$
Female	57 (88%)	56 (75%)	$p = .13$
Other	1 (2%)	1 (1%)	
Age (years)			
Mean (SD)	46.31 (12.64)	43.24 (12.84)	$F_{1, 138} = 2.03$
Range	19 to 79	19 to 80	$p = .16$
Education			
None	1 (2%)	1 (2%)	
High School or less	9 (14%)	20 (27%)	$\chi^2(3, N = 140) = 3.59$,
Trade / Technical Certificate	5 (8%)	4 (5%)	$p = .31$
Diploma / Degree	50(77%)	50 (67%)	
Employment			
Paid employment	46 (71%)	48 (64%)	
Student	4 (6%)	3 (4%)	$\chi^2(3, N = 140) = 1.57$,
Paid employment and a student	4 (6%)	6 (8%)	$p = .67$
Unemployed, retired or disabled	11 (17%)	28 (24%)	
Currently taking medication for depression and/or anxiety	28 (43%)	26 (35%)	$\chi^2(1, N = 140) = 1.35$, $p = .25$

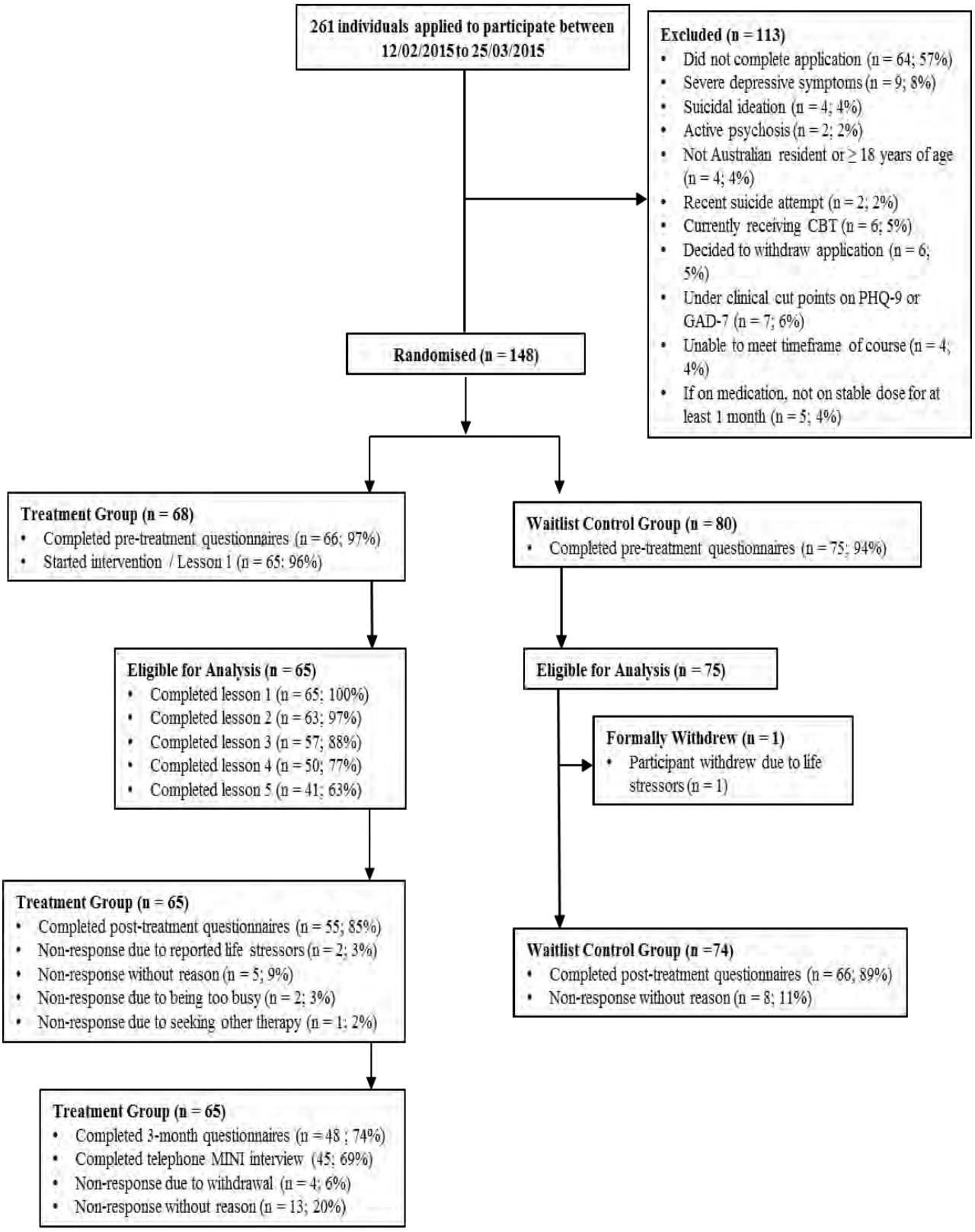


Figure 4.1. Participant flow from application to three-month follow-up

4.2.4 Measures

The PHQ-9, GAD-7, FATS, SDS, and SWLS described in Study II (Chapter Three) were used in the current study. Cronbach's alphas for these measures in the current study were: PHQ-9 = .80, GAD-7 = .90, SDS = .86, SWLS = .88. For the FATS: total = .84, cognitive restructuring subscale = .85, social interactions subscale = .75, rewarding behaviours subscale = .79, and activity scheduling subscale = .73.

Mini International Neuropsychiatric Interview Version 5.0.0 (MINI; Sheehan et al., 1998)

The MINI is a brief diagnostic interview developed to determine the presence of current Axis-I disorders using DSM-IV diagnostic criteria. It has excellent inter-rater reliability (k = 0.88 – 1.00) and adequate concurrent validity with the Composite International Diagnostic Interview and the Structured Clinical Interview for DSM-III-R Patients (Lecrubier et al., 1997; Sheehan et al., 1997). Apart from MDE and GAD, the presence of panic disorder with or without agoraphobia, social anxiety disorder, obsessive-compulsive disorder, and post-traumatic stress disorder was also assessed to describe the sample.

4.2.5 Treatment and Procedure

Participants accessed the internet-delivered Wellbeing Course through our research clinic's website (www.ecentreclinic.org). The treatment program, the Wellbeing Course, was the same treatment course described in Study II (Chapter Three).

4.2.6 Statistical Analyses

Analysis of Outcomes

Participants in both groups completed the PHQ-9, GAD-7, FATS, and SWLS at the treatment group's pre-treatment and post-treatment period. Post-treatment occurred at the end of the eight-week course. In addition, participants in the treatment group completed these questionnaires at a 3-month follow-up period and were also asked to complete the PHQ-9, GAD-7, and FATS weekly during the treatment period. Participants in the control group were not presented with these weekly questionnaires during this period as it is possible that constant exposure to the FATS' items may prompt an increase in these behaviours (i.e. Morgan et al., 2013).

SPSS 21 was used to conduct mixed linear models analyses on the overall sample to assess within-group changes in FATS, PHQ-9, GAD-7, SWLS, and FATS subscales scores at pre-treatment, post-treatment, and 3-month follow-up, and between-group differences at post-treatment. The mixed linear model analyses specified time (pre, post, and follow-up) and group (treatment or control) as fixed effects and participant as a random effect, and used an autoregressive covariance structure and maximum likelihood estimation (e.g. Titov et al., 2015a). Participants were eligible for analysis if they provided baseline data and, if in the treatment group, started the first lesson of the treatment. Primary interest was in the group by time interactions on the outcome measures. Significant within and between-group effects were followed up using pairwise comparisons. This approach is otherwise consistent with an intention-to-treat analytic approach under the assumption that data are missing at random. Estimated marginal means based on the mixed linear models are reported. Effect sizes (Cohen's *d*) for within-group changes and between-group differences were also calculated. Power analysis suggested that a total sample size of 128 would be sufficient to detect a between-group effect size of $d = 0.5$ with alpha set at .05 and with 80% power.

Mixed linear models were also used to assess within and between-group differences on primary outcomes amongst the clinical sub-populations meeting diagnostic criteria for MDE and for GAD. Diagnosis was based on results of the MINI conducted during the assessment period. The primary outcome for patients meeting criteria for MDE was the PHQ-9, and the GAD-7 for patients meeting criteria for GAD. As the number of participants in these sub-group analyses were much smaller compared with the overall sample, pre-treatment scores for the outcome variable were entered as covariates to help stabilise the effects (e.g. Titov et al., 2015a). Preliminary tests for between group differences at baseline were conducted using chi squares and one-way ANOVAs. All questionnaires were completed online.

Mediation Analysis

Mediation analysis was conducted to estimate the indirect effect of treatment (X) on symptom outcome (Y) via skills usage (M). The indirect effect is the product of the pathway *a* (X to M) and the pathway *b* (M to Y) (i.e. the indirect effect is *ab*). Mediation models were tested using the PROCESS macro for SPSS (Hayes, 2013) using the bootstrapping procedure described by Preacher and Hayes (2004).

Bootstrapping is a parametric technique that involves running a large number of data simulations based on randomly sampling observations with replacement from the data set. Bootstrapping does not make assumptions regarding the shape of the distribution of the indirect effect, thus addressing the limitations of the causal steps methods of mediation (e.g. Baron & Kenny, 1986) (MacKinnon et al., 2007; Preacher & Hayes, 2004). It therefore has greater power to detect significant indirect effects and is appropriate to use with lower sample sizes (Shrout & Bolger, 2002).

The bootstrapping approach provides an estimate and 95% confidence interval of the indirect effect. If the confidence interval of the indirect effect does not cross zero, the indirect effect is considered statistically significant (Preacher & Hayes, 2004). Mediation models were run for each mediator variable (the total FATS and each of its four subscales) for outcome variables (PHQ-9, GAD-7, and SWLS) for the overall sample. Mediation models were also conducted for patients meeting criteria for MDE and GAD with their respective primary outcomes specified as the outcome variable (i.e. PHQ-9 for MDE group; GAD-7 for the GAD group).

Following the mediation procedure conducted by Morgan and colleagues (2013), the indirect effect was bootstrapped with 2000 replications. Post-treatment PHQ-9 and GAD-7 scores were entered as the outcome variable (Y), post-treatment FATS total and subscale scores were entered as the mediator variable (M), and treatment was entered as a binary (active treatment = 1; waitlist control = 2) independent variable (X). The mediator and outcome variables being tested were controlled for by entering their baseline scores into the model as covariates (e.g. Morgan et al., 2013). Mediation models were conducted using complete data.

As there were only two waves of data for the control group, the design precluded using the longitudinal structural equation modelling approach to mediation described by Cole and Maxwell (2003). The analysis described above is akin to a 'half-longitudinal' mediation analysis (Cole & Maxwell, 2003) as it assesses the prospective relationship between treatment (X) (baseline) and skills usage (M) (post-treatment), but assesses the contemporaneous relationship between skills usage (M) (post-treatment) and outcomes (Y) (post-treatment) (whilst controlling for baseline scores of these two measures). This approach is still preferable to a cross-sectional mediation analysis in which the relationships between X, M and Y are assessed at the same time (Cole & Maxwell, 2003). It is also important to note that the

bootstrapping approach can be run adequately using smaller sample sizes (Shrout & Bolger, 2002), and was therefore more suitable for the current study.

4.3 Results

4.3.1 Participant Flow and Preliminary Tests

Figure 4.1 contains information of participant allocation, questionnaire and lesson completion throughout the trial. No differences were found between the treatment and control groups on the demographic variables shown in Table 4.1. The number of participants meeting diagnostic criteria at pre-treatment is shown in Table 4.2. No differences were found between the treatment and control groups in the proportions meeting diagnostic criteria. No differences were found between groups on the baseline outcome measures, PHQ-9 ($F_{1, 138}$ = 0.53, p = .47), GAD-7 ($F_{1, 138}$ = 2.86, p = .09), FATS ($F_{1, 138}$ = 0.28, p = .60), SWLS ($F_{1, 138}$ = 0.28, p = .60), and FATS subscales of cognitive restructuring ($F_{1, 138}$ = 1.97, p = .16), rewarding behaviours ($F_{1, 138}$ = 1.25, p = .27), and activity scheduling ($F_{1, 138}$ = 2.38, p = .13). The only exception was that the social interaction subscale of the FATS was significantly higher in the control group than the treatment group ($F_{1, 139}$ = 4.59, p < .05). Pre-treatment score on the social interaction subscale was entered as a covariate with all subsequent analysis involving this subscale.

