Subjective and Physiological Responses to Acute Stress in Socially Anxious Adults and Healthy Children

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ABSTRACT

Social anxiety disorder (SAD) is one of the most common anxiety disorders and understanding its symptoms and risk factors is vital for developing treatments and prevention strategies. Atypical physiological responses have been observed in anxious individuals and their consequences present a human and economic burden. This dissertation includes two studies that explore the subjective and physiological responses to an acute stress in the context of treatment and risk factors for SAD.

The goal of the first study was to examine whether cognitive behavioural group therapy (CBGT) and a mindfulness-based stress reduction (MBSR) program differentially influenced the subjective and physiological response to a speech task. Participants in the treatment groups performed two speech tasks, before and after treatment, while a healthy control group completed it only once. Results indicated significant differences for the subjective, but not the physiological measures of stress. Patients with SAD reported higher subjective anxiety than the healthy control group and these scores were significantly reduced following treatment. Greater improvements were noted in the CBGT group; nonetheless, the study did indicate promising results for MBSR.

The second study aimed to explore the effects of behavioural inhibition (BI), parental bonding variables and their interaction on the subjective and physiological responses to a similar speech task in healthy children. BI was related to subjective anxiety in a predictive manner, but was generally unrelated to the physiological measures. Parental bonding variables were not related to any of the stress responses and no interaction between BI and parental bonding was observed.

These studies contribute to the literature by demonstrating treatment differences and their subjective and physiological consequences on stress reactions and exploring the extent to which risk factors for SAD affect the stress response in healthy children.

RÉSUMÉ

L'anxiété sociale est l'un des problèmes d'anxiété les plus communs. Il est essentiel de comprendre ses symptômes et ses facteurs de risques pour être en mesure de développer des traitements et des méthodes de prévention. Des réponses physiologiques atypiques ont été observées chez des personnes anxieuses et leurs conséquences peuvent devenir un fardeau humain et économique. Cette thèse inclut deux études qui explorent les réponses subjectives et physiologiques au stress aigu dans le contexte du traitement et des facteurs de risques de l'anxiété sociale.

Le but de la première étude était d'examiner si la thérapie de groupe cognitive-comportementale (TGCC) et un programme de pleine conscience de réduction de stress (PCRS) influencent différemment les réponses subjectives et physiologiques à une tâche publique d'expression orale. Les participants sous traitement ont effectué deux tâches d'expression orale, avant et après le traitement, tandis qu'un groupe témoin de participants en bonne santé a accompli la tâche une seule fois. Les résultats indiquent la présence de différences significatives au niveau de la réponse subjective de stress, mais aucune différence au niveau des mesures de stress physiologiques. Les patients souffrant d'anxiété sociale ont rapporté plus de stress subjectif que celle constatée chez le groupe témoin et ces résultats étaient significativement réduits après le traitement. Des améliorations plus grandes ont été notées pour le groupe TGCC, bien que les résultats soient également prometteurs pour le programme de PCRS.

La deuxième étude visait l'exploration des effets du comportement inhibé (CI), des variables de camaraderie parentale et de leur interaction sur les réponses subjectives et physiologiques à une tâche similaire d'expression orale chez des enfants en santé. Le CI était

lié de façon prédictive à l'anxiété subjective mais, dans l'ensemble, n'avait aucun lien avec les mesures physiologiques. Les variables de camaraderie parentale n'étaient liées à aucune mesure de stress et aucune interaction entre le CI et la camaraderie parentale n'a été observée.

Ces études contribuent aux connaissances en identifiant des différences dues aux traitements et leurs conséquences sur les réactions subjectives et physiologiques de stress et en explorant à quel point les facteurs de risque de l'anxiété sociale ont un effet sur les réponses de stress d'enfants en santé.

CONTRIBUTIONS OF AUTHORS

The two studies described in this dissertation were based on secondary data generously provided by Dr. Koszycki. I determined the design of the data analysis and interpretation in consultation with Dr. Bielajew. The manuscripts were written by me and edited in conjunction with Drs. Bielajew and Koszycki. I am first author on both papers.

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GENERAL INTRODUCTION

Anxiety disorders are very common, affecting approximately 25% of the population (Smoller, Block, & Young, 2009), and have important implications for the individual and society (Beesdo, Knappe, & Pine, 2009; Nutt, Garcia de Miguel, & Davies, 2008; Smoller et al., 2009). Anxiety is a basic emotion that is a response to danger and is present from infancy. It can be very adaptive by helping one to avoid danger or motivate one towards action (Beesdo et al., 2009; Nutt et al., 2008). However, anxiety becomes pathological when it is severe, frequent, persistent, and leads to impaired functioning (Beesdo et al., 2009; Nutt et al., 2008). There are many anxiety disorders, and while they each have their specific symptoms, they also share certain features, such as intense anxiety, physiological symptoms, and behavioural disruptions including avoidance of the feared stimuli and/or distress and impairment in functioning (Beesdo et al., 2009; Nutt et al., 2008). According to the DSM-IV-TR, specific anxiety disorders include the following: Separation Anxiety, Specific Phobia, Social Anxiety Disorder , Panic Disorder with or without Agoraphobia, Agoraphobia, Generalized Anxiety Disorder, Post-Traumatic Stress Disorder, Obsessive-Compulsive Disorder.

The lifetime prevalence of any anxiety disorder has been estimated to be about 15 to 20% and all anxiety disorders are two to three times more common in females than in males (Beesdo et al., 2009). The onset of anxiety disorders can vary. Separation Anxiety and Specific Phobia appear earliest, often before the age of 12 (Beesdo et al., 2009). Social anxiety disorder has a typical onset around late childhood and early adolescence, while panic disorder with or without Agoraphobia and generalized anxiety disorder are usually diagnosed around late adolescence or early adulthood (Beesdo et al., 2009).

Studies have shown that without treatment, anxiety disorders may become chronic (Bruce et al., 2005; Woodman, Noyes, Black, Schlosser, & Yagla, 1999; Yonkers, Bruce, Dyck, & Keller, 2003). For example, some studies have shown that children with anxiety disorders have significantly greater chance of having the same disorder, or signs of it, later in life (Bittner et al., 2007; Pine, Cohen, Gurley, Brook, & Ma, 1998); the reverse is also true, that adults with an anxiety disorder are likely to have experienced the same problem earlier in life (Gregory et al., 2007). Other studies, however, have also suggested that the stability rates in specific anxiety disorders are low to moderate (Beesdo et al., 2009). In fact, in some individuals, anxiety disorders tend to come and go over time (APA, 2000). Some studies have examined differences between full diagnostic remission (no mental health disorders at follow-up), strict homotypic continuity (the same anxiety disorder at follow-up), broad homotypic continuity (another anxiety disorder at follow-up), and heterotypic continuity (another mental health disorder at follow-up, such as depression or substance abuse) (Angst & Vollrath, 1991; Last, Perrin, Hersen, & Kazdin, 1996; Pine et al., 1998). For example, results from the Early Developmental Stages of Psychopathology study indicated that only 13% of children and adolescents with a SAD at baseline had no mental health disorder diagnoses at the 10 year follow-up, 35% reported having the same diagnosis (strict homotypic continuity), and 64% reported any other anxiety disorder (broad homotypic continuity) or depression (heterotypic continuity) (Beesdo, 2009). Similar results have been found in the case of other anxiety disorders. Therefore, it appears that without treatment, only a small percentage of individuals reach a full diagnostic remission and that children with anxiety disorders do not typically develop into healthy adults (Angst & Vollrath, 1991; Beesdo et al., 2009; Last et al., 1996; Pine et al., 1998).

Social anxiety disorder

The focus of this dissertation will be on Social Anxiety Disorder (SAD), one of the most common anxiety disorders according to the DSM-IV-TR. It is characterized by persistent fears that lead to avoidance of social and/or performance situations. Patients with SAD fear being judged or humiliated and generally attempt to avoid such situations; however when forced, they will endure them with marked distress and great anxiety. The severity of SAD can vary, but to meet diagnostic criteria it must create marked distress or impairment in the person's daily life and must be differentiated from shyness. Acarturk et al. (2009) found that low education, low mastery, low self-esteem, emotional neglect in childhood, and ongoing difficulties were risk indicators for SAD.

Social anxiety disorder has an early onset, with symptoms typically emerging between the ages of 11 and 15 (Kessler, 2003; Kessler et al., 2005; Ruscio et al., 2008; Wittchen & Fehm, 2003) although some studies have reported an age of onset before 10 years old (Leahy & Holland, 2000). SAD is considered to be chronic and often persists into adulthood (Chartrand, Cox, ElGabalawy, & Clara, 2011; Keller, 2003; Kessler, 2003; Wittchen, Fuetsch, Sonntag, Muller, & Liebowitz, 2000; Wittchen & Fehm, 2003). The mean age of clients who seek services for SAD is roughly 30 years (Leahy and Holland, 2000).