4.3.2 Changes in FATS and Subscales

Mixed linear models analyses revealed main effects for time for the total FATS ($F_{2, 160}$ = 19.12, p < .01), cognitive restructuring ($F_{2, 161}$ = 20.03, p <.001), social interactions ($F_{2, 224}$ = 5.40, p <.01), rewarding behaviours ($F_{2, 159}$ = 11.83, p <.001), and activity scheduling ($F_{2, 161}$ = 6.43, p <.01). Analysis revealed a significant time by group interaction for the total FATS

($F_{1, 216}$ = 7.67, p <.01), cognitive restructuring ($F_{1, 227}$ = 8.17, p <.01) and activity scheduling ($F_{1, 221}$ = 4.65, p = .03) , but not for social interactions ($F_{1, 300}$ = 3.42, p = .07) or rewarding behaviours ($F_{1, 226}$ = 2.36, p = .13). Pairwise comparisons showed that mean scores for the total FATS and all four subscales were significantly higher at post-treatment in the treatment group compared with the control group (ps < .05). Pairwise comparisons also showed that mean total FATS and subscales scores were significantly higher at post-treatment and 3-month follow-up compared with pre-treatment in the treatment group (ps < .05). There were no significant differences between pre and post-treatment scores in the control group (ps > .05). There were no significant differences between post-treatment and 3-month follow-up for total FATS or subscales scores for the treatment group (ps > .05). Table 4.3 contains estimated marginal means and standard deviations for the FATS.

4.3.3 Outcomes for Overall Sample

The mixed-models analyses revealed a significant main effect for time for the PHQ-9 ($F_{2, 162}$ = 17.73, p < .01) and a significant time by group interaction ($F_{1,234}$= 6.23, p < .05). For GAD-7, analysis revealed a significant main effect for time ($F_{2, 157}$ = 38.57, p < .01) and a significant time by group interaction, ($F_{1, 221}$ = 12.24, p < .01). For the SWLS, there was a significant main effect for time ($F_{2, 161}$ = 21.22, p < .01), and a significant time by group interaction ($F_{1, 206}$ = 5.67, p < .05).

Pairwise comparisons revealed the treatment group had significantly lower GAD-7 and PHQ-9 scores, and significantly higher SWLS scores, than the waitlist-control group at post-treatment (ps < .01). In the treatment group, post-treatment and 3-month follow-up scores for the PHQ-9 and GAD-7 were significantly lower compared with pre-treatment scores (ps < .01), and post-treatment and 3-month follow-up scores for the SWLS were significantly greater compared with pre-treatment scores. There were no significant changes in the

treatment group from post-treatment to 3-month follow-up for the PHQ-9, GAD-7, and SWLS (*ps* > .05), indicating that changes on these measures between pre-treatment and post-treatment were maintained at 3-month follow-up. For the control group, there were no differences between pre and post-treatment scores on any of the outcome measures (*ps* > .05). Table 4.3 contains estimated marginal means and effect sizes for these outcomes.

Table 4.2
Participants Meeting Diagnostic Criteria Based on Diagnostic Interview at Assessment

	Application		
	Treatment (n = 65)	**Waitlist** (n = 75)	**Significance**
MINI-Diagnosis			
Major Depressive Episode	27 (42%)	28 (37%)	$\chi^2(1, N = 140) = 0.26, p = .61$
Panic disorder/Agoraphobia	21 (32%)	26 (35%)	$\chi^2(1, N = 140) = 0.09, p = .77$
Social Phobia	19 (29%)	22 (29%)	$\chi^2(1, N = 140) = 0.00, p = .99$
Obsessive-Compulsive Disorder	1 (2%)	4 (5%)	$\chi^2(1, N = 140) = 1.46, p = .23$
Post-Traumatic Stress Disorder	3 (5%)	2 (3%)	$\chi^2(1, N = 140) = 0.38, p = .54$
Generalized Anxiety Disorder	43 (66%)	46 (61%)	$\chi^2(1, N = 140) = 0.35, p = .55$
Number of diagnoses			
0	13 (20%)	15 (20%)	$\chi^2(1, N = 140) = 0.00, p = 1.00$
1	14 (22%)	16 (21%)	$\chi^2(1, N = 140) = 0.00, p = .98$
2	22 (34%)	27 (36%)	$\chi^2(1, N = 140) = 0.07, p = .79$
3	8 (12%)	11 (15%)	$\chi^2(1, N = 140) = 0.17, p = .68$
4	8 (12%)	5 (7%)	$\chi^2(1, N = 140) = 1.32, p = .25$
5	0 (0%)	1 (1%)	$\chi^2(1, N = 140) = 0.87, p = .35$

4.3.4 Primary Symptom Outcomes for Clinical Subsamples

The mixed-models analysis for participants meeting criteria for MDE revealed a significant main effect for time for the PHQ-9 ($F_{2, 83} = 26.14$, $p < .001$) and a significant time by group interaction ($F_{1,112} = 9.65$, $p < .01$). Pairwise comparisons revealed that the treatment group reported significantly lower scores at post-treatment compared with the control group ($p < .01$). The treatment group reported significantly lower PHQ-9 scores at post-treatment and 3-month follow-up compared with their pre-treatment scores ($ps < .01$), but there was no difference between post-treatment and 3-month follow-up scores ($p > .05$). The control group reported significantly lower scores at post-treatment compared to pre-treatment ($p < .05$).

The mixed models analysis for participants meeting diagnostic criteria for GAD revealed a significant main effect for time for the GAD-7 ($F_{2, 137} = 53.07$, $p < .01$) and a significant time by group interaction ($F_{1,189} = 18.40$, $p < .01$). Pairwise comparisons revealed that the treatment group reported significantly lower scores at post-treatment compared with the control group ($p < .01$). The treatment group reported significantly lower GAD-7 scores at post-treatment and 3-month follow-up compared with their pre-treatment scores ($ps < .01$), but there was no difference between post-treatment and 3-month follow-up scores ($p > .05$). The control group reported significantly lower scores at post-treatment compared to pre-treatment ($p < .05$). Table 4.3 contains estimated marginal means and effect sizes for these outcomes.

4.3.5 Mediation Analysis

Bootstrapped estimates of the indirect effects, total effects, standard errors, and 95% confidence intervals of the FATS and FATS subscales scores on the PHQ-9, GAD-7, and SWLS at post-treatment are presented in Table 4.4 for the overall sample. The total effect represents the raw difference between the treatment and control group on the outcome. For example, the total effect for the overall sample on post-treatment PHQ-9 is 2.47. This means

that the treatment group's PHQ-9 score is on average 2.47 points lower than the control group. The indirect effect represents the raw difference of the outcome that is attributable to the differences in FATS scores between both groups. For example, the indirect effect for the overall sample for the total FATS is 1.27. This means that, of the 2.47-point difference on PHQ-9 between both groups, 1.27 points are attributable to the difference in FATS scores. The total effects reported in the Tables differ between mediator variables as they are each bootstrapped estimates of the effect.

The bootstrapping mediation procedure revealed that post-treatment scores on the total FATS and its cognitive restructuring, rewarding behaviours, and activity scheduling subscales each significantly mediated the effect of treatment on outcomes. The total FATS and its cognitive restructuring and rewarding behaviours subscales each significantly mediated the effect of treatment on life satisfaction scores.

Results from the bootstrapped mediation models run for the two clinical sub-groups are reported in Table 4.5. For the MDE subsample, the total FATS score as well as the cognitive restructuring and activity scheduling subscales significantly mediated treatment effects for depression symptoms. For the GAD subsample, the total FATS and its cognitive restructuring, rewarding behaviours, and activity scheduling subscales significantly mediated treatment effects for anxiety symptoms.

4.4 Discussion

This study examined whether iCBT for depression and general anxiety would increase the frequency in CBT skills behaviours and if this mediated symptom reductions and increased life satisfaction. Consistent with hypotheses, the treatment group reported significantly higher levels of skills usage and life satisfaction, and significantly lower

depression and general anxiety symptoms compared with the waitlist control group after treatment. Between-group effect sizes at post-treatment were moderate for overall skills usage and life satisfaction and small for symptom reduction. These findings are generally consistent with other trials demonstrating the efficacy of CBT for depression and general anxiety, both online (Dear et al., 2015; Titov et al., 2015b) and face-to-face (Cuijpers et al., 2013a; Hanrahan et al., 2013), and that CBT treatment is associated with greater life satisfaction and quality (Hofmann et al., 2014). These results are also consistent with findings that CBT treatments are associated with increases in CBT and other skill related behaviours (Hundt et al., 2015; Jacob et al., 2011; Jarrett et al., 2011; Strunk et al., 2014; Terides et al., 2016), but significantly extends this evidence base by demonstrating that CBT interventions causally increase skills usage.

The bootstrap mediation analysis revealed that reductions in symptoms in the treatment group were significantly mediated by their greater frequency of skills usage compared with the control group. For the two subsamples meeting diagnostic criteria for MDE and GAD respectively, skills usage was found to be a significant mediator of treatment outcome. Specifically, the skills of cognitive restructuring and activity scheduling mediated primary symptom reduction for both groups, and engaging in rewarding behaviours was an additional significant mediator for general anxiety symptoms in the GAD group. It should be noted, however, that although skills usage was found to be a significant mediator, skills usage alone did not account for the entire treatment effect. This indicates that there were other unmeasured variables contributing to symptom reduction.

Table 4.3
Estimated Marginal Means, Standard Deviations, and Effect sizes on Outcome Measures

	n	Estimated Marginal Means (Standard Deviation)			Effect Sizes (Confidence Intervals) (Based On Estimated Marginal Means)		
		Pre	Post	3-Month Follow-up	**Within Group** pre to post	**Between Group** post treatment	**Within Group** pre to 3-month
OVERALL SAMPLE							
PHQ-9							
Treatment	65	10.82 (5.24)	6.78 (5.64)	6.91 (5.72)	0.74 (0.38 – 1.09)	0.38 (0.04 – 0.71)	0.71 (0.35 – 1.06)
Control	75	10.19 (5.20)	8.90 (5.54)	-	0.24 (-0.08 – 0.56)		-
GAD-7							
Treatment	65	11.65 (5.56)	6.47 (5.97)	5.56 (6.97)	0.90 (0.53 – 1.25)	0.39 (0.05 – 0.72)	0.97 (0.60 – 1.32)
Control	75	10.08 (5.54)	8.79 (5.89)	-	0.23 (-0.10 – 0.55)		-
FATS							
Total							
Treatment	65	16.52 (8.47)	22.34 (9.03)	22.75 (9.11)	0.66 (0.31 – 1.01)	0.58 (0.24 – 0.92)	0.71 (0.35 – 1.06)
Control	75	15.81 (8.49)	17.14 (8.92)	-	0.15 (-0.17 – 0.47)		-
Cognitive Restructuring							
Treatment	65	4.28 (2.66)	6.42 (2.90)	6.41 (2.90)	0.77 (0.41 – 1.12)	0.76 (0.41 – 1.10)	0.77 (0.40 – 1.12)
Control	75	3.67 (2.68)	4.24 (2.86)	-	0.21 (-0.12 – 0.53)		-

Social Interactions							
Treatment	65	4.82 (1.93)	5.78 (2.10)	5.98 (2.18)	0.48 (0.12 – 0.82)	0.33 (-0.01 – 0.66)	0.56 (0.21 – 0.91)
Control	75	4.99 (1.91)	5.09 (2.08)	-	0.05 (-0.27 – 0.37)		-
Rewarding Behaviours							
Treatment	65	3.51 (2.82)	4.90 (3.06)	5.25 (3.06)	0.47 (0.12 – 0.82)	0.46 (0.12 – 0.80)	0.59 (0.24 – 0.94)
Control	75	3.00 (2.86)	3.49 (3.03)	-	0.17 (-0.16 – 0.49)		-
Activity Scheduling							
Treatment	65	4.32 (2.66)	5.65 (2.82)	5.50 (2.82)	0.49 (0.13 – 0.83)	0.64 (0.30 – 0.98)	0.49 (0.13 – 0.83)
Control	75	3.65 (2.68)	3.85 (2.77)	-	0.07 (-0.25 – 0.39)		-
SWLS							
Treatment	65	16.31 (7.26)	19.66 (7.74)	21.28 (7.74)	0.45 (0.10 – 0.79)	0.30 (-0.03 – 0.64)	0.66 (0.31 – 1.01)
Control	75	16.93 (7.27)	17.33 (7.62)	-	0.05 (-0.27 – 0.37)		-

	n	Estimated Marginal Means (Standard Deviation)			Effect Sizes (Confidence Intervals) (Based On Estimated Marginal Means)		
		Pre	Post	3-Month Follow-up	**Within Group** pre to post	**Between Group** post treatment	**Within Group** pre to 3-month
CLINICAL SAMPLE							
GAD-7 (GAD subgroup)							
Treatment	43	13.52 (3.73)	6.81 (4.07)	5.21 (4.33)	1.72 (1.21 – 2.20)	1.09 (0.64 – 1.53)	2.06 (1.52 – 2.56)
Control	46	13.03 (3.87)	11.34 (4.21)	-	0.42 (0.00 – 0.83)		-
PHQ-9 (MDE subgroup)							
Treatment	27	13.74 (3.43)	8.49 (3.90)	6.88 (4.16)	1.43 (0.81 – 2.00)	1.00 (0.43 – 1.55)	1.80 (1.14 – 2.40)
Control	28	13.38 (3.49)	12.27 (3.65)	-	0.31 (-0.22 – 0.83)		-

Note. FATS = Frequency of Actions and Thoughts Scale; PHQ-9 = Patient Health Questionnaire-9 Item; GAD-7 = Generalized Anxiety Disorder- 7 Item; SWLS = Satisfaction With Life Scale.; GAD = Generalised Anxiety Disorder; MDE = Major Depressive Episode. Clinical subsample determined via diagnostic interview during assessment period.