This disorder is more common in women, with studies reporting the incidence in women to be twice that of men (APA, 2000; Acarturk, Smit, de Graaf, van Straten, ten Have et al., 2009; Ohayon & Schatzberg, 2010). Despite this, studies indicate that males with SAD are as likely, and in some cases slightly more likely than females, to seek services for the disorder (APA, 2000; Leahy & Holland, 2000; Xu et al., 2012).

Studies have shown that the one-month prevalence for SAD varies between 1.6% and 15.6%, the 12-month prevalence varies from 1.2% and 7.2%, and the lifetime prevalence

varies between 2.3% and 13% (Acarturk et al., 2009; Chartrand et al., 2011; Furmark, 2002; Kessler, 2003; Kessler et al., 2005; Ruscio et al., 2008b; Shields, 2004; Wittchen, Essau, von Zerssen, Krieg, & Zaudig, 1992). Ohayon and Schatzberg (2010) suggest that the differences in prevalence can be explained by the differences in the classification of SAD in the various DSM versions. In addition, studies frequently include participants who have different levels of impairment and distress, as well as participants who may or may not meet criteria for SAD, but have high levels of SAD symptoms. Finally, cultural differences may also explain some of the discrepancy in reported rates of prevalence (Ohayon & Schatzberg, 2010).

Many types of functional impairments have been associated with SAD and may manifest themselves in different domains including educational, social, and occupational ones (e.g., (Acarturk et al., 2009; Acarturk, Smit, de Graaf, van Straten, ten Have et al., 2009; Schneier et al., 1994; Shields, 2004; Stein & Kean, 2000; Swinson, 2005; Vriends, Becker, Meyer, Michael, & Margraf, 2007; Wittchen et al., 2000). More specifically, individuals with SAD have been found to have lower levels of education (Lepine & Lellouch, 1995), higher unemployment, lower income (Magee, Eaton, Wittchen, McGonagle, & Kessler, 1996), poorer overall health, and seek more consultations with physicians (Acarturk, de Graaf, van Straten, ten Have, & Cuijpers, 2008; Falk Dahl & Dahl, 2010; Kessler, 2003; Lepine & Lellouch, 1995; Magee et al., 1996; Ruscio et al., 2008; Stein & Stein, 2008; Vicente et al., 2006). In addition, they are more likely to have never been married (Magee et al., 1996) or to be separated (Vicente et al., 2006). Patients with SAD seek more help from mental health professionals than that reported for the general population although they typically seek help for concerns other than their social anxiety (Acarturk et al., 2008; Davidson, Hughes, George, & Blazer, 1993; Schneier, Johnson, Hornig, Liebowitz, & Weissman, 1992).

SAD has also often been associated with co-morbid disorders, particularly with mood and other anxiety disorders (Acarturk et al., 2008; Acarturk et al., 2009; Kessler, 2003; Ruscio et al., 2008; Stein & Stein, 2008; Wittchen, Kessler, Pfister, & Lieb, 2000). In particular, SAD has been associated with phobias (59%), panic disorder (49%), and depression (17%) (Schatzberg, Samson, Rothschild, Bond, & Regier, 1998; Stein, McQuaid, Laffaye, & McCahill, 1999). In addition, increased alcohol consumption is frequently reported in individuals diagnosed with SAD (Chartier, Walker, & Stein, 2003; Falk Dahl & Dahl, 2010; Shields, 2004; Stein & Deutsch, 2003).

Since the DSM III-R, SAD diagnosis has been classified into two subtypes (Leahy & Holland, 2000). The first and most severe subtype is called generalized SAD and comprises individuals who are anxious in most social situations, both interactional and performance situations, and they experience marked distress as a result. In contrast, the second subtype, non-generalized, is less severe and includes individuals who are anxious in only one or a few social situations (APA, 2000; Leahy & Holland, 2000). The most current version of the DSM, the DSM-5, no longer includes both subtypes; instead they refer to the non-generalized subtype with a specifier of "performance only" if the individual is only affected by speaking or performing in public. This work only focuses on individuals with SAD generalized subtype, excluding those who would currently be considered within the "performance only" specifier.

There are some well-established psychotherapeutic treatments (Cognitive Behavioural Therapy (CBT), for example) for SAD. However, not all individuals respond to these; therefore, alternate treatments and prevention strategies are needed (Beesdo et al., 2009; Nutt et al., 2008; Smoller et al., 2009) for these individuals. Furthermore, because of the prevalence of SAD in childhood and adolescence, prevention strategies targeting these

populations are crucial. Some researchers have noted the difficulty of distinguishing between typical and pathological anxiety in children and adolescents given that normally developing children go through particular phases of anxiety (e.g., separation anxiety 12-18 months; thunder and lightning 2-4 years) and cannot at those ages necessarily communicate their distress (Beesdo et al., 2009). Hence, it is important to identify and understand risk factors for anxiety disorders in order to develop target age-appropriate prevention efforts.

The first article of this dissertation focuses on the effects of the treatments for SAD on the subjective and physiological measures of stress, while the second focuses on how behaviour inhibition (BI) and parental bonding variables, risk factors for SAD, , interact to affect healthy children's subjective and physiological reactions to stress. The goal is to identify the factors that place children at risk for SAD in order to develop targeted prevention interventions.

Psychological treatments for SAD

The different types of treatments for SAD have been well-studied (Acarturk, Cuijpers, van Straten, & de Graaf, 2009; Blanco et al., 2010; Heimberg, 2002; Hofmann & Smits, 2008; Hofmann & Bogels, 2006; Kocovski, Fleming, & Rector, 2009; Koszycki, Benger, Shlik, & Bradwejn, 2007; Lipsitz, Markowitz, Cherry, & Fyer, 1999; Piet, Hougaard, Hecksher, & Rosenberg, 2010). Psychotherapy treatments include interpersonal, cognitive-behavioural methods which often incorporate social skills training, exposure, applied relaxation, and cognitive restructuring, as well as mindfulness based approaches. Cognitive behavioural and mindfulness treatments will be described below.

Cognitive behavioural therapy (CBT). CBT is the most studied psychological treatment for SAD (Davidson et al., 2004; Eskildsen, Hougaard, & Rosenberg, 2010; Fedoroff & Taylor, 2001; Heimberg, 2002; Hofmann & Bogels, 2006). Its group format,

CBGT, is considered the evidenced-based treatment of choice for SAD (Butler, Chapman, Forman, & Beck, 2006; Heimberg, 2002; Rodebaugh, Holaway, & Heimberg, 2004). There are three proposed CBGT models to explain SAD, and each is associated with at least one specific CBT technique: the conditioning model (Baumeister & Tice, 1990; Leahy & Holland, 2000), skills deficit model (Fedoroff & Taylor, 2001; Leahy & Holland, 2000; Wolpe, 1990), and the cognitive model (Beck & Emery, 1985; Cho & Telch, 2005; Vassilopoulos, 2005).

The conditioning model proposes that SAD is a conditioned response of fear, anxiety, or humiliation that stems from past experiences of one or more traumatic social interactions (Baumeister & Tice, 1990), or from vicarious observation of others, which over time generalizes to more and more social situations. This model is associated with the exposure technique which allows the patient to gradually be subjected to the feared stimulus so that eventually it loses its negative consequence. Relaxation is another technique that stems from the conditioning model, and it aims to replace the conditioned fear response with a relaxation response (Heimberg, 2002; Ost, 1987; Rodebaugh et al., 2004).

Unlike the conditioning model's emphasis on fear responses, the skills deficit model proposes that individuals with SAD experience anxiety due to deficits in social skills such as poor eye contact or poor conversation skills which evoke negative reactions from others (Fedoroff & Taylor, 2001; Leahy & Holland, 2000; Wolpe, 1990). Social Skills Training is a treatment (or technique) that is associated with the skills deficit model (Heimberg, 2002; Leahy & Holland, 2000;Rodebaugh et al., 2004) . Although certain authors have shown some efficacy of the social skills training, it is unclear if the benefits come from the social skills training itself, or from the mere exposure to the social situation while practicing the social skills (Heimberg, 2002; Rodebaugh et al., 2004). Heimberg, (2002) and Rodebaugh et al.,

(2004) have reviewed this treatment. Moreover, there has been substantial debate in the literature as to whether individuals with SAD show skill deficits in social situations because they lack appropriate social knowledge, or because their anxiety leads to inhibitions or avoidant behaviours (Fedoroff & Taylor, 2001; Glasgow & Arkowitz, 1975; Halford & Foddy, 1982; Heimberg, 2002; Rodebaugh et al., 2004) or a combination of these factors (Heimberg, 2002; Leahy & Holland, 2000; Rodebaugh et al., 2004). The consensus seems to be that although most patients with SAD do not demonstrate social skills deficits, those who do may benefit from training to overcome these deficits (Leahy & Holland 2000; Rodebaugh et al., 2004).

Finally, the cognitive model proposes that it is cognitive factors that are central to the development of SAD (Beck & Emery, 1985; Cho & Telch, 2005; Vassilopoulos, 2005). The research suggests that in social situations, patients with SAD have a greater ratio of negative to positive thoughts (Leahy & Holland, 2000; Rapee, Gaston, & Abbott, 2009), particularly more about the impressions they are making, underestimating their social performance, and overestimating the visibility of their anxiety symptoms (Damer, Latimer, & Porter, 2010; Moscovitch, 2009; Rapee et al., 2009). Patients with SAD also interpret ambiguous situations negatively (Leahy & Holland, 2000). Cognitive restructuring is the CBT technique that is associated with this model. The rationale is that it is not the situation itself, but rather the thoughts and beliefs about the situation that generate distress and anxiety for those with SAD. Although there are different types of cognitive restructuring programs, all of them involve teaching patients to identify negative beliefs and to challenge these in order to help them develop more adaptive beliefs (Leahy & Holland, 2000).

Cognitive behavioural therapy outcome. The effectiveness of CBT has been assessed for anxiety disorders in general, as well as for SAD specifically. (e.g. Acarturk et al., 2009;

Blanco et al., 2010; Buckner & Schmidt, 2009; Hofmann & Smits, 2008). Among the meta-analyses that have examined the efficacy of CBT for anxiety disorders, Hoffmann and Smits (2008) compared CBT to psychological and/or pharmacological placebos. They found that CBT techniques had medium to large effect sizes and were more effective than a placebo. They also found that the effect sizes tended to vary between diagnostic groups with those showing the biggest to the lowest effects as follows: Obsessive-Compulsive Disorder, Acute Stress Disorder, SAD, Posttraumatic Stress Disorder, Generalized Anxiety Disorder, and Panic Disorder. Similarly, in an article reviewing meta-analyses to determine the empirical status of CBT for anxiety disorders, Butler et al., (2006) reported large effect sizes of CBT for Depression, Generalized Anxiety Disorder, Panic Disorder, SAD, Posttraumatic Stress Disorder, as well as childhood depression and anxiety disorders. The results of these meta-analyses suggest that SAD is among the disorders for which CBT has been empirically validated and it is considered, either in its individual or group from, to be the psychological treatment of choice for SAD (Aderka, 2009; Fedoroff & Taylor, 2001; Heimberg, 2002; Hofmann & Bogels, 2006; Rodebaugh et al., 2004).

Meta-analyses that have focused on the efficacy of CBT for SAD specifically have compared CBT to control groups, CBT techniques to one another (Acarturk et al., 2009; Feske & Chambless, 1995; Gould, Buckminster, Pollack, Otto, & Yap, 1997; Rodebaugh et al., 2004; Taylor, 1996) CBT format (i.e. group vs individual therapy) (Aderka, 2009; Damer et al., 2010; Gould et al., 1997; Hofmann & Bogels, 2006; McEvoy, 2007) and CBT to other treatments for SAD, especially pharmacological based ones (Acarturk et al., 2009; Blomhoff et al., 2001; Clark et al., 2003; Davidson et al., 2004; Eskildsen et al., 2010; Fedoroff & Taylor, 2001; Gould et al., 1997; Heimberg et al., 1998; Liebowitz et al., 1999). These authors found support for the effectiveness of CBT/CBGT in SAD patients, but results as to

which CBT technique is most effective were inconsistent. For example, Taylor (1996) suggested that the combination of cognitive restructuring and exposure was superior to exposure alone, while others showed no benefits for the combined techniques (Feske & Chambless, 1995; Gould et al., 1997; Rodebaugh et al., 2004).

A more recent meta-analysis of the efficacy of CBT for the treatment of SAD by Acarturk et al., (2009), including only randomized trials, confirmed that CBT was effective but added that the effect size varied depending on the control group, with higher effect size for wait-list control versus treatment as usual groups. Moreover, they reported that the effect size was also lower for participants with a formal diagnosis of SAD as opposed to those with other inclusion criteria such as a high level of symptoms. They also concluded that there was no evidence that any given technique was more effective than another. Overall, there is general consensus that CBT is superior to the usual psychological and pharmacological control groups (wait-list and drug placebo).

Many studies have also examined the long-term effects of CBT interventions (Acarturk et al., 2009; Butler et al., 2006; Fedoroff & Taylor, 2001; Taylor, 1996). In his review of four meta-analyses, Heimberg (2002) indicated that all studies reported a maintenance of gains at follow-up and some found that these continued after treatment cessation (Fedoroff & Taylor, 2001; Taylor, 1996). Similarly, Buttler et al., (2006) suggested that SAD was among the diagnoses for which significant evidence was found for the long-term effectiveness of CBT and Acarturk et al., (2009) commented that some participants treated with CBT even increase their gains at follow-up.

One important question is how CBT compares to pharmacological treatments. Studies in this area have yielded somewhat inconsistent results, and there are too few studies comparing CBT and pharmacological treatments for SAD to determine which is the best

treatment (Acarturk et al., 2009; Heimberg, 2002). Some report that pharmacological treatments are superior to CBT, at least in the short term (Blomhoff et al., 2001; Clark et al., 2003; Davidson et al., 2004; Fedoroff & Taylor, 2001; Heimberg et al., 1998); others find similar results for both (Acarturk et al., 2009), and finally, a few studies conclude that the gains achieved from CBT interventions are more durable than pharmacological treatments (Eskildsen et al., 2010; Gould et al., 1997; Liebowitz et al., 1999). In fact, Liebowitz et al., (1999) reported that after a maintenance phase and a treatment-free phase, 50% of patients who had received Phenelzine, a monoamine-oxidase inhibitor commonly used to treat depressions and anxiety, had relapsed as compared to 17% of the CBGT patients. These inconsistencies are partly due to the variety of pharmacological treatments used in these studies, some of which have not been reliably shown to be more effective than placebo (Clark & Agras, 1991; Turner, Beidel, & Jacob, 1994).

In addition, although the combination of CBT/CBGT and pharmacological treatments is often used clinically, little research has been done on the efficacy of incorporating both treatments (Blomhoff et al., 2001; Davidson et al., 2004; Haug et al., 2003; Rodebaugh & Heimberg, 2005; Rodebaugh et al., 2004). Some studies have shown promising results indicating that combining both treatments has some benefits at least in terms of the speed of treatment response (Blomhoff et al., 2001). However, not all findings have been positive (Davidson et al., 2004; Haug et al., 2003). For example, Haug et al., (2003) reported results from a 1-year follow-up of the participants in Blomhoff et al., (2001) and indicated that only the patients who received exposure and supportive treatment following the initial intervention continued to improve, whereas patients who had received sertraline, with or without exposure, had shown some deterioration following treatment, albeit with superior results to that of a placebo.

A review of the literature on the combination of treatments by Rodebaugh & Heimberg (2005) suggests guidelines for concurrent treatments while stressing the importance of more research. They propose that in combined CBT and pharmacological treatments, drug therapy should be presented first and CBT added during the stabilization period; it would include information about the medications, the risk of relapse, and should continue after drug therapy has ceased.

The benefits of group versus individual therapy have also been explored in some studies. For many years, CBGT was considered the treatment of choice for SAD (Aderka, 2009; Damer et al., 2010; Gould et al., 1997; McEvoy, 2007) and many authors have enumerated the advantages and disadvantages of group therapy. First, it is considered to be time and cost-effective (Damer et al., 2010; McEvoy, 2007). Group settings can also help normalize the symptoms for SAD patients, help patients learn from each other's experiences, provide a social context for exposure and encouragement from others, and help patients comply with their treatments and their homework assignments due to social pressure (Aderka, 2009; McEvoy, 2007; Camart et al., 2006). On the other hand, it is possible that participants may have to wait longer for a group to form before receiving services, that scheduling could be less flexible, and treatment strategies would not be tailored to the individual (Aderka, 2009; McEvoy, 2007; Stangier, Heidenreich, Peitz, Lauterbach, & Clark, 2003). Evidence supporting individual CBT interventions has been rapidly increasing (Aderka, 2009).