Table 4.4
Bootstrapped Mediation Analysis Results for Overall Sample

Outcome	Mediator (post-treatment score)	Total effect	Indirect effect	Bootstrap SE	Bootstrap results for 95% CI of indirect effects	
					Lower	Upper
PHQ-9	FATS:					
	Total	2.47	1.27	0.42	0.57	2.23
	Cognitive Restructuring	2.44	1.06	0.39	0.42	1.95
	Social Interaction	2.60	0.29	0.24	-0.05	0.89
	Rewarding Behaviours	2.48	0.66	0.28	0.26	1.49
	Activity Scheduling	2.35	0.96	0.35	0.40	1.79
GAD-7	FATS:					
	Total	3.29	1.08	0.42	0.40	2.11
	Cognitive Restructuring	3.28	0.88	0.43	0.13	1.85
	Social Interaction	3.48	0.27	0.24	-0.03	1.03
	Rewarding Behaviours	3.30	0.64	0.29	0.21	1.37
	Activity Scheduling	3.21	0.68	0.36	0.12	1.60
SWLS	FATS:					
	Total	-2.73	-1.05	0.66	-2.66	-0.15
	Cognitive Restructuring	-2.58	-1.07	0.55	-2.37	-0.18
	Social Interaction	-3.14	-0.43	0.37	-1.40	0.13
	Rewarding Behaviours	-2.74	-0.55	0.38	-1.63	-0.04
	Activity Scheduling	-2.61	-0.43	0.42	-1.54	0.15

Note. FATS = Frequency of Actions and Thoughts Scale; PHQ-9 = Patient Health Questionnaire-9 Item; GAD-7 = Generalized Anxiety Disorder- 7 Item; SWLS = Satisfaction With Life Scale.

Table 4.5
Bootstrapped Mediation Analysis Results for Clinical Subsamples

Outcome	Mediator (post-treatment score)	Total effect	Indirect effect	Bootstrap SE	Bootstrap results for 95% CI of indirect effects	
					Lower	Upper
MDE sample (n = 46)	FATS:					
PHQ-9	Total	3.37	1.49	0.76	0.42	3.48
	Cognitive Restructuring	3.42	1.90	0.80	0.62	3.83
	Social Interaction	3.50	0.30	0.53	-0.65	1.50
	Rewarding Behaviours	3.37	0.05	0.58	-1.12	1.19
	Activity Scheduling	3.30	0.88	0.59	0.05	2.56
GAD sample (n = 76)	FATS:					
GAD-7	Total	4.19	2.35	0.70	1.17	3.95
	Cognitive Restructuring	4.22	1.68	0.73	0.52	3.40
	Social Interaction	4.40	0.51	0.41	-0.03	1.68
	Rewarding Behaviours	4.20	1.01	0.47	0.33	2.27
	Activity Scheduling	4.14	1.24	0.50	0.44	2.46

Note. FATS = Frequency of Actions and Thoughts Scale; PHQ-9 = Patient Health Questionnaire-9 Item; GAD-7 = Generalized Anxiety Disorder- 7 Item; MDE = Major Depressive Episode; GAD = Generalised Anxiety Disorder

The findings are consistent with the results of a similar study, which demonstrated that increased adaptive behaviours mediated depressive symptom reduction in an automated email intervention (Morgan et al., 2013). The findings of the current study are also consistent with other research indicating that increases in skills usage are associated with symptom reduction (e.g. Hundt et al., 2015; Jacob et al., 2011; Jarrett et al., 2011; Manos et al., 2011; Miner et al., 2015; Strunk et al., 2014; Terides et al., 2016). However, it extends upon this existing research by showing that CBT skills usage statistically mediates symptom reduction in a structured CBT intervention.

The findings support the notion that clinical effects achieved in CBT for symptoms of depression and general anxiety are driven by changes in adaptive behaviours. Specifically, skills relating to cognitive restructuring and behavioural activation (activity scheduling and engaging in rewarding activities) may be especially important, but frequency of social interactions may be less so. This latter finding was somewhat unexpected as having good social relationships and social support has been shown to reduce risk of depression (Teo, Choi, & Valenstein, 2013). Teo and colleagues (2013), in a longitudinal cohort study consisting of 4642 participants in the United States, found that the quality of relationships was a significant predictor of depression, but social isolation was not. This may indicate that the benefits of social relationships are more dependant on their quality than the frequency of social interactions per se. Increasing positive social interactions may be more important however for other conditions, such as social anxiety (Rapee & Heimberg, 1997).

It is likely that different CBT skills behaviours vary in importance for different populations, including demographic (e.g. age, gender) and clinical (e.g. comorbid, psychotic) populations (Hundt et al., 2013). For example, one study has found that cognitive skills are associated with better clinical outcomes in females undergoing CBT for depression (Sasso,

Strunk, Braun, DeRubeis, & Brotman, 2015). Another study found that more severely depressed individuals benefitted more from tangible problem-focused cognitive skills (Webb et al., 2012). This research area is still in its infancy, so future research should seek to explore and replicate these effects and assess other potentially important demographic, clinical, and psychological predictors and moderators of skills usage behaviours.

The mediation analysis also provided preliminary evidence that increased life satisfaction is mediated by skills usage behaviours; in particular, cognitive restructuring and engaging in rewarding behaviours. This is consistent with research indicating that engagement in behavioural activation skills is associated with higher life satisfaction (Manos et al., 2011). Another study investigating predictors of life satisfaction after CBT for anxiety and depression found that symptom reduction, but not changes in dysfunctional thinking, reliably predicted improved life satisfaction (Oei, McAlinden, & Cruwys, 2014). This contrasts with the finding in the current study that cognitive restructuring was a significant mediator of life satisfaction. It is important to note, however, that the current study measured the frequency that participants engaged in an active skill, as opposed to the Oei et al (2014) study, which assessed change in cognitive style. More research is required to understand the mechanism of how CBT improves life satisfaction and quality.

Limitations of this study include that the relationship between the mediating variable (skills usage) and outcomes (depression, general anxiety, and life satisfaction) in the mediation analyses were both assessed at post-treatment. So although the prospective relationship between X (treatment) and M (skills usage) was confirmed, we are unable to confirm that the increased skills usage had a causal effect on the outcome variables. It is plausible that the reductions in symptom outcomes may have increased skills behaviours or that symptom reduction may have increased engagement with the course, leading to greater

frequency of skills usage. It is important however to note that this mediation design, which controls for baseline scores on the mediator and outcome, is still superior to a purely cross-sectional analysis: where only the contemporaneous relationships between X, M and Y are assessed (Cole & Maxwell, 2003). As there are few studies investigating the mediational role of skills usage in iCBT for depression and general anxiety, the results from the current study will be informative for future studies aiming to implement full longitudinal mediation models.

Future research trials may include administering measures more frequently (e.g. weekly) for treatment and comparison conditions, or measuring mediator variables at key times during treatment when change on the mediator variables are likely to occur (Laurenceau et al., 2007; Lorenzo-Luaces et al., 2015). For example, skills usage in CBT could be measured on the weeks after an important skill has been taught to participants. However, there is currently little data to inform when these key times would be and when participants benefit most from CBT skills learned from CBT programs. Future research should aim to determine when increasing CBT skills usage is optimal in order to observe its effects on treatment outcome.

Another limitation of the study was the small sample size in the clinical subgroup mediation analysis, especially for the clinical depression group. Although bootstrap mediation models can work with low sample sizes (e.g. n = 25) (Preacher & Hayes, 2004) future studies should aim to replicate these findings in larger clinical samples to ensure they are reliable effects. It is also important to acknowledge the diagnostic limitations of the MINI, which has a tendency to be over-inclusive when compared with more structured interviews such as the Structured Clinical Interview for DSM (Sheehan et al., 1997). This means that there were likely some participants falsely meeting criteria for a disorder. However, the subsections of the MINI for diagnosing major depression and GAD have both been found to have good

sensitivity and specificity when using the Structured Clinical Interview for DSM-III-R as the benchmark (Sheehan et al., 1997).

Although this study provides more evidence for skills use frequency being a mechanism of change in CBT, it will be important for future studies to assess the mediating role of skills use quality as well. This will assist in providing a more wholistic view of the role that skills usage plays in treatment. It should however be noted that the FATS assesses core CBT skills, which are covered in the Wellbeing Course. This makes the FATS an appropriate measure to use in this study. Future research investigating skills use quality as a mediator of treatment should ensure that the instrument assesses skills that are relevant to the given treatment protocol.

The current study suggests that engaging in CBT skills usage behaviours, including cognitive restructuring, activity scheduling, and engaging in rewarding behaviours, are important behavioural mediators of change for depression and general anxiety symptoms in CBT. Skills usage may also be an important mechanism of change for improving life satisfaction in CBT. Investigating the role of various CBT skills, and effecting adaptive behavioural change, will be an important step in improving our understanding of how CBT interventions work and in improving clinical outcomes.

Chapter Five

Study IV: Predictors and Moderators of Skills Usage in iCBT for Depression and Anxiety

5.1 Introduction

The results of the studies in the previous chapters suggest that CBT skills usage is an important mechanism for depression and general anxiety symptom reduction in iCBT. However, there is currently limited evidence in the broader literature suggesting which variables predict increased skills usage behaviours. Understanding which patient characteristics predict skills usage will improve our understanding of skills usage as a mechanism of change (Kazdin, 2007). This information will also help to identify patients who will benefit most from skills-focused therapies and will enhance clinical outcomes generally (Hundt et al., 2013; Kraemer et al., 2002). The study in this chapter explores potential predictors of skills usage and variables that may moderate these relationships.

There are relatively few studies investigating predictors and moderators of CBT skills usage for depression and general anxiety symptom reduction. Furthermore, much of the literature focuses on comparing outcomes between CBT and other treatment models and do not specifically measure CBT skills usage; CBT is thus acting as a proxy for CBT skills usage. It is therefore important to exercise caution when drawing conclusions from the available research.

Age has been reported to be a general predictor of treatment in CBT for treatment-resistant depression, whereby older adults tend to benefit more than younger adults (Wiles et al., 2014). Consistent with this, a two-group RCT design comparing iCBT to internet-delivered interpersonal therapy (iIPT), found that older participants benefitted more from the iCBT condition (Donker et al., 2013). This study, however, did not directly assess the role of skills usage, but only suggested that older adults benefit more from CBT, which included components of skills usage.

A meta-analysis investigating the moderating role of gender between CBT and pharmacotherapy for depression found that gender did not moderate outcome between these two types of treatments (Cuijpers et al., 2014a). Although gender might not moderate the overall treatment effect for depression between CBT and medications, it is possible that the importance of skills varies as a function of gender. For instance, a recent study assessing moderators of skills usage in CBT for depression found that gender was a significant moderator of skill type and clinical outcomes (Sasso et al., 2015). Specifically, female participants benefitted more from cognitive-based techniques compared with their male counterparts. This study also found that higher pre-treatment anxiety, and fewer previous depressive episodes, were each (individually) significant moderators of skills usage and outcome. Those with higher pre-treatment anxiety benefitted more from behavioural techniques compared with those lower in pre-treatment anxiety, and those with fewer previous depressive episodes benefitted more from behavioural techniques compared with participants with a larger number of previous depressive episodes. This study also assessed age, baseline depression, and the presence of a personality disorder at baseline but failed to demonstrate that these variables were significant moderators of skills usage and outcome. This study is the most informative to date regarding interactions between patient characteristics and skills usage, but unfortunately had a small sample size (n = 57), indicating the need for further research and replication.

Symptom severity is another factor that has been explored in relation to CBT skills usage. Severely depressed patients benefitted more from using tractable and problem-focused cognitive techniques compared with less severely depressed patients (Webb et al., 2012). In contrast, a RCT comparing different treatments for depression found that individuals with severe and persistent depression benefitted more from a pure behavioural activation treatment compared with a CBT (Dimidjian et al., 2006). Although skills usage

was not measured in this study, the implication is that behaviour-focused skills usage may be more appropriate for severely depressed patients (Dimidjian et al., 2006; Jacobson et al., 1996). Another RCT comparing CBT with mindfulness-based therapy for anxiety disorders found that participants with higher baseline anxiety sensitivity and low baseline depression scores benefitted more from the CBT condition at post-treatment than the mindfulness condition (Arch & Ayers, 2013). The mindfulness intervention was found to be more effective for participants with higher baseline depression scores.

In summary, there are relatively few existing studies that investigate patient variables that predict skills usage in CBT. This is further limited by the fact that many of the available studies do not formally assess skills usage and thus CBT is being used as a proxy for skills usage. This approach can be informative as skills usage is a primary component in CBT and differentiates it from some other models of psychotherapy (Blagys & Hilsenroth, 2002). However, in most of these studies CBT skills usage is not quantified, so the unique contribution of skills usage, compared with other treatment components, cannot be accurately assessed.

This chapter utilises the results from studies two and three of this thesis to explore if pre-treatment variables and their interactions significantly predict skills usage in iCBT. As there is a dearth of evidence in this area and findings have been mostly inconclusive, no specific hypotheses are made and the analyses are intended to be exploratory.

5.2 Method

5.2.1 Design and Participants

Participants who provided post-treatment data in Study II (Chapter Three) (n = 109) and the active treatment group of Study III (Chapter Four) (n = 55) were combined (N = 164)

to explore predictors and moderators of CBT skills usage in iCBT for depression and general anxiety. The combined demographics of these samples are presented in Table 5.1.

5.2.2 Dependent Variables

CBT skills usage frequency, as measured by the FATS, at post-treatment and FATS change scores (post-treatment minus pre-treatment scores) were the dependent variables in the current study. Operationalising the dependent variables in these different ways allows a more in-depth analysis of how skills usage may operate. This approach is consistent with the exploratory nature of this study.

5.2.3 Predictor Variables

Selection of predictor variables was guided by the type of variables investigated in similar research trials (e.g. Donker et al., 2013). Predictor variables included demographic variables: age, gender, anxiety and depression medication usage, and education. Clinical variables used as predictors were the following: baseline depression, anxiety, disability, and life satisfaction. Interaction terms of each of these predictors were calculated to investigate if any moderated the predictor-outcome relationship.

5.2.4 Data Analysis

Chi square tests and one-way ANOVAs were conducted to ensure the participants from the two samples were equivalent, justifying their combination for subsequent analyses. Data of the overall sample were screened for skewness and kurtosis, and SPSS boxplots were used to assess outliers.

Table 5.1
Demographic Characteristics of Participants from the Two Samples

	Group			
	Study I (n = 109)	**Study II** (n = 55)	**Significance**	**Overall** (n = 164)
Gender				
Male	23 (21.1%)	6 (10.9%)	$\chi^2(1, N = 163) = 2.46$	29 (17.68%)
Female	86 (78.9%)	48 (87.3%)	$p = .12$	134 (81.7%)
Other	0 (0%)	1 (1.8%)		1 (0.6%)
Age (years)				
Mean (SD)	42.82 (10.69)	46.65 (12.02)	$F_{1, 162} = 4.32$; $p = .04$	44.10 (11.26)
Range	21 to 68	19 to 79	-	19 to 79
Baseline scores				
Mean PHQ-9 (SD)	10.02 (5.27)	10.56 (5.00)	$F_{1, 162} = 0.41$; $p = .53$	10.20 (5.17)
Mean GAD-7 (SD)	10.32 (5.36)	11.67 (5.40)	$F_{1, 162} = 2.31$; $p = .13$	10.77 (5.40)
Mean FATS (SD)	16.32 (7.47)	16.18 (7.38)	$F_{1, 162} = 0.02$; $p = .90$	16.27 (6.82)
Mean SDS (SD)	14.72 (6.99)	12.42 (7.54)	$F_{1, 162} = 3.78$; $p = .05$	13.95 (7.24)
Mean SWLS (SD)	16.61 (7.51)	16.42 (6.99)	$F_{1, 162} = 0.26$; $p = .87$	16.55 (7.32)
University Qualifications				
No	29 (26.6%)	12 (21.8%)	$\chi^2(1, N = 164) = 0.48$	41 (25.0%)
Yes	80 (73.4%)	43 (78.2%)	$p = .50$	123 (75.0%)
Currently taking medication for depression and/or anxiety				
No	75 (68.8%)	31 (56.4%)	$\chi^2(1, N = 164) = 2.48$	106 (64.6%)
Yes	34 (31.2%)	24 (43.6%)	$p = .12$	58 (35.4%)

Note. FATS = Frequency of Actions and Thoughts Scale; PHQ-9 = Patient Health Questionnaire-9 Item; GAD-7 = Generalized Anxiety Disorder- 7 Item; SDS = Sheehan Disability Scale; SWLS = Satisfaction With Life Scale. As one participant specified their gender as 'other', this participant was excluded from the gender chi square analysis.

Separate univariate regression analyses were used to identify significant predictors by examining the association between each predictor variable and the dependent variables. Following this, significant predictors were entered into a stepwise multiple regression analysis to investigate unique contributions of each of the significant predictor variables.

Moderation was assessed using the bootstrapping method, which was implemented through the PROCESS macro in SPSS, described by Hayes (2013). Post-treatment FATS scores and FATS change scores were entered as the dependent variable (Y), the predictor variables were entered as independent variables (X) or as moderating variables (M), such that each possible interaction (XM) was tested. Moderation is significant when the 95% confidence intervals of the estimated effect do not contain zero (Hayes, 2013).

PROCESS also produces output to probe moderation effects (interaction effects; i.e. the effect of the product XM on Y), as an analysis of simple slopes. When M is dichotomous, the conditional effects of X on Y are provided for both groups, as well as p-values to assess if the conditional effect is significant at a given level of the moderator. For continuous variables, the same information is provided at the mean of the sample and for one standard deviation below and above the mean. This is the default setting for output in PROCESS and is suitable for an exploratory analytic approach (Hayes, 2013). All predictor variables were mean-centred prior to moderation analysis and heteroscedasticity-consistent standard errors, estimated by the PROCESS macro, are reported. The effects in the current study were estimated from 10000 bootstraps (Hayes, 2013). Significant moderators were followed up with simple slopes analysis provided by PROCESS to probe the interaction.

One hundred and sixty-four (86.3%) participants provided data and were included in the analyses. Given the high response rate, and that there are assumptions and risks of

introducing artificial patterns with simulated data, missing data were not imputed; the current analyses employed observed data only.

5.3 Results

5.3.1 Sample Checks

Analyses revealed that the two samples did not differ significantly on baseline depression, general anxiety, disability, life satisfaction, and skills usage scores, nor did they differ on the demographic characteristics of gender, education, and medication use. The mean age of participants in sample two was significantly higher than sample one. However, given that the mean ages of both samples were within similar ranges, the two samples were combined for subsequent analyses. Demographic data and baseline scores for each sample and the combined sample are provided in Table 5.1.

5.3.2 Data Screening

Analyses conducted on predictor and dependent variables revealed no significant skewness or kurtosis in the data (defined as an SPSS skewness/kurtosis value ≥ two), suggesting that the data were normally distributed. Standardised residuals for the regression analyses were also found to be normally distributed. Boxplot analysis revealed one outlier, whose baseline FATS score was 2.88 standard deviations above the mean. This outlier was removed for subsequent analyses. There was one participant who reported their gender as 'other'. This participant's data were excluded for any analysis that involved gender as a predictor; their data were included in all other analyses.

5.3.3 Predictors Analysis

Tables 5.2 and 5.3 contain results from the prediction analyses, with post-treatment FATS scores and FATS change scores specified as the dependent variables, respectively. Baseline life satisfaction significantly predicted post-treatment FATS scores. There were no other significant effects. As there was only one significant predictor, the multiple regression analysis was not required.

5.3.4 Moderation Analysis

Tables 5.4 and 5.5 contain results from the moderation analyses, with post-treatment FATS scores and FATS change scores specified as the dependent variables, respectively. University education was found to significantly moderate the relationship between baseline GAD-7 and post-treatment FATS scores, and baseline GAD-7 and FATS change scores.

5.3.5 Simple Slopes Analysis

Simple slopes analyses were conducted for the significant effect of university education moderating baseline anxiety for post-treatment FATS and change in FATS score. For post-treatment FATS scores, although the overall interaction was significant, the simple slopes analysis revealed that the effects were not statistically significant at either level of the moderator (i.e. 1) no university qualification; 2) university qualification) (*ps* > .05). For change in FATS, both levels of the moderator significantly moderated the effect of baseline anxiety on FATS change. For participants without university qualifications, increasing baseline anxiety (GAD-7) predicted decreases in FATS change.

Table 5.2
Unstandardised Coefficients (*B*), Standard Errors (*SE*), 95% Confidence Intervals, Standardised Coefficients (*β*), and *P* values of Post-Treatment FATS Scores Regressed on Demographic and Baseline Variables

Predictor variable	*B*	*SE*	95% confidence intervals of *B*		*β*	*p* values
			Lower	Upper		
Gender	1.53	1.95	-2.32	5.38	0.06	.43
Age	0.09	0.07	-0.04	0.22	0.11	.17
Medication	-1.58	1.55	-4.63	1.47	-0.08	.31
Education	2.73	1.70	-0.62	6.09	0.13	.11
PHQ-9	-0.13	0.14	-0.41	0.16	-0.07	.38
GAD-7	0.04	0.14	-0.23	0.32	0.03	.75
SDS	-0.12	0.10	-0.32	0.08	-0.09	.24
SWLS	0.26	0.10	0.06	0.46	0.20	.01

Note. FATS = Frequency of Actions and Thoughts Scale; Gender is a binary variable (0 = female, 1 = male); Medication specifies participants taking medications for anxiety and/or depression prior to the current study and is coded as a binary variable (0 = not taking medication; 1 = taking medication); Education refers to university qualifications and is a binary variable (0 = non-university qualifications; 1 = university qualifications); PHQ-9 = Patient Health Questionnaire-9 Item; GAD-7 = Generalized Anxiety Disorder- 7 Item; SDS = Sheehan Disability Scale; SWLS = Satisfaction With Life Scale.

Table 5.3
Unstandardised Coefficients (B), Standard Errors (SE), 95% Confidence Intervals, Standardised Coefficients (β), and P values of FATS Change Scores Regressed on Demographic and Baseline Variables

Predictor variable	*B*	*SE*	95% confidence intervals of *B*		*β*	*p* values
			Lower	Upper		
Gender	0.53	1.52	-2.55	3.43	0.02	.77
Age	0.02	0.05	-0.08	0.13	0.04	.63
Medication	-0.92	1.20	-3.29	1.46	-0.06	.45
Education	2.04	1.32	-0.57	4.65	0.12	.12
PHQ-9	0.11	0.11	-0.11	0.33	0.08	.33
GAD-7	0.14	0.11	-0.07	0.35	0.11	.18
SDS	0.04	0.08	-0.12	0.19	0.04	.66
SWLS	-0.09	0.08	-0.25	0.07	-0.09	.26

Note. FATS = Frequency of Actions and Thoughts Scale; Gender is a binary variable (0 = female, 1 = male); Medication specifies participants taking medications for anxiety and/or depression prior to the current study and is coded as a binary variable (0 = not taking medication; 1 = taking medication); Education refers to university qualifications and is a binary variable (0 = non-university qualifications; 1 = university qualifications); PHQ-9 = Patient Health Questionnaire-9 Item; GAD-7 = Generalized Anxiety Disorder- 7 Item; SDS = Sheehan Disability Scale; SWLS = Satisfaction With Life Scale.

For participants with university qualifications, increasing baseline anxiety (GAD-7) predicted increases on FATS change. See Table 5.6 for results.