However, despite the studies supporting the effectiveness of CBT as an evidenced-based treatment for SAD, there are still many individuals who do not improve or even respond to CBT interventions or do improve but never attain a functional state comparable to that of control subjects (Aderka, 2009; Eskildsen et al., 2010; Hofmann & Bogels, 2006;

Rodebaugh et al., 2004). In fact, according to Hofmann and Bögels, (2006), the results from clinical trials have suggested that as many as 40 to 50% of participants with SAD do not improve significantly with CBT. Because of this, some investigators have explored the factors that predict or are associated with positive treatment outcome (Erwin, Heimberg, Juster, & Mindlin, 2002; Eskildsen et al., 2010; Heimberg, 2002; Otto et al., 2000).

The variables that have been most consistently and clearly linked to post-treatment functioning are pre-treatment severity and the subtype of SAD, with the most severe generalized SAD being associated with more significant symptoms post-treatment (Eskildsen et al., 2010; Heimberg, 2002; Otto et al., 2000). Having a comorbid disorder has also been linked to treatment outcome, but this association has been inconsistent (Erwin et al., 2002; Eskildsen et al., 2010; Heimberg, 2002; Turner, Beidel, Wolff, Spaulding, & Jacob, 1996; van Velzen, Emmelkamp, & Scholing, 1997), possibly due in part to the type of comorbid diagnosis being studied (Erwin et al., 2002; Eskildsen et al., 2010; Heimberg, 2002). In their systematic review, Eskildsen et al., (2010) found that avoidant personality disorder and depression were both associated with negative post-treatment functioning, but there was no evidence that other anxiety or personality disorders were necessarily predictive of treatment outcome.

It is important to note that all of these factors have been associated with post-treatment outcome, but not with the degree of improvement, meaning that patients with more severe symptoms before treatment continue to have more severe symptoms at post-treatment; still these symptoms do improve and are lower at post- than at pre-treatment (Eskildsen et al., 2010). Other factors that have possible associations with post-treatment outcomes are the treatment outcome expectancy (Eskildsen et al., 2010; Heimberg, 2002) and anger (Eskildsen et al., 2010). For example, in their systematic review of the literature of pre-treatment

variables predicting drop out and outcome of CBT for SAD, Eskildsen et al., (2010) noted studies that had identified a tendency for anger among those who dropped out of treatment, and also some evidence that levels of anger predicted outcome of the CBT treatment. Other variables that have been examined but as yet provide little evidence of impact on outcome include homework compliance and frequency of negative thoughts during social interactions (Heimberg, 2002).

Mindfulness based techniques. In addition to examining what predicts positive treatment outcomes for CBT, another avenue to explore is the availability of different treatment options for individuals who do not respond to CBT. One of the newer psychological treatments that has been assessed for SAD is Mindfulness Based Stress Reduction (MBSR) therapy. Many different approaches are based on mindfulness or involve mindfulness as an important component. These approaches originate from Buddhist and other contemplative traditions without requiring adherence to the religious belief or philosophy of such traditions (Baer, 2003; Bishop, 2002; Brown & Ryan, 2003; Chiesa & Serretti, 2010; Hofmann, Sawyer, Witt, & Oh, 2010; Kabat-Zinn, 2003; Melbourne Academic Mindfulness Interest Group, 2006). Mindfulness and mindfulness based approaches have become very popular forms of psychotherapy (Baer, 2003; Bishop, 2002; Hayes & Wilson, 2003; Hofmann et al., 2010; Melbourne Academic Mindfulness Interest Group, 2006), and research on the subject has rapidly increased in the past two decades (Bishop, 2002; Fjorback, Arendt, Ornbol, Fink, & Walach, 2011; Proulx, 2003).

Mindfulness is defined as a process in which one is aware and paying deliberate attention to all available information in the present moment. It is characterized by a non-judgmental, accepting, open, and curious nature (Baer, 2003; Bishop, 2002; Brown & Ryan, 2003; Chiesa & Serretti, 2010; Fjorback et al., 2011; Hofmann et al., 2010; Kabat-Zinn,

2003; Kocovski et al., 2009; Melbourne Academic Mindfulness Interest Group, 2006). Mindfulness is compared to awareness or attention that is blunted or restricted (e.g. focused only on emotional aspects), automatic or impulsive (e.g. not taking everything into consideration), or divided (e.g. being distracted by worries while working) (Brown & Ryan, 2003). The concept of mindfulness is thought to exist in varying degrees in the general population, such that some individuals are naturally more mindful than others (Brown & Ryan, 2003), but it is also learned through practice (Baer, 2003; Fjorback et al., 2011; Brown & Ryan, 2003)

In individuals with SAD, learning mindfulness involves becoming aware, not only of how one comes across in a social situation, but being aware of all available information in the present moment, whether it is positive or negative. More specifically, mindfulness discourages evaluation of the information in awareness, and encourages acceptance and allowance of symptoms, thoughts, and feelings (Kocovski et al., 2009).

Essentially, with practice of mindfulness meditation, when stressful or negative situations arise, individuals are less likely to enter into the cycle of stress by worrying or by having negative thoughts. Instead, by paying attention to all the available information non-judgmentally, it is likely that the range of coping strategies will increase (Baer, 2003; Fjorback et al., 2011; Roemer & Orsillo, 2003).

***Mindfulness-based stress reduction program*.** One approach is referred to as MBSR, a structured program developed in a behavioural medicine setting that teaches mindfulness meditation in order to reduce stress and manage emotions through increased self-regulation (Baer, 2003; Bishop, 2002; Fjorback et al., 2011). The original program developed by Kabat-Zinn, (1990) consists of 8 weekly group sessions of 2.5 hours, plus one full-day retreat (Baer, 2003; Bishop, 2002; Kabat-Zinn, 1990).

The program provides psychoeducation regarding the psychophysiology of stress and emotions and encourages the development of skills through practice, for example, approaching stressful situations using mindfulness skills (Baer, 2003; Bishop, 2002; Kabat-Zinn, 1990). It also includes in-session experience, discussions regarding achievements and challenges of the group, as well as homework exercises involving the practice of techniques on a daily basis and in stressful situations (Baer, 2003; Bishop, 2002; Kabat-Zinn, 1990).

The different meditation techniques used in MBSR to promote mindfulness are sitting meditation, the body scan, yoga, as well as walking, standing, and eating meditation (Baer, 2003; Bishop, 2002; Melbourne Academic Mindfulness Interest Group, 2006). The sitting meditation involves sitting comfortably on a chair or floor while attention is focused on breathing. When attention inevitably gets directed to thoughts or emotions that arise, the individual merely notices them, accepts each of them, and then redirects his or her attention back to breathing (Baer, 2003; Bishop, 2002). The body scan and yoga exercises are similar to the sitting meditation; however, they have a different object of focus (Bishop, 2002; Melbourne Academic Mindfulness Interest Group, 2006).

Other mindfulness-based approaches. Another approach that incorporates the use of mindfulness and has been used primarily to prevent depression relapse is mindfulness-based cognitive therapy (MBCT) (Baer, 2003; Fjorback et al., 2011; Segal, William, Teasdale, 2002). It stems from MBSR, but involves cognitive focus and is also designed to help patients view thoughts, emotions, and bodily sensations as "mental events" as opposed to facts (Baer, 2003; Fjorback et al., 2011; Segal et al., 2002).

Finally, other approaches include dialectic behavioural therapy and acceptance and commitment therapy. Both of these include mindfulness strategies, but contrary to MBSR and MBCT mindfulness is not the primary intervention technique (Baer, 2003; Chiesa &

Serretti, 2010). Dialectic behavioural therapy is an integrated approach often used with borderline personality disorder (Baer, 2003; Melbourne Academic Mindfulness Interest Group, 2006). It includes cognitive and behavioural strategies, as well as mindfulness (Baer, 2003). Acceptance and commitment therapy is used with a variety of populations (Melbourne Academic Mindfulness Interest Group, 2006). It is not described as mindfulness but shares many features of mindfulness (Baer, 2003) and its importance in acceptance and commitment therapy is increasing (Kocovski et al., 2009).

Some authors have debated whether mindfulness should be used as a standalone treatment, like MBSR, or used as an integrated part of another treatment, like MBCT, ACT or DBT (Roemer & Orsillo, 2003). Either way, the emphasis and goal do not change except that in a standalone treatment, there may be more time dedicated to the practice of mindfulness (Baer, 2003; Roemer & Orsillo, 2003).

There is a need for more research that examines the costs and benefits of these differences as the results to date have been mixed (Roemer & Orsillo, 2003; Fjorback et al., 2011). Mindfulness is difficult to master and may require more of a time commitment than is feasible for some individuals, leaving less time available for other potentially helpful interventions (Baer, 2003; Roemer & Orsillo, 2003). In their review, Fjorback et al., (2011) indicated that some studies have suggested that the time spent practicing mindfulness is associated with outcome, while other studies have concluded that it is not. Yet another noted that positive expectation toward MBSR, as well as adherence to the practice of meditation, was related to outcome (Proulx, 2003). There has not been enough research at this point to know what is the minimum commitment required for the practice of mindfulness to produce optimal results (Melbourne Academic Mindfulness Interest Group, 2006).