5.4 Discussion

Skills usage is an important mechanism of change in CBT. The aim of the current study was to investigate if certain variables predict skills usage behaviours in iCBT for depression and general anxiety. No reliable predictors of skills usage have been identified in studies of CBT or iCBT. We therefore have little evidence to indicate which patients are likely to experience greater changes in skills usage behaviours and how this may influence outcomes. The current study pooled data from the studies described in chapters three and four of this thesis to explore predictors of skills usage and if any of these variables moderated the predictor-outcome relationships. As there are no clear findings in the literature, the current study was exploratory and no specific hypotheses were made.

Linear regression analyses revealed that baseline life satisfaction positively predicted the frequency of skills usage behaviours at post-treatment. Although there are no previous studies investigating life satisfaction as a predictor of skills usage, several studies have investigated baseline quality of life as a predictor of treatment effect. A trial investigating predictors and moderators of iCBT and iIPT found that quality of life reported at baseline predicted reductions in depressive symptoms at the end of treatment in both treatment types (Donker et al., 2013). However, a three-group RCT of internet delivered therapy for depression, found that baseline quality of life was unassociated with significant clinical change (Warmerdam, Van Straten, Twisk, & Cuijpers, 2013). These equivocal results indicate additional research into the effect of life satisfaction as a predictor is warranted.

Table 5.4
Moderation Analysis of Baseline Variables in Predicting Post-Treatment FATS Scores

Predictor interaction terms	Interaction coefficient	Bootstrap SE	Bootstrap results for 95% CI of interaction effects	
			Lower	Upper
Gender x Age	0.18	0.15	-0.12	0.49
Gender x Medication	-0.44	4.15	-8.64	7.75
Gender x Education	-5.34	4.44	-14.12	3.43
Gender x PHQ-9	0.04	0.40	-0.74	0.83
Gender x GAD-7	-0.73	0.45	-1.63	0.16
Gender x SDS	0.25	0.31	-0.37	0.87
Gender x SWLS	-0.11	0.39	-0.89	0.66
Age x Medication	0.12	0.13	-0.14	0.38
Age x Education	-0.16	0.13	-0.42	0.10
Age x PHQ-9	0.01	0.01	-0.02	0.04
Age x GAD-7	0.00	0.01	-0.02	0.03
Age x SDS	0.01	0.01	-0.01	0.03
Age x SWLS	0.00	0.01	-0.02	0.02
Medication x Education	-3.23	3.79	-10.72	4.26
Medication x PHQ-9	0.11	0.30	-0.48	0.71
Medication x GAD-7	-0.52	0.30	-1.11	0.08
Medication x SDS	0.28	0.41	-0.54	1.11
Medication x SWLS	-0.15	0.27	-0.68	0.37
Education x PHQ-9	0.18	0.35	-0.51	0.86
Education x GAD-7	**0.71**	**0.35**	**0.02**	**1.40**
Education x SDS	-0.31	0.45	-1.21	0.59
Education x SWLS	0.58	0.38	-0.18	1.34
PHQ-9 x GAD-7	0.02	0.03	-0.04	0.08
PHQ-9 x SDS	0.04	0.02	-0.00	0.09
PHQ-9 x SWLS	-0.02	0.02	-0.07	0.02
GAD-7 x SDS	0.01	0.02	-0.03	0.06
GAD-7 x SWLS	-0.02	0.02	-0.06	0.03
SDS x SWLS	-0.02	0.02	-0.05	0.01

Note. FATS = Frequency of Actions and Thoughts Scale; Gender is a binary variable (0 = female, 1 = male); Medication specifies participants taking medications for anxiety and/or depression prior to the current study and is coded as a binary variable (0 = not taking medication; 1 = taking medication); Education refers to university qualifications and is a binary variable (0 = non-university qualifications; 1 = university qualifications); PHQ-9 = Patient Health Questionnaire-9 Item; GAD-7 = Generalized Anxiety Disorder- 7 Item; SDS = Sheehan Disability Scale; SWLS = Satisfaction With Life Scale.

Table 5.5
Moderation Analysis of Baseline Variables in Predicting FATS Change Scores

Predictor interaction terms	Interaction coefficient	Bootstrap SE	Bootstrap results for 95% CI of interaction effects	
			Lower	Upper
Gender x Age	0.01	0.18	-0.35	0.36
Gender x Medication	0.21	3.75	-7.19	7.62
Gender x Education	-2.88	3.99	-10.76	5.00
Gender x PHQ-9	-0.15	0.42	-0.99	0.69
Gender x GAD-7	-0.68	0.44	-1.55	0.19
Gender x SDS	0.27	0.27	-0.26	0.80
Gender x SWLS	0.17	0.36	-0.55	0.89
Age x Medication	0.17	0.12	-0.06	0.40
Age x Education	-0.04	0.12	-0.28	0.19
Age x PHQ-9	0.01	0.01	-0.01	0.03
Age x GAD-7	0.01	0.01	-0.01	0.03
Age x SDS	0.00	0.01	-0.01	0.02
Age x SWLS	-0.00	0.01	-0.02	0.01
Medication x Education	-2.37	3.19	-8.66	3.93
Medication x PHQ-9	-0.08	0.24	-0.56	0.39
Medication x GAD-7	-0.46	0.23	-0.92	0.00
Medication x SDS	0.15	0.16	-0.17	0.48
Medication x SWLS	-0.17	0.18	-0.52	0.19
Education x PHQ-9	0.03	0.30	-0.56	0.63
Education x GAD-7	**0.84**	**0.26**	**0.32**	**1.36**
Education x SDS	0.13	0.19	-0.24	0.51
Education x SWLS	0.35	0.29	-0.23	0.93
PHQ-9 x GAD-7	0.00	0.02	-0.04	0.04
PHQ-9 x SDS	0.01	0.02	-0.02	0.04
PHQ-9 x SWLS	0.01	0.02	-0.03	0.04
GAD-7 x SDS	0.01	0.01	-0.02	0.04
GAD-7 x SWLS	0.01	0.01	-0.02	0.04
SDS x SWLS	0.01	0.01	-0.01	0.03

Note. FATS = Frequency of Actions and Thoughts Scale; Gender is a binary variable (0 = female, 1 = male); Medication specifies participants taking medications for anxiety and/or depression prior to the current study and is coded as a binary variable (0 = not taking medication; 1 = taking medication); Education refers to university qualifications and is a binary variable (0 = non-university qualifications; 1 = university qualifications); PHQ-9 = Patient Health Questionnaire-9 Item; GAD-7 = Generalized Anxiety Disorder- 7 Item; SDS = Sheehan Disability Scale; SWLS = Satisfaction With Life Scale.

Table 5.6
Simple Slopes Analysis of Levels of University Education Moderating Effect of Baseline GAD-7 Scores on FATS Change Scores

Levels of Moderator	Effect	*SE*	95% confidence intervals of *B*		*p* values
			Lower	Upper	
No university qualification	-0.54	0.24	-1.01	-0.06	.03
University qualification	0.31	0.11	0.09	0.52	.01

Note. GAD-7 = Generalized Anxiety Disorder – 7-item; FATS = Frequency Actions of Thoughts Scale.

It is important to note that these two previous studies assessed significant symptom changes as the outcome variable, whereas the present study assessed skills usage as the primary outcome. Although these two outcomes can be seen as proxies for treatment response, they represent different aspects of treatment and caution must be taken when making conclusions based on the combined evidence. Furthermore, although life satisfaction predicted post-treatment FATS scores, life satisfaction was not a predictor of FATS change. This finding casts doubt on the reliability of life satisfaction being a true predictor of skills usage and suggests that the significant finding may be a result of the elevated type two error rate in the current analysis. More research is required to investigate if higher life satisfaction is a reliable predictor of skills usage.

Moderation analysis found that university qualifications significantly moderated the relationship between baseline general anxiety and the change in FATS across treatment, which was probed with a simple slopes analysis. This revealed that those without university qualifications had less positive change on the FATS as their baseline anxiety increased. The simple slopes analysis also revealed that those with university qualifications had more positive change on the FATS as their baseline anxiety increased. This finding suggests that

anxiety plays a different role in response to treatment for people with different education backgrounds. Having a university qualification might be an indicator that someone is more motivated or that they can persevere through challenging situations, such as completing a university degree or a self-directed treatment course. However, the general predictive effect of education level in the literature is inconsistent. Warmerdam et al (2013) found that patients with higher levels of educational attainment had better treatment outcomes in depression, whereas Donker et al (2013) failed to find this link. There is otherwise limited evidence that education level is a predictor of response to CBT for depression and available findings are inconsistent (Hamilton & Dobson, 2002).

Currently, no studies have found an interaction between baseline anxiety and educational attainment in predicting skills usage behaviours. In the current study the overall moderation effect of university education on the baseline-anxiety and skills usage behaviours outcomes (post-treatment FATS and FATS change) were significant. This consistency lends some credibility to there being a reliable interaction between general anxiety and educational attainment, however, the simple slopes analysis for post-treatment FATS was not statistically significant, so caution must be taken with interpreting this effect. Again, more research is required to replicate this effect to determine its reliability.

Overall, the lack of significant findings suggests that baseline variables and demographic characteristics do not appear to reliably predict who demonstrates greater skills usage by the end of treatment. This implies that many different types of patients undergoing CBT can learn and benefit from skills usage and adaptive behavioural change. Future research utilising larger sample sizes could investigate if the mediating role of skills usage behaviours operates differently between different populations. This could be done using moderated mediation analysis (Preacher, Rucker, & Hayes, 2007).

The current analysis has several important limitations. First, the analysis was exploratory and there were a high number of analyses conducted, thus elevating the type II error rate. Therefore, the significant findings need to be taken with caution and future trials would need to be conducted to reliably establish if they are truly significant predictors of skills usage. Another limitation is that the analyses only assessed the frequency of skills usage behaviours. It is not known if any of the predicted variance of skills usage was also associated with clinically important symptom reduction. Although, as found in Chapter four, the FATS was a significant mediator of the treatment effect. This implies that increases in FATS and a higher FATS score by the end of treatment is beneficial.

Future research should also investigate the link between other relevant symptom clusters that CBT is used for, such as social anxiety and panic symptoms, as well as relevant traits and characteristics that may be important in predicting skills usage. This includes variables such as self-efficacy and motivation for change. Future research would also benefit from investigating if any variables predict quality of skills usage by the end of treatment. This would be useful to observe if any particular demographic or clinical group vary in their understanding or the way they relate to different skills that goes beyond the frequency of skills use.

This study explored the potential predictive role of demographic and clinical variables of skills usage in iCBT for depression and general anxiety. The results suggest that those with higher life satisfaction at the start of treatment, as well as those who have university qualifications and have higher anxiety prior to treatment, may respond better to CBT treatments. As the analyses are exploratory, caution should be taken with the significant findings and more research is required to establish if they are reliable predictors of skills usage. As the current analysis found very few significant predictors, it is suggested that skills-

focused interventions are appropriate for all of the demographic and clinical subgroups involved in this analysis. Skills usage is likely an important mechanism of therapeutic change for many types of patients.

Chapter Six

General Discussion

6.1 General Summary

Symptoms of depression and general anxiety are common and cause significant burden. iCBT is an efficacious treatment but there is a paucity of research investigating how iCBT works. Improved understanding of the mechanisms of change will help develop more efficacious and efficient treatments for these disorders. The current thesis investigated the usage of CBT skills as a potential mechanism of change for this treatment.

Although instruments assessing the frequency of skills usage existed at the time of planning this thesis (e.g. Jacob et al., 2011; Jarrett et al., 2011), certain aspects of these measures, including that some used complicated language, had limited skills coverage, or contained a large number of items, limited their utility to investigate skills usage as a mechanism of change. Thus, the first challenge of this thesis was developing an instrument suitable for assessing the frequency of skills usage over treatment. This measure needed to assess the core skills whilst also being brief and able to be administered at key times during treatment (Kazdin, 2007).

Study I (Chapter Two) of this thesis utilised a sample (N = 661) of individuals with varying symptom severity to develop a questionnaire assessing the frequency of core CBT skills. The resultant measure, the FATS, comprised items assessing the skills of cognitive restructuring and aspects of behavioural activation. Using a method of exploring then

confirming the factor structure of the items, the FATS was found to have a reliable factor structure, with a four-factor solution characterising the data. These four factors represented: cognitive restructuring, social interactions, rewarding behaviours, and activity scheduling. The FATS was also shown to be negatively associated with symptom scores (PHQ-9, GAD-7, and SDS) and positively associated with a measure of behavioural activation (BADS-SF) and life satisfaction (SWLS); this provided preliminary support for its convergent validity.

The next step was to replicate and extend these findings in the context of treatment and to obtain preliminary data on the trajectory of skills usage changes during treatment. In Study II (Chapter Three), the FATS was administered to a treatment-seeking sample (n = 125), with clinical symptoms of depression and general anxiety, undergoing an eight-week iCBT course. A confirmatory factor analysis was conducted, which again found that the factor structure was reliable and additional analyses further supported the validity of the FATS and its subscales, extending these findings to a clinical population. Furthermore, skills usage was found to increase over treatment, which was associated with a reduction in symptoms. This data provided preliminary support for the proposition that skills usage is involved in the process of symptom reduction in iCBT for depression and anxiety. However, as this study used a single-group design and the results were mainly correlational, questions regarding the treatment's causal role in increasing skills usage frequency and the mediating role of skills usage on symptom reduction remained.

Study III (Chapter Four) aimed to shed light on these questions by using a two-group RCT design: treatment (n = 65) vs waitlist control (n = 75). The results indicated that skills usage only increased in the treatment group, suggesting that iCBT increases frequency in skills usage behaviours. Mediation analysis found that the decreased symptoms observed in the treatment group were statistically mediated by the increased skills usage. Individual

mediation analyses specifying the FATS subscales as the mediator variables found that the skills of cognitive restructuring, engaging in rewarding behaviours, and activity scheduling were each significant mediators of depression and anxiety symptom reduction, while social interactions were not significantly related. These findings were replicated within the clinical subsamples meeting diagnostic criteria for MDE and GAD, with the exception that engaging in rewarding behaviours was not significant mediators of depression reduction in the MDE group.

An important limitation of the mediation analyses in the third study is that the mediating variables (skills usage) and the outcome variables (depression and anxiety) were assessed concurrently. It therefore cannot be established that the changes in skills usage occurred prior to the reductions in symptoms. Unfortunately, this means that the timeline criterion outlined by Kazdin (2007) was not fully met by this study.

With evidence consistent with the notion that skills usage is an important mediator of symptom reduction, the next step was to investigate if the importance of skills usage varied as a function of patients' pre-existing demographic and clinical variables. Study four pooled the data from studies two and three to explore predictors and moderators of skills usage. Univariate regression analyses revealed that baseline life satisfaction significantly predicted FATS scores at post-treatment. Moderation analyses and follow-up simple slopes analyses revealed that university qualifications moderated the relationship between baseline anxiety and FATS pre-post treatment change scores. Participants with university qualifications had greater change on the FATS as their baseline anxiety increased. Participants without university qualifications had less change on the FATS as their baseline anxiety increased. However, as there were relatively few significant variables or moderators predicting skills

usage, it is concluded that skills usage is likely an important factor for most patients undergoing treatment.

In combination, the studies reported in this thesis contribute to better understanding the mechanisms of change in iCBT for depression and general anxiety and suggest that increasing the frequency of skills usage behaviours may be an important general driver of symptom reduction. The current thesis also has contributed a new self-report instrument, the FATS, which is suitable for assessing the frequency of skills usage behaviours in mechanism research.

6.2 Relation to Existing Research

The development and validation of the FATS is comparable to development of other measures of skills usage. The CBTSQ (Jacob et al., 2011), SoCT (Jarrett et al., 2011), CCTS (Strunk et al., 2014), CBRSS (Miner et al., 2015), and BADS-SF (Manos et al., 2011) each subjected items to exploratory factor analysis for item selection, and the CBTSQ, CBRSS, and BADS-SF also used confirmatory factor analysis to confirm the reliabilities of the factor structures for these measures. Consistent with the latter three measures, the FATS items were also subjected to an exploratory factor analysis then a confirmatory factor analysis using independent samples. Similar to the FATS, construct validity for these other instruments were assessed through their relationships with relevant clinical measures including symptom measures and existing skills usage measures.

The FATS has many similarities, but some important differences, with the existing measures. Unlike the BADS-SF, the FATS targets both cognitive and behavioural skills. The CBTSQ, SoCT, CCTS, and CBRSS contain items covering both cognitive and behavioural skills but they do not further delineate behavioural skills and are thus unable to quantify the

unique contributions these different domains may exert on symptom reduction. Furthermore, the FATS uses very simple language and has relatively few items. In comparison, the SoCT contains several technical terms, making it unsuitable for collecting baseline assessments, and the CCTS has a relatively high number of items at 29. This makes the FATS a suitable choice for mechanism research as it covers a wide array of CBT skills and is short and simple to administer.

The results of the current thesis are consistent with other studies investigating the relationship between CBT skills usage and symptom outcomes. Most of these studies have demonstrated that greater skills usage is associated with reductions in depression symptoms and have predominately used face-to-face CBT treatments (Hundt et al., 2015; Jacob et al., 2011; Jarrett et al., 2011; Manos et al., 2011; Miner et al., 2015; Strunk et al., 2014).

Trials assessing skills usage during CBT for depression have found small to large increases in the frequency of skills usage behaviours, ranging from Cohen's *d* of 0.38 – 1.41, using the CBTSQ, CBRSS, CCTS-SR, and SoCT (Hundt et al., 2015; Jacob et al., 2011; Jarrett et al., 2011; Manos et al., 2011; Miner et al., 2015; Strunk et al., 2014; Webb et al., 2016). In the single-group trial (Study II) of the current thesis, the pre-post effect size increase was $d = 0.90$, and was $d = 0.66$ in the treatment group of the RCT (Study III), which fit within the range observed in the literature. The wide range of scores among these various studies is likely due to the fact that different measures of skills usage are being used and that treatment protocols vary between studies.

Methods assessing the relationship between change in skills usage frequency during treatment and reduction in depression symptoms vary considerably in the existing literature. Hundt and colleagues (2015) regressed post-treatment depression scores onto the pre to mid-treatment skills usage change scores, finding a β of -.29. Jacob and colleagues (2011) used

hierarchical multiple regression, regressing post-treatment depression scores onto skills usage change scores. They found βs of -.15 and -.30 for cognitive restructuring and behavioural activation, respectively. Miner and colleagues (2015) used hierarchical linear regression, entering baseline skills usage scores in the first step, to predict residualised change in depression scores from skills usage frequency at post-treatment (step two). They found a significant ΔR^2 of .31 for total skills frequency. Strunk and colleagues (2014) calculated residualised change scores of skills usage as a predictor of post-treatment depression controlling for baseline depression. They found a β of -.49. Another study investigating the predictive role of CBT skills for psychiatric in-patients, using repeated measures regressions, found that behavioural activation (b = -.16), but not cognitive restructuring, skills predicted subsequent reductions in depression symptoms (Webb et al., 2016).

In comparison with these studies, Study II (Chapter Three) of the current thesis assessed the correlation between residualised change scores of skills usage and depression, finding an r of -.30. The results of the current thesis relating skills usage to depression over treatment are therefore largely consistent to other studies.

The aforementioned studies have each been single-group trials reporting correlational data and there are relatively few studies with control groups to address spontaneous fluctuations in CBT skills usage. However, a study of iCBT for subthreshold depression, which utilised an enhanced treatment-as-usual comparison group (n = 204), found that those in the iCBT group (n = 202) reported significantly greater engagement in behavioural activation as measured by the BADS-SF (Buntrock et al., 2015). Consistent with this study, Study III (Chapter Four) of the current thesis also demonstrated a causal relationship between iCBT and increased skills usage, which includes skills related to behavioural activation as well as cognitive restructuring.

The majority of the studies in this area have investigated skills usage specifically in individuals with clinically significant depression (e.g. Buntrock et al., 2015; Hundt et al., 2015; Jacob et al., 2011; Jarrett et al., 2011; Manos et al., 2011; Miner et al., 2015; Strunk et al., 2014). The study by Jacob and colleagues (2011) utilised a psychiatric in-patient population with various psychiatric conditions; though dominant diagnoses were mood disorders (66%) and anxiety disorders (22%). Although they did not use a specific measure of anxiety symptoms, they did find that skills usage predicted reduction of general psychiatric symptoms, which included anxiety. Changes in skills usage over treatment predicted post-treatment psychiatric symptoms (βs: -.22 to -.31). This is comparable to the results found in Study II (Chapter Three) of the current thesis between the FATS and the GAD-7 (r = -.28). Contrary to this, Webb and colleagues (2016) used the GAD-7 as an outcome measure in their study, but did not find that skills usage predicted subsequent reductions in anxiety symptoms.

Surprisingly, few research trials have investigated the mediating role of skills usage for symptom reduction. A study assessing regular automated emails containing helpful behaviours for people experiencing symptoms of depression found that increases in these helpful behaviours statistically mediated reductions in symptoms (Morgen et al., 2013). Although the suggested behaviours were consistent with CBT principles, the intervention itself was not a CBT program. Study III (Chapter Four) of the current thesis used a similar analytic approach as this study, but utilised a structured iCBT program, and similarly found that increased skills usage mediated reduction in symptoms of depression and also anxiety.

The few available studies investigating predictors and moderators of skills usage have been unable to find reliable predictors of skills usage (e.g. Donker et al., 2013; Warmerdam et al., 2013; Webb et al., 2012). Results from the current thesis investigated variables that have been shown to be significant predictors such as age (Donker et al., 2013), gender (Sasso et al.,

2015), and symptom severity (Webb et al., 2012), but failed to replicate these effects. This may indicate that skills usage likely does not vary in importance amongst different populations, but much more research is required before any firm conclusions can be drawn.

Overall, the results of the current thesis are commensurate with the available literature, which generally shows that CBT skills usage behaviours are associated with reductions in depression. There are currently much fewer studies investigating the link between skills usage and anxiety symptoms. Results from the current thesis and the existing literature are mixed, though are more in favour of the position that skills usage is associated with reduced anxiety symptoms. Nevertheless, more research investigating skills usage for anxiety is warranted. The current results add to the emerging body of evidence for skills usage in iCBT but also have implications for other modes of treatment.

6.3 Theoretical Implications

This thesis set out to test underlying assumptions of iCBT and CBT theory more generally. CBT is based on the premise that depression and anxiety result from a combination of dysfunctional thinking and maladaptive behaviours with the aim of treatment to address these (A.T. Beck et al., 1979; Ellis, 1980; Hofmann et al., 2013). Teaching patients cognitive and behavioural skills that they can utilise themselves is one of the mechanisms of clinical improvement proposed by CBT theory (A.T. Beck et al., 1979; Hundt et al., 2013). iCBT models are also based on the assertion that clinical change occurs through adaptive behavioural changes, such as increasing CBT skills usage behaviours and completing homework tasks to practice these skills (Andersson & Titov, 2014; Andrews et al., 2010; Ritterband et al., 2009; Titov et al., 2015b).

The current studies address several of the requirements of a mediator of therapeutic change as outlined by Kazdin's (2007) framework. These are: strong association, consistency, and coherence. For 'strong association', the current studies found statistically significant relationships between treatment, skills usage, and symptom outcomes. The relationship between skills usage and symptom reduction was replicated throughout each of the studies, which helps to address the requirement of 'consistency'. As mentioned above, the current findings are also consistent with similar studies conducted by other research teams, that skills usage is associated with symptom reduction (e.g. Hundt et al., 2015; Jacob et al., 2011; Jarrett et al., 2011; Miner et al., 2015; Strunk et al., 2014). This and the consistency of the current results with CBT theory more generally support the criterion of 'coherence'.

Two of Kazdin's criteria were partially fulfilled. In Study III (Chapter Four), which used a RCT design, iCBT was found to cause increases in skills usage, which had significant relationships with symptom outcomes. This provides some support for the 'experimental manipulation' criterion. However, additional highly controlled laboratory experiments specifically manipulating the type and quantity of skills usage could provide additional information about how it works and strengthen its case as a mediator of clinical change. Similar to this point, the criterion of 'gradient' was also partially fulfilled. Although skills usage itself was not experimentally manipulated in the current thesis, correlation analysis suggested that greater activation of skills usage was associated with greater symptom reduction. Experimentally manipulating the dose-response relationship would be a stronger method of assessing this criterion.

Finally, two of the criteria were not satisfactorily addressed in the current thesis. In terms of 'specificity', the current studies were not aimed at ruling out alternative plausible mediators of change. Future research is required to investigate other plausible mechanisms,

especially alongside skills usage to assess their relative effects on treatment outcome. The criterion of establishing a 'timeline' between the treatment, mediator, and outcome was also not fully established in the current thesis as the mediator and outcomes were assessed simultaneously; although the prospective relationship between treatment and the mediator was established in Study III (Chapter Four). A compelling case for the role of skills usage as a mediator of clinical change will be to demonstrate that changes in skills usage temporally precede then predict subsequent symptom reductions.