Some investigators have assessed whether treatment in group or individual format is best (Kocovski et al., 2009; Melbourne Academic Mindfulness Interest Group, 2006; Proulx, 2003). Although many therapists are more accustomed to individual therapy and would need to acquire further skills in order to administer group therapy (Melbourne Academic Mindfulness Interest Group, 2006), most authors recognize the many advantages of using a group format (Kocovski et al., 2009; Melbourne Academic Mindfulness Interest Group, 2006; Proulx, 2003).

Efficacy of mindfulness-based approaches. Many studies have reviewed the efficacy data for mindfulness based approaches in various populations, including effects on well-being and stress reduction in the general population, community samples, and medical or nursing students (Baer, 2003; Bishop, 2002; Chiesa & Serretti, 2010; Fjorback et al., 2011; Hofmann et al., 2010; Melbourne Academic Mindfulness Interest Group, 2006; Roemer & Orsillo, 2003; Proulx, 2003; Toneatto & Nguyen, 2007). Most of these reviews agree that MBSR shows positive effects on well-being and quality of life, and possibly reduction of stress, anxiety, and depression symptoms.

Other studies have examined the effects of mindfulness-based approaches in clinical populations with illnesses such as chronic pain, fibromyalgia, rheumatoid arthritis, cancer, multiple sclerosis, chronic obstructive lung disease, and HIV (Baer, 2003; Bishop, 2002; Chiesa & Serretti, 2010; Fjorback et al., 2011; Melbourne Academic Mindfulness Interest Group, 2006; Proulx, 2003). The majority of these reviews indicate that MBSR shows promise with stress reduction and improvements in mental and physical health. Finally, this approach has also been applied to clinical populations with psychiatric disorders including Generalized Anxiety Disorder, Panic Disorder, SAD, binge eating, anxiety, and mood disorders (Baer, 2003, Bishop, 2002; Chiesa & Serretti, 2010; Fjorback et al., 2011;

Hofmann et al., 2010; Melbourne Academic Mindfulness Interest Group, 2006; Proulx, 2003; Roemer & Orsillo, 200; Toneatto & Nguyen, 2007).

Studies reviewing anxiety and depression outcomes following mindfulness treatment have yielded mixed results, with some showing a reduction in symptoms (Baer, 2003) while others find no effects (Toneatto & Nguyen, 2007). One meta-analysis supported the use of mindfulness based approaches for the reduction of anxiety and depression in a clinical population, but stated that the benefits may not be diagnosis specific and may instead address mechanisms that are common to many disorders (Hofmann et al., 2010).

Some of the discrepancies in reviews and meta-analyses may be explained by differences in study inclusion criteria - using controlled as well as uncontrolled designs. In addition, almost all reviews highlight various methodological flaws in the assessment of the effects of mindfulness. These issues include the use of inappropriate statistical analyses, administration of measures that have not been validated, the lack of control for treatments that may occur simultaneously (for example, some studies include participants who have received other types of treatment simultaneous with mindfulness-based treatments), the arbitrary determination of what constitutes a clinical response on measures that do not provide such cut offs, inadequate sample sizes, no appropriate control groups or lack of randomization, no measures of treatment compliance or homework completion, no long-term follow-up, the possibility of inaccurate self-reports due to social-desirability, and of a self-selection bias (Baer, 2003; Bishop, 2002; Chiesa & Serretti, 2010; Fjorback et al., 2011; Hofmann et al., 2010; Melbourne Academic Mindfulness Interest Group, 2006; Proulx, 2003).

However, despite these lengthy methodological concerns that make it difficult to evaluate the strength of the findings, the reviews still consider the results encouraging

(Proulx, 2003). In fact, there is preliminary evidence for the efficacy of mindfulness techniques with stress reduction in the general, non-clinical population (Baer, 2003; Bishop, 2002; Chiesa & Serretti, 2010; Proulx, 2003) as well as positive results in cancer patients (Bishop, 2002). The evidence for other disorders, both psychiatric and physical, is less conclusive albeit still encouraging and at the very least warrants more research (Baer, 2003; Bishop, 2002; Chiesa & Serretti, 2010; Melbourne Academic Mindfulness Interest Group, 2006; Roemer & Orsillo, 2003). In a review of more rigorous designs, Fjorback et al., (2011) cautiously supported the idea that mindfulness techniques result in positive outcomes; however, they also suggested that clarification is needed as to whether improvements stem from having learned new skills, having practiced meditation, or from increases in mindfulness (based on responses to mindfulness questionnaires). Ultimately, all reviews highlight the need for more rigorous methodologies (Baer, 2003; Bishop, 2002; Chiesa & Serretti, 2010; Kabat-Zinn, 2003; Roemer & Orsillo, 2003).

The numerous reviews investigating the efficacy of mindfulness on various physical and mental health disorders attest to the rapidly growing interest in this area (Baer, 2003; Bishop, 2002; Chiesa & Serretti, 2010; Kabat-Zinn, 2003; Roemer & Orsillo, 2003). However, studies that have specifically examined the effects of mindfulness on participants suffering from SAD are relatively recent and their numbers are growing (Bogels, Sijbers, & Voncken, 2006; Goldin, Ziv, Jazaieri, & Gross, 2012; Goldin, Ziv, Jazaieri, Hahn, & Gross, 2013; Goldin & Gross, 2010; Jazaieri, Goldin, Werner, Ziv, & Gross, 2012; Kocovski, Fleming, Hawley, Huta & Antony, 2013; Kocovski et al., 2009; Koszycki, Benger, Shlik, & Bradwejn, 2007; Piet, Hougaard, Hecksher, & Rosenberg, 2010). The first of these studies by Bogels, Sijbers, & Voncken, (2006) assessed a treatment that combined mindfulness and Task Concentration Training for SAD. Task Concentration Training is a relatively new

approach that helps individuals learn to move their attention away from the self towards a particular task, for example a social situation. The authors hypothesized that each component would address symptoms of SAD. For example, the mindfulness approach would allow participants to become aware of all the aspects of a situation and of themselves, thereby reducing hyperawareness to negative aspects of the self. The task concentration training would then allow them to move their attention outward to the social situation, reducing their tendency to avoid noticing social cues from people in their environment by focusing on themselves.

The results of their study indicated that the treatment was effective in reducing the symptoms of SAD in the short-term, with effect sizes similar to that of CBT for social phobia (moderate to high range). These reductions were maintained, and even improved at a two month follow-up. The greatest impact was the decrease in fear of negative evaluation, beliefs, and the discrepancy between the self-image and the ideal self. However, the authors acknowledged that it is difficult to determine whether the benefits arose from mindfulness, the task concentration training, or both.

The second study was conducted by Koszycki et al., (2007), who compared an MBSR to a CBGT treatment. They concluded that CBGT was the treatment of choice, but that MBSR may have had some benefits. In fact, the results showed that both treatments were comparable on their improvements in levels of mood, functionality, and quality of life, but CBGT showed better results in the reduction of SAD symptoms. Given this, Fjorback et al., (2011) suggested that following MBSR, individuals may still experience SAD symptoms, but may find them less distressing. Kocovski et al., (2009) noted that Koszycki et al.'s (2007) study demonstrated possible beneficial effects for participants with SAD despite the lack of

an exposure component and the use of MBSR instructors who were not mental health professionals.

Kocovski et al., (2009) performed a pilot study in which they assessed a treatment called mindfulness and acceptance based group therapy that incorporated mindfulness, acceptance, and exposure. They found significant decreases in social anxiety, depression, and rumination, as well as increases in acceptance and mindfulness, gains that were maintained at a 3 year follow-up. They also assessed acceptance, mindfulness, and rumination as possible mechanisms of change and found preliminary evidence for acceptance as a mediator.

Kocovski et al., (2013) also later reported on a randomized control trial of their mindfulness and acceptance-based group therapy compared to CBGT for SAD. Their results indicated that both treatments were effective at reducing SAD symptoms as well as improving on other secondary outcome measures, such as increases in mindfulness and acceptance, decreases in rumination, and changes in cognitive reappraisals for both groups. Both treatment groups were significantly more improved than the wait list control group, but not significantly different from each other. Overall, although many of the studies examining mindfulness-based techniques in the context of SAD combine this approach with other techniques, they all have shown promising results, barring some methodological concerns. One key issue that hampers research development of this treatment modality is the use of mindfulness as a construct. Until the year 2003, mindfulness had only been vaguely defined and there is still no consensus on the operational definition of mindfulness (i.e., should it be considered as a trait versus state and a unitary versus multiple construct (Bishop, 2002; Chiesa & Serretti, 2010; Proulx, 2003; Roemer & Orsillo, 2003).