Overall, three of Kazdin's requirements were satisfactorily fulfilled (strong association, consistency, and coherence), two were partially fulfilled (experimental manipulation and gradient), and two were not addressed satisfactorily (specificity and timeline). The current thesis adds much groundwork investigating skills usage as a mechanism of change in iCBT. Future research is required to address the remaining criteria.

The results of the studies in this thesis support the role of adaptive behavioural change as an important driver of clinical improvement in iCBT. The results from these studies are some of the first in iCBT to demonstrate that this treatment increases skills usage behaviours and that this statistically mediates symptom reduction. These results thus support the theoretical CBT model for which both iCBT and face-to-face CBT is based on (Andersson & Titov, 2014; A.T. Beck et al., 1979).

6.4 Practical Implications

The findings of the current thesis suggest the importance of including components aimed at teaching practical skills when designing iCBT interventions for depression and anxiety. Although the methods assessing the relationships between symptoms and skills usage in the current thesis differ slightly from the existing face-to-face CBT literature, the effect

sizes are comparable. Based on these findings it seems plausible to suggest that skills usage is also an important mechanism of clinical change in face-to-face CBT as well. The findings also suggest that programs and clinicians may benefit from actively facilitating the frequency of these behaviours in patients.

As skills usage was found to be associated with symptom outcome, measuring the frequency of skills usage during treatment may also be a convenient way of assessing patients' engagement with the treatment. This may be informative for identifying patients who are not engaged with treatment or who are unlikely to benefit. The FATS is a convenient instrument to assess this with. Although the FATS was used in online treatment in this thesis, the items themselves do not explicitly refer to any exclusive aspect of online treatment, meaning it can also be administered in face-to-face treatment settings.

The results of these studies have also demonstrated that iCBT is a suitable format for conducting CBT mechanism research generally. The component of skills usage as a mechanism of change was able to be assessed with greater treatment fidelity than face-to-face CBT as the self-guided format is less susceptible to confounding factors such as therapist drift (Andersson, 2009).

6.5 Limitations

Despite the promising results obtained in the current studies, there are some important limitations of the research that need to be taken into consideration.

Sample Representativeness

Participants in the current thesis were an online-treatment-seeking sample who were self-referred. This limits the generalisability of the results to the broader clinical population. However, research comparing patient characteristics between internet-treatment-seeking and outpatient clinic samples have found them to be generally similar on demographic and clinical variables (Titov et al., 2010). This indicates that inferences made regarding skills usage as a mechanism of change in iCBT may also apply to the broader clinical population if they were to engage in iCBT.

Comparison Conditions

Study III (Chapter Four) employed a waitlist group as the control condition. Given that the aims of the thesis were to assess the mediational role of skills usage in iCBT, as opposed to assessing the efficacy of treatment, a waitlist group was an appropriate option. However, utilising active comparison groups, such as alternative models of treatment (e.g. internet-delivered interpersonal psychotherapy), would have provided additional important information regarding the specificity, or non-specificity, of skills usage as a mechanism of change in iCBT. The current thesis provides preliminary evidence for future research to build upon to test these questions of the specificity of this mechanism of change.

Sample Sizes

The sample size for Study I (Chapter Two) ($N = 661$) was adequate for the purposes of using exploratory and confirmatory factor analysis in the development of the FATS (Floyd & Widaman, 1995). Sample sizes in Study II (Chapter Three) ($n = 125$) and Study III (Chapter Four) ($N = 141$) were also adequate to detect at least moderate within and between-group

effects on symptom and skills usage outcomes. The sample sizes for the mediation analyses for the clinical subgroups, particularly for the clinical depression group, were low. As other similar mediation analyses are scarce, it is difficult to approximate a minimum adequate sample for these analyses. Although the bootstrapping approach is suitable for low sample sizes (Preacher & Hayes, 2004), caution is required when interpreting these findings. Replication of these results is required to have confidence that these effects are reliable.

The predictor analyses conducted in Study IV (Chapter Five) were also likely to be underpowered to detect small to moderate effect sizes. A more productive method for the exploration of predictors and moderators might be to subject data from multiple studies into a meta-regression analysis to obtain the desired power.

What Does Frequency of Skills Usage Represent?

Although the studies in this thesis found evidence that skills usage was a statistical mediator of symptom reduction, the studies could not rule out the possibility that skills usage plays a non-causal role in treatment. For instance, reductions in symptoms may have driven increases in skills behaviours. It is also plausible that symptom decreases may have increased treatment adherence, which was represented by greater engagement in skills usage. Another alternative explanation is that skills behaviours are the inverse of behaviours associated with depression and anxiety. This would mean that the presence of skills behaviours indicates the absence of symptoms. More research teasing these processes apart will be necessary to gain a complete understanding of the precise role that skills usage plays in therapy.

Diagnostic Interview

The use of the MINI presents a convenient way of assessing clinical diagnoses, but does have a tendency to be over-inclusive with diagnosis compared with more highly structured clinical interviews, such as the Structured Clinical Interview for DSM-III-R (Sheehan et al., 1997). It should be noted though that the MDE and GAD subscales of the MINI, have both been found to have good sensitivity and specificity in relation to the Structured Clinical Interview for DSM-III-R (Sheehan et al., 1997). This is important considering that MDE and GAD were the primary disorders of interest in this thesis.

Methodological and Statistical

As mentioned previously, a notable flaw of this thesis was the design limitation in Study III (Chapter Four), where the mediator (skills usage) and the outcome measures (symptoms and life satisfaction) were measured at the same time. This design prevents concluding that increases in skills usage were causing symptom reductions.

A variety of approaches to mediation analyses exists (MacKinnon et al., 2007) and there is no general consensus as to the most preferred approach in the context of clinical psychology research (Cole & Maxwell, 2003). Although there does appear to be consensus that models employing the causal steps methodology, made famous by Baron and Kenny (1986), are generally underpowered and will likely give biased estimations of indirect effects (Shrout & Bolger, 2002; MacKinnon et al., 2007; Preacher & Hayes, 2004). More recent models employing parametric bootstrapping (e.g. Preacher & Hayes, 2004) and structural equation modelling (e.g. Cole & Maxwell, 2003) have gained prominence as they are able to address the shortcomings of the causal steps mediation models (MacKinnon et al., 2007). Given the modest sample sizes in Study III (Chapter Four), bootstrapping was the most

appropriate method as it performs adequately with smaller sample sizes (Shrout & Bolger, 2002).

6.6 Future Research

There are many questions that remain unanswered and many avenues for future research that would advance our knowledge in the area of mechanisms of change in iCBT for depression and anxiety, and psychotherapy more generally.

Measurements of Skills Usage

As with all questionnaires, the items on the FATS should be refined to improve its clinical and research utility and to remain a contextually relevant instrument. Future research administering the FATS in both research and frontline clinical practice contexts will be useful in further assessing its validity and provides opportunities for further refinement via feedback from researchers, clinicians, and patients. Future iterations of the FATS may include rewording current items to make them more clinically relevant as well as creating new items to assess other types of skill domains (such as graded exposure). As an ideal clinical instrument, a future iteration of the FATS would contain additional subscales that assess different skills, which can be added or subtracted from the measure to reflect the different aims of researchers and clinicians. For example, a clinician might wish to only track cognitive restructuring and social interaction skills of a patient and thus would not administer the other subscales. This would be useful for targeted research and clinical aims whilst reducing burden on participants/patients. These potential subscales need not be confined specifically to core

CBT skills. Subscales related to problem-solving therapy or acceptance and commitment therapy, such as mindfulness, could also be included.

Future research administering the FATS in other clinical samples is also required to extend its validity and reliability. The current studies utilised internet-treatment-seeking samples who self-referred for research trials. Administering the FATS in applied clinical settings, such as out and in-patient clinics and primary care settings, will help to assess its validity as a clinical tool.

Quality of skills usage may also be an important aspect to assess as it is possible that individuals are using the skills but may not be using them competently (Hundt et al., 2013). However, both the SoCT (Jarrett et al., 2011) and the CCTS (Strunk et al., 2014) studies found that therapists' assessment of their patients' skills usage had similar patterns in predicting clinical outcomes as patients' self-report on these respective measures. This provides confidence that patient self-report may be as reliable as clinician assessment. The difficulty with assessing quality of skills usage is that it requires a trained clinician to assess, which increases the time and cost of doing this kind of assessment. There is currently no clear way to assess quality of skills usage that does not depend on a human assessor. As self-report is comparable to clinician judgement, it may be preferable to use self-report given its additional convenience.

Skills Usage as a Mechanism of Change

As mentioned above, although the current results support skills usage as a mechanism of change, several requirements for establishing a mediator of change (Kazdin, 2007; Nock, 2007; Johannson & Hoglend, 2007) were not fully addressed. Chief amongst these is the

demonstration of the causal timeline between changes in skills usage and reduction in symptoms. Future research would benefit from using a similar design as was used in Study III (Chapter Four), but to measure symptoms and skills usage during the waitlist period for the control group. This would allow for assessing the mediational effect of changes in skills usage during treatment on symptom reduction observed after treatment. A positive finding with this kind of research design would address the timeline issue of mechanism research (Kazdin, 2007) and provide compelling evidence that skills usage is a causal mechanism of clinical change. Caution with questionnaire presentation would be required as constant exposure to a list of adaptive behaviours (i.e. the FATS) could potentially increase the frequency of these behaviours. This could be addressed by limiting the number of presentations of the FATS to the weeks that correspond to key times in the treatment group, such as after an important skill has been taught.

Further research experimentally manipulating skills usage type and dosage (e.g. time spent by a clinician teaching skills, or the number of modules included in a treatment program) would provide additional information about its mechanistic role in treatment. Using dismantling studies, where certain treatment components are added or removed from treatment conditions (e.g. Jacobson et al., 1996), is a potential method of assessing the relative effect of skills components to one another and to other treatment components (e.g. psychoeducation and therapeutic alliance).

Who Does Skills Usage Work For?

Investigating predictors and moderators of change can be informative for describing how mechanisms of change work (Kazdin, 2007; Nock, 2007). A more complicated technique for investigating who a mediator works for is 'moderated mediation' (Preacher et al., 2007),

which tests if mediation is conditional on another variable. For example, moderated mediation analysis could test if skills usage is a mediator of change for one gender but not the other.

Moderated mediation could be useful in investigating questions of who skills usage works for, but requires large samples to ensure there is sufficient variance in the subgroups being tested. As there are few studies investigating predictors of skills usage, and the existing evidence is inconsistent, there is currently little empirical support to suggest a potential candidate variable for this investigation. Prediction analyses, utilising large clinical samples would be a good first step to inform subsequent targeted moderated mediation analyses.

Mechanism of Skills Usage

The current studies provided evidence consistent with the proposition that skills usage is an important mechanism of change in iCBT. If this proposition is true, it raises another question of theoretical and practical interest: what is the mechanism of skills usage? Or in other words, what is it about skills usage that brings about clinical change? There are many potential explanations for this question. For instance, it could be that skills usage leads to or facilitates new learning or that engaging in skills usage behaviours increases one's self-efficacy, providing more confidence to deal with stressors.

Future research utilising both clinical trials and experimental research designs will help further understanding in this area. Large clinical trials utilising multiple measures of potential mechanisms of skills usage, such as self-efficacy and dysfunctional attitudes, will allow exploration of their relationships with skills usage and clinical outcomes. These results could then inform laboratory-based mechanism research studies using more tightly controlled experimental research designs to uncover the underlying processes.

A greater understanding of the underlying mechanism of skills usage might uncover more fundamental principles of increasing psychological wellness and decreasing dysfunction. A comprehensive understanding of these processes may lead to the development of novel treatment techniques that adhere to an underlying principle, but may manifest as different types of skills or as qualitatively different entities altogether. Practical clinical applications aside, this would also shed light on understanding processes between behaviours and cognitions more generally.

Exploring Other Mechanisms of Change in iCBT for Depression and Anxiety

Identifying and investigating other potential mechanisms of change in iCBT for depression and anxiety will further improve our knowledge of how to optimise treatment to maximise clinical outcomes and efficiency. The current literature within iCBT is very limited, though a meta-analysis investigated mechanisms of change using RCTs of iCBT for depression and found that cognitive changes, such as reductions in dysfunctional attitudes, were associated with symptom reduction (Muresan et al., 2012). Warmerdam, van Straten, Jongsma, Twisk, and Cuijpers (2010) also carried out a mediation analysis for iCBT and internet-delivered problem solving therapy for depression, compared to a control group, and found that reductions in dysfunctional thinking, worrying, a negative problem orientation, and increases in perceived control, were each significant mediators of symptom reduction. Their design was also unable to determine whether change on these mediators temporally preceded symptom reduction in the mediation analysis.

Although little is known about mechanisms of change in iCBT, the existing literature and the results from the current thesis suggest that cognitive changes and skills usage behaviours are prime candidates for further investigation. Addressing the timeline issue

appears to be the greatest challenge in this area of research. Addressing this issue may involve administering assessments at more frequent intervals, for both treatment and control conditions, or measuring putative mediators at key times when they are likely to change (Laurencreu et al., 2007; Lorenzo-Luaces et al., 2015); for example, measuring skills usage the week after an important skill was learned. This still does not guarantee that change will be captured in the assessment. It is possible that changes on mediators and symptoms, particularly cognitive mediators, can occur simultaneously, or occur within a much shorter time range (e.g. minutes) than the time between assessments (e.g. weekly) (Lorenzo-Luaces et al., 2015).

Advances in and proliferation of mobile devices (e.g. smartphones) may offer solutions to these issues as they afford assessments to be made in real-time, helping to increase the frequency and convenience of assessments. Several studies have demonstrated that daily symptom assessments using smartphone applications for individuals with psychotic symptoms have relatively high compliance, patient satisfaction, and assessment scores correspond with other validated assessment methods (Palmier-Claus et al., 2012; Ainsworth et al., 2013). This may present a viable solution to addressing timeline issues in mechanism research.

6.7 Conclusion

There is much evidence supporting the efficacy of iCBT for depression and general anxiety (Andersson et al., 2015; Cuijpers et al., 2014a; 2014b). There is sparse evidence, however, describing the mechanisms of therapeutic change for this treatment. The current thesis set out to investigate the mechanistic role of CBT skills usage and to answer these three questions: 1) Does iCBT for depression and general anxiety increase the frequency of skills

usage behaviours? 2) Do increases in the frequency of skills usage mediate treatment effects? and 3) What variables predict skills usage during treatment?

This thesis provides evidence that iCBT does increase the frequency of skills usage behaviours, and that these increases statistically mediated symptom reduction; though this latter finding requires additional research to determine if changes in skills usage temporally precede symptom reduction to make firm causal claims. The results indicated that life satisfaction and the interaction between university qualifications and baseline anxiety were significant predictors of skills usage over treatment. Overall, the results suggest the importance of skills usage behaviours in iCBT and are consistent with the proposition that skills usage is a causal mechanism of therapeutic change.

Outstanding questions that have arisen from this work include understanding how skills usage itself operates to achieve its effects and what is the relative effect, and relationship, between skills usage and alternate plausible mechanisms on clinical outcomes. Further research investigating the mechanisms of change for iCBT will help to improve clinical outcomes and efficiency of treatment delivery, benefiting patients and society.

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MACQUARIE UNIVERSITY

MATTHEW TERIDES <matthew.terides@students.mq.edu.au>

Approved- Ethics application- Titov (Ref No: 5201300452)

1 message

Ethics Secretariat Mon, Jul 1, 2013 at 4:07 PM
To: A/Prof Nick Titov
Cc: Dr Blake Dear , Mr Matthew Dean Terides

Dear A/Prof Titov

Re: "Towards better measurement of behavioural change during psychotherapy" (Ethics Ref: 5201300452)

The above application was reviewed by the Human Research Ethics Committee (Human Sciences and Humanities) at its meeting on 28/06/2013. Approval of the above application is granted, effective 01/07/2013. This email constitutes ethical approval only.

This research meets the requirements of the National Statement on Ethical Conduct in Human Research (2007). The National Statement is available at the following web site:

http://www.nhmrc.gov.au/_files_nhmrc/publications/attachments/e72.pdf.

The following personnel are authorised to conduct this research:

A/Prof Nick Titov
Dr Blake Dear
Mr Matthew Dean Terides

NB. STUDENTS: IT IS YOUR RESPONSIBILITY TO KEEP A COPY OF THIS APPROVAL EMAIL TO SUBMIT WITH YOUR THESIS.

Please note the following standard requirements of approval:

1. The approval of this project is conditional upon your continuing compliance with the National Statement on Ethical Conduct in Human Research (2007).

2. Approval will be for a period of five (5) years subject to the provision of annual reports.

Progress Report 1 Due: 01 July 2014
Progress Report 2 Due: 01 July 2015
Progress Report 3 Due: 01 July 2016
Progress Report 4 Due: 01 July 2017
Final Report Due: 01 July 2018

NB. If you complete the work earlier than you had planned you must submit a Final Report as soon as the work is completed. If the project has been discontinued or not commenced for any reason, you are also required to submit a Final Report for the project.

Progress reports and Final Reports are available at the following website:

http://www.research.mq.edu.au/for/researchers/how_to_obtain_ethics_approval/human_research_ethics/forms

3. If the project has run for more than five (5) years you cannot renew

approval for the project. You will need to complete and submit a Final Report and submit a new application for the project. (The five year limit on renewal of approvals allows the Committee to fully re-review research in an environment where legislation, guidelines and requirements are continually changing, for example, new child protection and privacy laws).

4. All amendments to the project must be reviewed and approved by the Committee before implementation. Please complete and submit a Request for Amendment Form available at the following website:

http://www.research.mq.edu.au/for/researchers/how_to_obtain_ethics_approval/human_research_ethics/forms

5. Please notify the Committee immediately in the event of any adverse effects on participants or of any unforeseen events that affect the continued ethical acceptability of the project.

6. At all times you are responsible for the ethical conduct of your research in accordance with the guidelines established by the University. This information is available at the following websites:

http://www.mq.edu.au/policy/

http://www.research.mq.edu.au/for/researchers/how_to_obtain_ethics_approval/human_research_ethics/policy

If you will be applying for or have applied for internal or external funding for the above project it is your responsibility to provide the Macquarie University's Research Grants Management Assistant with a copy of this email as soon as possible. Internal and External funding agencies will not be informed that you have approval for your project and funds will not be released until the Research Grants Management Assistant has received a copy of this email.

Please retain a copy of this email as this is your official notification of ethics approval.

Yours sincerely

Dr Karolyn White
Director of Research Ethics
Chair, Human Research Ethics Committees

Office of the Deputy Vice Chancellor (Research)

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30 May 2014

Associate Professor Nickolai Titov
Department of Psychology
Faculty of Human Sciences
Macquarie University NSW 2109

Dear Associate Professor Titov,

RE: *Behavioural and Cognitive Change During a Self-Guided Online Cognitive Behavioural Therapy Course for Anxiety and Depression: An Open Trial (Ref: 5201300812)*

Thank you for submitting an amendment request on the 13th May 2014 for the above study. The Human Research Ethics Committee (HREC) (Medical Sciences) delegated the review of your amendment request to the Ethics Secretariat.

I am pleased to advise that ethical approval of the following amendments to the above study have been granted:

1. Administer 5 additional questionnaires (i.e., the ERQ, CBTSQ, SDS, TEQ and LCBS) at different times during the clinical trial.

2. The Thoughts and Actions Frequency Scale, which was developed by the investigators, being reduced from 53 questions to 24.

3. Change the BADS-SF (9 items) from the original submission to the extended BADS (25 items).

2. Recruit an additional 120 participants; increasing the total number of participants from 30 to 150.

3. Addition of Dr Blake Dear's honours student, Ms Nicole Langman, to the project personnel. Ms Langman will only have access to de-identified data and will have no contact with participants in the research trial.

4. Addition of Dr Vincent Fogliati and Dr Milena Gandy, who are both clinical psychologists, to the project. Dr Fogliati and Dr Gandy will provide clinical support where required (e.g. risk assessment if a patient experiences clinically significant deterioration in mood).

The following documentation submitted with your amendment request has been reviewed and approved:

Document	Version	Date
Macquarie University Human Research Ethics Committee Amendment Request Form	2	Received 13/05/2014
Responses from Dr Blake Dear regarding HREC issues raised (received 30 May 2014)		

Participant Information and Consent Form entitled "*Changes in Behaviours and Thoughts During a Self-Guided Course for Anxiety and Depression*"	1.1	30 May 2014
Research Protocol entitled "*Behavioural and Cognitive Change During a Self-Guided Online Cognitive Behavioural Therapy Course for Anxiety and Depression: An Open Trial*"	1.1	30 April 2014
Emotion Regulation Questionnaire (Gross & John, 2003)		Received 30/05/2014
Cognitive Behavioral Therapy Skills Questionnaire (Jacob et al., 2011)		Received 30/05/2014
Sheehan Disability Scale (Sheehan, 1983)		Received 30/05/2014
Locus of Control of Behaviour Scale (Franklin & Andrews, 1984)		Received 30/05/2014
Treatment Evaluation Questionnaire (TEQ)		Received 30/05/2014
Thoughts and Actions Frequency Scale (TAFS)		Received 30/05/2014
Behavioral Activation for Depression Scale (Kanter et al, 2001)		Received 30/05/2014

Please ensure that all documentation submitted in the future for with amendment requests contains a version number and date.

Should you have any queries regarding your project, please contact the Ethics Secretariat on 9850 4194 or by email ethics.secretariat@mq.edu.au

The HREC (Medical Sciences) Terms of Reference and Standard Operating Procedures are available from the Research Office website at:

http://www.research.mq.edu.au/for/researchers/how_to_obtain_ethics_approval/human_research_ethics

The HREC (Medical Sciences) wishes you every success in your research.

Yours sincerely

Professor Tony Eyers
Chair, Macquarie University Human Research Ethics Committee (Medical Sciences)

This HREC is constituted and operates in accordance with the National Health and Medical Research Council's (NHMRC) *National Statement on Ethical Conduct in Human Research* (2007) and the *CPMP/ICH Note for Guidance on Good Clinical Practice*.

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MACQUARIE University

22 January 2015

Professor Nikolai Titov
Department of Psychology
Faculty of Human Sciences
Macquarie University
NSW 2109

Dear Professor Titov

Reference No: 5201401119

Title: Behavioural and Cognitive Changes During Self-Guided Internet-Delivered Cognitive-Behavioural Therapy for Anxiety and Depression: A Randomised Controlled Trial

Thank you for submitting the above application for ethical and scientific review. Your application was considered by the Macquarie University Human Research Ethics Committee (HREC (Medical Sciences)) at its meeting on 27 November 2014 at which further information was requested to be reviewed by the HREC (Medical Sciences) Executive.

The requested information was received with correspondence on 31 December 2014.

The HREC (Medical Sciences) Executive considered your responses at its meeting held on19 January 2015.

I am pleased to advise that ethical and scientific approval has been granted for this project to be conducted at:

- Macquarie University

This research meets the requirements set out in the *National Statement on Ethical Conduct in Human Research* (2007 – Updated March 2014) (the *National Statement*).

Details of this approval are as follows:

Approval Date: 19 January 2015

The following documentation has been reviewed and approved by the HREC (Medical Sciences):

Documents reviewed	Version no.	Date
National Ethics Application Form	2.2	2014
Correspondence from Professor Titov responding to		Received

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the issues raised by the HREC (Medical Sciences)		31/12/2014
Macquarie University Research Protocol	1.0	2/11/2014
MQ Participant Information and Consent Form (PICF)	1.1	12/11/2014

This letter constitutes ethical and scientific approval only.

Standard Conditions of Approval:

1. Continuing compliance with the requirements of the *National Statement,* which is available at the following website:

http://www.nhmrc.gov.au/book/national-statement-ethical-conduct-human-research

2. This approval is valid for five (5) years, subject to the submission of annual reports. Please submit your reports on the anniversary of the approval for this protocol.

3. All adverse events, including events which might affect the continued ethical and scientific acceptability of the project, must be reported to the HREC within 72 hours.

4. Proposed changes to the protocol must be submitted to the Committee for approval before implementation.

It is the responsibility of the Chief investigator to retain a copy of all documentation related to this project and to forward a copy of this approval letter to all personnel listed on the project.

Should you have any queries regarding your project, please contact the Ethics Secretariat on 9850 4194 or by email ethics.secretariat@mq.edu.au

The HREC (Medical Sciences) Terms of Reference and Standard Operating Procedures are available from the Research Office website at:

http://www.research.mq.edu.au/for/researchers/how_to_obtain_ethics_approval/human_research_ethics

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The HREC (Medical Sciences) wishes you every success in your research.
Yours sincerely

Professor Tony Eyers
Chair, Macquarie University Human Research Ethics Committee (Medical Sciences)

This HREC is constituted and operates in accordance with the National Health and Medical Research Council's (NHMRC) *National Statement on Ethical Conduct in Human Research* (2007) and the *CPMP/ICH Note for Guidance on Good Clinical Practice*.