Bishop (2002) has suggested that mindfulness may simply be a form of relaxation. To shed more light on this, questionnaires have been developed to assess mindfulness (Baer,

Smith, & Allen, 2004; Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006; Brown & Ryan, 2003; Cardaciotto, Herbert, Forman, Moitra, & Farrow, 2008; Erisman & Roemer, Mar 2012; Feldman, Hayes, Kumar, Greeson, & Laurenceau, Sep 2007; Lau et al., 2006) and are increasingly incorporated in research designs. One criticism that has been levied at mindfulness related research is that most of the outcome measures assess symptom reduction, which is not one of the goals of MBSR or mindfulness (Proulx, 2003; Roemer & Orsillo, 2003). It is argued that it would be best to use measures of quality of life or functioning to assess outcome. Finally, it is not always possible to distinguish the effects of mindfulness itself when it is integrated with other treatments (Chiesa & Serretti, 2010; Proulx, 2003). This leads to the issue of identifying the mechanism of action in mindfulness-based approaches and clarifying whether the active ingredients are different or the same as other treatments. Baer (2003) and Roemer & Orsillo (2003) concluded that although both CBT and MBSR aim for changes in cognitions, CBT involves a change in the content of cognitions, whereas MBSR involves a change in one`s relationship to cognition in that cognitions are simply viewed as a "mental event" instead of as fact/reality (Baer, 2003; Roemer & Orsillo, 2003).

Mindfulness is also thought to share features of interoceptive exposure which is exposure to the internal sensations felt during panic, as both techniques encourage individuals to look internally (Baer, 2003; Roemer & Orsillo, 2003). However, the goals of each treatment are different in that with mindfulness, the individual is not expecting his anxiety to decrease but learns to experience their internal arousal in a non-judgmental, accepting way (Roemer & Orsillo, 2003). As such, the potentially unique contribution of mindfulness, that is, acceptance and letting go of efforts to feel better, requires further investigation.

Mindfulness in the context of an acute stressor in different populations such as healthy college students, anxious participants, and patients with substance abuse disorders (Arch & Craske, 2006; Arch & Craske, 2010; Barnes, Brown, Krusemark, Campbell, & Rogge, 2007; Brewer et al., 2009; Kaviani, Javaheri, & Hatami, 2011; Weinstein, Brown, & Ryan, 2009) has also been studied. Among these, some have assessed the effects of trait mindfulness (Arch & Craske, 2010; Barnes et al., 2007; Weinstein et al., 2009) while others have examined induced mindfulness (Arch & Craske, 2006; Brewer et al., 2009; Kaviani et al., 2011). Stressors involved in these studies varied and included laboratory stressors (e.g., mental arithmetic) and real-life stressors (e.g., exams, relational conflict discussion). All found that levels of mindfulness were associated with better coping strategies and a more positive evaluation of stressful events. For example, Kaviani et al., (2011) assessed the impact of MBCT (versus wait-list control) on measures of anxiety, depression, and automatic thoughts among healthy students, and found that MBCT helped them cope before, during, and after exams. Moreover, Weinstein et al., (2009) found that higher levels of trait mindfulness were associated with less perceived stress and a better recovery following a mental arithmetic task. To our knowledge, no studies have specifically looked at the response to an acute stress before and after treatment with MBSR in SAD patients.

***Risks of MBSR*.** Despite the numerous studies reporting the efficacy of mindfulness, there is very little research examining the possible risks or side effects associated with mindfulness. For example, a recent study suggests that mindfulness is often associated with worsening symptoms corresponding to increased awareness (Fjorback et al., 2011; Melbourne Academic Mindfulness Interest Group, 2006). Others have reported depersonalization, unusual behaviours, or psychosis following mindfulness, particularly in individuals with a previous history of psychosis; as a result, mindfulness treatments are

contraindicated for individuals who have experienced psychotic episodes (Melbourne Academic Mindfulness Interest Group, 2006). In addition, long-term retreats (i.e., intensive mindfulness training that can last up to 10 days) may not be appropriate for beginners of meditation practice; for example, many studies have reported episodes of depersonalization, psychotic features, or euphoria in response to intense mindfulness session (Melbourne Academic Mindfulness Interest Group, 2006). Despite these risks, research on the efficacy of mindfulness based interventions has yielded relatively positive results.

Biological basis of SAD

The two systems that comprise the stress response are the hypothalamic pituitary adrenal (HPA) axis and the Autonomic Nervous System (ANS) (Adam & Gunnar, 2001; Porges, Doussard-Roosevelt, & Maiti, 1994; Stansbury & Gunnar, 1994). In response to a perceived stress, the hypothalamus secretes corticotropic releasing hormone which causes the release of adrenocorticotropic hormones from the anterior pituitary gland into the bloodstream. The adrenocorticotropic hormones act on the adrenal gland, which in turn releases corticosteroid hormones such as cortisol, which is often referred to as the "stress hormone" and is believed to be a good indicator of HPA axis functioning (Adam & Gunnar, 2001; Braarud & Stormark, 2006; Clow, Thorn, Evans, & Hucklebridge, 2004; Pruessner, Hellhammer, & Kirschbaum, 1999; van Veen et al., 2008).

A feedback loop plays an important role as corticosteroid hormones travel back to the brain through the bloodstream, reaching both the hypothalamus and the pituitary gland. When this occurs, the production and release of corticotropic releasing hormone and adrenocorticotropic hormones are inhibited. As a result of this mechanism, the release of hormones is self-limiting and a relatively constant blood level of hormones is maintained.

Cortisol has a diurnal rhythm, characterized by a morning elevation shortly after wakening and progressively drops throughout the day (Adams & Gunnar, 2001; Gonzalez, Jenkins, Steiner, & Fleming, 2008; Michaud, Matheson, Kelly, & Anisman, 2008**)**. In response to an acute stressor, cortisol typically increases and peaks within 20-40 minutes, returning to baseline levels shortly thereafter (Condren, O'Neill, Ryan, Barrett, & Thakore, 2002; Kirschbaum et al., 1995).

There is much interest in the atypical response to stress, often observed in those who have suffered chronic stress (Adam & Gunnar, 2001; Gonzalez, Jenkins, Steiner, & Fleming, 2009; Uhde, Tancer, Gelernter, & Vittone, 1994; van Veen et al., 2008). In some individuals, the rhythm can be either in the form of a hypercortisol or a hypocortisol pattern, either of which can lead to increased risk of heart disease or immune-related disorders (Bower et al., 2005; Buske-Kirschbaum, Geiben, Hollig, Morschhauser, & Hellhammer, 2002; Jafarian-Tehrani & Sternberg, 1999; Mason, 1991; Sternberg et al., 1989). Some individuals also show an atypical response to an acute stressor, being characterized by either no cortisol change, a higher response, or a longer recovery time to baseline values (Berger et al., 1987; Bower, Ganz, & Aziz, 2005; Condren et al., 2002; Elzinga, Spinhoven, Berretty, de Jong, & Roelofs, 2010; Furlan, DeMartinis, Schweizer, Rickels, & Lucki, 2001; Gerra et al., 2001; Kirschbaum et al., 1995; Levin, Saoud, Strauman, & Gorman, 1993; Martel et al., 1999; Roelofs et al., 2009). Salivary sampling is typically used for the assessment of cortisol levels (Kirschbaum & Hellhammer, 1994); it is minimally invasive and correlates well with levels found in serum (Kirschbaum & Hellhammer, 1994).

The second system associated with stress is the ANS, which includes the sympathetic (SNS) and parasympathetic nervous system (PNS) branches (Kandel, Schwartz, & Jessell,

2000; Porges et al., 1994). The PNS is involved in growth and digestion, reduces heart rate, breathing, and has a calm, vegetative function. The SNS is stimulated by arousal, vigilance, and emergency which activates what is referred to as the "fight or flight" response where the body undergoes certain changes in preparation to fight or flee. These changes include, but are not limited to increased heart rate, blood pressure, sweating, and pupil dilation (Kandel et al., 2000; Porges et al., 1994). Just as cortisol provides an indication of HPA axis functioning, levels of heart rate variability (HRV) are indicators of ANS functioning (Bazhenova & Porges, 1997; Friedman, 2007; Mezzacappa et al., 1997; Monk et al., 2001).

Cortisol and SAD. Many studies have examined the link between SAD and cortisol levels and generally have found no abnormal diurnal patterns in individuals with SAD (Martel et al., 1999; Uhde et al., 1994; van Veen et al., 2008). Other studies have questioned whether individuals with SAD have abnormal cortisol secretion, either hypocortisolism or hypercortisolism, in response to an acute stressor (Condren et al., 2002; Elzinga et al., 2010; Furlan et al., 2001; Levin et al., 1993; Martel et al., 1999; Roelofs et al., 2009). Studies employing psychological stressors have yielded mixed results, with some finding a hypercortisol pattern (Condren et al., 2002; Roelofs et al., 2009), and others, no differences in cortisol responses to an acute stressor between SAD and healthy control groups (Levin et al., 1993; Martel et al., 1999). For example, Roelofs et al., (2009) investigated whether a cortisol response to a psychological stressor would be associated with social avoidance behaviours in a SAD group. The authors compared results from SAD participants, a treatment control group with post-traumatic stress disorder, and a healthy control group. Participants were asked to perform a social approach-avoidance task during a baseline condition as well as during a stress condition - the Trier Social Stress Task (TSST); this is a laboratory procedure for inducing an acute stress response and consists of the preparation of

a short speech task (anticipatory stress), followed by its delivery. Some versions include a brief mental arithmetic task as well (Kirschbaum, Pirke, & Hellhammer, 1993).

The results showed that the SAD patients had a greater increase in cortisol after the TSST as compared to individuals in both control groups. Similarly, a study by Furlan et al. (2001) found that the presentation of a stressor yielded both responders and non-responders. Among those associated with higher levels of cortisol – defined as the responders - the SAD group had significantly higher levels of cortisol as compared with the responders from the healthy control group. They also reported that the SAD group was much more dichotomized with7 responders and 11 non-responders, in contrast to the control group with 14 responders and only 3 non-responders, suggesting the presence of non-responders and hyperactive individuals in the SAD group. Interestingly, cortisol levels do not always match self-reported levels of anxiety (Condren et al., 2002; Furlan et al., 2001; Levin et al., 1993; Roelofs et al., 2009). For example, Furlan et al. (2001) found that following a speech task, both groups of SAD participants (responders and non-responders) reported comparable increases in subjective anxiety as assessed by the State-Trait Anxiety Inventory. Likewise, Roelofs et al., (2009) compared SAD, post-traumatic stress disorder, and healthy control groups. They found that despite similar observable reactions, both the SAD and post-traumatic stress disorder groups were subjectively more anxious than the healthy control group. Moreover, the SAD group showed a higher increase in cortisol after the TSST than both of the other groups even though their levels of self-reported anxiety were similar across groups.

It is important to note that these studies vary considerably in their methodologies, particularly in the types of stressors used, cortisol measurement procedure, and statistical analyses. Various means of inducing stress including the TSST (Roelofs et al., 2009), speech tasks (Furlan et al., 2001; Levin et al., 1993), a modified TSST in which participants are

asked to retell a story that they have just heard (Martel et al., 1999), and a mental arithmetic/working memory task (Condren et al., 2002) have been employed, which might explain some of the differences, particularly if the stressors were not powerful enough to elicit a cortisol response. Another key variation has been the way in which cortisol levels are determined, either extracted from plasma (Condren et al., 2002; Levin et al., 1993), saliva (Furlan et al., 2001; Martel et al., 1999; Roelofs et al., 2009; van Veen et al., 2008), or urine (Uhde et al., 1994).

Cortisol and CBT. Cortisol has been used as a biomarker of the effects of CBT interventions in various populations, including in groups with different levels of depression severity (Kim, Lim, Chung, & Woo, 2009; Thase, Simons, & Reynolds, 1993), depressed persons with elevated cardiovascular risk (Taylor et al., 2009), panic disorder with agoraphobia (Siegmund et al., 2011), soldiers with a phobia of wearing a protective mask (Brand, Annen, Holsboer-Trachsler, & Blaser, 2011), elderly hypertensive patients (Sung, Woo, Kim, Lim, & Chung, 2012), individuals diagnosed with chronic fatigue syndrome (Roberts, Papadopoulos, Wessely, Chalder, & Cleare, 2009; Roberts et al., 2010), obese women with binge eating disorder (Gluck, Geliebter, & Lorence, 2004), individuals with eating disorders (Vocks, Legenbauer, Wachter, Wucherer, & Kosfelder, 2007), women waiting for assisted reproduction (Facchinetti, Tarabusi, & Volpe, 2004), women undergoing treatment for breast cancer (Antoni et al., 2009; Phillips et al., 2008), men infected with HIV (Antoni et al., 2005), and a healthy population (Gaab, Sonderegger, Scherrer, & Ehlert, 2006; Granath, Ingvarsson, von Thiele, & Lundberg, 2006; Hammerfald et al., 2006).

In many cases, no changes in cortisol from pre-treatment to post-treatment (Gluck et al., 2004; Siegmund et al., 2011) have been found, although some have specified that cortisol levels have been higher in treatment groups than in control groups, both before and after

treatment (Taylor et al., 2009; Vocks et al., 2007), while others have found a reduction in cortisol following CBT treatments (Antoni et al., 2009; Brand et al., 2011; Facchinetti et al., 2004; Hammerfald et al., 2006; Kim et al., 2009; Phillips et al., 2008; Sung et al., 2011); indeed, one study reported a cortisol reduction that persisted for at least 12 months (Antoni et al., 2009).

One of the difficulties in comparing across studies is that many different types of CBT treatments have been used, such as Forest therapy (Kim et al., 2009; Sung et al., 2011), two day intensive CBT (Brand et al., 2011), flooding (Siegmund et al., 2011), cognitive behavioural stress management (Antoni et al., 2005, 2009; Gaab et al., 2006; Granath et al., 2006; Hammerfald et al., 2006; Phillips et al., 2008), CBT plus diet (Gluck et al., 2004), or CBT alone (Facchinetti et al., 2004; Robert et al., 2009, 2010; Taylor et al., 2009; Thase et al., 1993).

In addition, the reference or control group employed varied across studies, including CBT versus no treatment (Antoni et al., 2005; Gaab et al., 2006; Gluck et al., 2004; Hammerfald et al., 2006; Sung et al., 2006; Vocks et al., 2007), CBT versus psychoeducation (Antoni et al., 2009; Phillips et al., 2008), treatment versus healthy control (Brand et al., 2011; Siegmund et al., 2011) and pre-post treatment designs with no control group (Robert et al., 2009, 2010; Thase et al., 1993). Very few studies have included a treatment group, a treatment control group, and a healthy control group (Kim et al., 2009; Taylor et al., 2009).

Finally, among the types of stressors used have been a cold pressure stress test (Gluck et al., 2004), a Stroop color-word task (Facchinetti et al., 2004), "real-life stressor", such as an exam (Gaab et al., 2006), and a standardized psychosocial stress test (Hammerfald et al., 2006). Given the methodological and population differences in these studies of CBT and

cortisol, it is difficult to conclude whether CBT treatments would lead to lower cortisol responses, let alone whether this would be the case in a group of SAD patients.

Cortisol and MBSR. The effects of mindfulness interventions on variants of diurnal or reactive cortisol have been investigated in a number of populations such as substance users (Marcus et al., 2003), women with histories of heart disease (Robert McComb, Tacon, Randolph, & Caldera, 2004), women diagnosed with early stage breast cancer (Witek-Janusek et al., 2008), breast and prostate cancer patients (Carlson, Speca, Faris, & Patel, 2007), individuals with anxiety and depression (Manzaneque et al., 2011), healthy adults (Klatt, Buckworth, & Malarkey, 2009; Pace et al., 2009, 2010), and health care professionals (Galantino et al., 2005). These share exactly the same methodological concerns as described above (Carlson et al., 2007; Manzaneque et al., 2011; Marcus et al., 2003; Pace et al., 2009; Pace et al., 2010; Robert McComb et al., 2004; Witek-Janusek et al., 2008) making comparisons across studies difficult.

Some report no effect of mindfulness on diurnal or reactive cortisol (Klatt et al., 2009; Manzaneque et al., 2011; Pace et al., 2009; Robert McComb et al., 2004), while others report decreases in diurnal or awakening cortisol levels for participants in a mindfulness as opposed to a no intervention, or treatment as usual group (Carlson et al., 2007; Marcus et al., 2003; Witek-Janusek et al., 2008).

For example, in the study by Robert-McComb et al., (2004), women with histories of heart disease were randomly assigned to a mindfulness skill development training group or control group. A reduction in resting diurnal cortisol levels, albeit not significant, was found in the treatment, but not in the control group.

In contrast, Witek-Janusek et al., (2008) studied women recently diagnosed with early stage breast cancer who self-selected either a MBSR intervention or an assessment only

control group. Assessments were completed at four time points: following surgery just prior to the MBSR, mid-therapy, upon completion, and four weeks after the intervention. Although the women in the MBSR and the non-MBSR group had similar cortisol levels at baseline, results showed that they had lower cortisol levels at the end of treatment compared to the non-MBSR breast cancer group. Moreover, the women in the MBSR group reported greater improvements in quality of life and more effective coping skills than the non-MBSR breast cancer group.

Heart rate variability and SAD. The sympathetic branch of the ANS has been studied in the context of anxiety disorders and of SAD specifically (Beaton et al., 2006; Burg, Wolf, & Michalak, 2012; Edelmann & Baker, 2002; Friedman, 2007; Garakani et al., 2009; Gerlach, Wilhelm, & Roth, 2003; Libby, Worhunsky, Pilver, & Brewer, 2012; Licht, de Geus, Eco, van Dyck, & Penninx, 2009; Martinez, Garakani, Kaufmann, Aaronson, & Gorman, 2010). HRV has been recognized as a sensitive and reliable estimate of ANS activity during basal and stressful conditions across the lifespan (Bazhenova & Porges, 1997; Friedman, 2007; Mezzacappa et al., 1997; Monk et al., 2001; Porges et al., 1994). HRV measured through spectral analyses yields multiple results, with Low Frequency (LF) data being a measure of the sympathetic activity, High Frequency (HF) data, a measure of the cardiac vagal tone and parasympathetic activity, and LF:HF ratio, indicative of the balance between both systems (Akselrod et al., 1981; Pagani et al., 1986).

Lower HRV activity and anxiety disorders have both been linked to increased mortality in coronary artery disease (Garakani et al., 2009; Licht et al., 2009; Martinez et al., 2010). Many studies suggest that patients with anxiety disorders show decreases in HRV as well as decreases in cardiac vagal tone and increases in sympathetic cardiac function (Friedman, 2007; Garakani et al., 2009; Licht et al., 2009; Martinez et al., 2010). For

example, Martinez et al., (2010) compared the HRV of 30 patients with Panic Disorder to that of a healthy control group during a restful condition and a tilt test. At rest, patients with Panic Disorder showed higher HR, lower HRV, and higher LF/HF ratios than the healthy control group. Moreover, the patients with Panic Disorder showed a smaller change in reaction to the tilt test, which the authors concluded was indicative of a lower ability to adjust the SNS/PNS balance.

However, not all studies have found the same pattern of results in assessing HR or HRV and anxiety disorders, some reported no differences between anxiety and control groups on these measures (Asmundson & Stein, 1994; Beaton et al., 2006; Edelmann & Baker, 2002; Stein & Asmundson, 1994). According to Friedman (2007), the relationship between HRV and anxiety has been studied mostly in individuals with Panic Disorder, based on the clear theoretical link between panic attack symptoms and ANS activity. His review suggests that Panic Disorder shows the greatest support for the pattern of results described above (i.e., lower HRV, higher sympathetic activity, lower parasympathetic activity) and the least so in SAD patients. Given the lower HRV observed in individuals with many types of anxiety disorders and its link to mortality in cardiovascular disease, especially among individuals with Panic Disorder, including HRV as a measure to determine the effects of treatment in anxiety disorders is warranted. Garakani et al., (2009) showed that CBT not only reduced clinical symptoms of patients with Panic Disorder, but also increased their HRV and decreased HR. Mindfulness techniques, examined in the context of individuals participating in a program to quit smoking (Libby et al., 2012) and in a study of undergraduate psychology students completing a mindful breathing exercise (Burg et al., 2012), have also been shown to have a positive impact on HRV.

In summary, many studies have found lower HRV in patients with anxiety disorders, especially those with Panic Disorder. However, the results are less clear in the case of SAD patients and more work is needed to clarify the link between HRV and SAD. Moreover, CBT and Mindfulness techniques have both been associated with improvements in HRV, but, to our knowledge, this link has not yet been examined specifically in patients with SAD.

Visual Analog Scales and SAD

Cortisol and HRV are physiological biomarkers that lend themselves well to serial measurement. There are many subjective measures of anxiety, but only a limited number allow for frequent measurement. Visual Analog Scales (VAS) have been used for many decades (Wewers & Lowe, 1990; Williams, Morlock, & Feltner, 2010) and are employed for measuring a wide variety of subjective phenomena such as pain (Scrimshaw & Maher, 2001), quality of life (de Boer et al., 2004), mood (Cox, Connor, Henderson, McGuire, & Kendell, 1983; Lingjaerde & Foreland, 1998; Steiner & Streiner, 2005), and anxiety (Argyropoulos et al., 2004; Williams et al., 2010). They represent brief, quick methods of measurement which are easy to translate and simple for participants to use (Scrimshaw & Maher, 2001; Wewers & Lowe, 1990; Williams et al., 2010).

Although there is some debate concerning the use and types of VAS (de Boer et al., 2004; Revill, Robinson, Rosen, & Hogg, 1976; Wewers & Lowe, 1990), the general consensus is that such scales show relatively good psychometric properties (Cox et al., 1983; Kendell, McGuire, Connor, & Cox, 1981; McCoy et al., 2005; Wewers & Lowe, 1990; Williams et al., 2010).William et al., (2010) examined the psychometric properties of VAS specifically in the context of anxiety. They assessed its reliability, convergent and discriminant validity, as well as its responsiveness. They demonstrated adequate test-retest reliability of the general anxiety VAS after a week as well as good convergent validity with

high correlation between the general anxiety VAS and other anxiety measures (i.e. Hamilton Rating Scale for Anxiety, Hospital Anxiety and Depression Scale-Anxiety subscale and the Clinical Global Impression of Severity). Moreover, they showed good divergent validity, given that the general anxiety VAS had higher correlations with anxiety measures than with measures of depression.

Risk factors for SAD among children and adolescents

Although treatments for SAD continue to be developed, it is important that at the same time, prevention methods be explored. One way is to identify children who are at risk for anxiety disorders before symptoms are manifested. The second study in this dissertation will focus on this aspect. As mentioned above, anxiety disorders are not only prevalent in adulthood, but they often have their onset in childhood with lifetime prevalence by the age of 18 years estimated at 30% (Cartwright-Hatton, McNicol, & Doubleday, 2006; Costello, Egger, & Angold, 2005; Merikangas et al., 2010).

Many studies have examined risk factors for anxiety disorders (Beesdo et al., 2009; Essex, Klein, Slattery, Goldsmith, & Kalin, 2010; Hudson, Dodd, Lyneham, & Bovopoulous, 2011; Hudson, Dodd, & Bovopoulos, 2011; Lewis-Morrarty et al., 2012; Shamir-Essakow, Ungerer, & Rapee, 2005, Williams et al., 2009 to name a few). Although many factors have been identified, it is not always clear whether they are risk factors, correlates, or consequences of anxiety disorders (Beesdo et al., 2009; Beesdo, Pine, Lieb, & Wittchen, 2010). For example, sex, education, and household income have often been identified as potential risk factors. That is, being a female, having a lower education and lower household income (or an unsatisfactory income) tends to be associated with higher rates of anxiety disorder (Canino et al., 2004; Costello et al., 2003; Kringlen et al., 2001; Pine et al., 1998; Vega et al., 1998; Wittchen et al., 1998). In addition, a family history of anxiety disorder has

been consistently established as a risk factor (Beesdo et al., 2009; Hettema et al., 2001; Johnson et al., 2008; Lieb et al., 2000; Merikangas et al., 1999; Smoller et al., 2009; Wittchen et al., 2000); however, it is not clear how much of this association is due to genetic or environmental factors (Hettema et al., 2005; Smoller et al., 2009). According to Smoller et al.'s (2009) review, all anxiety disorders run in families and are heritable and possibly the result of a complex interaction between multiple genes, or between genes and the environment.

Parental depression has also been found to be associated with an increased risk of developing an anxiety disorder (Lieb et al., 2002; Weissman et al., 2006), as have temperament, personality traits (e.g., neuroticism, trait-anxiety and behavioural inhibition), as well as parenting style (e.g., overprotection and/or parental rejection), childhood adversities (e.g., loss of parents, parental divorce, physical and sexual abuse), and life events (Beesdo et al., 2009).

Models of psychopathology, including SAD, have all included interaction between the individual and the environment. Research on the topic has led to competing hypotheses/models on the link between biological vulnerabilities and negative or positive outcomes. The first proposed model, the diathesis-stress/dual stress model is well known and has had overwhelming support in the literature (Ingram & Luxton, 2005). It proposes that individuals have vulnerabilities (i.e., diatheses), which may be genetic, biological, or psychological (e.g., cognitive or interpersonal) factors that are predispositions to psychopathology. The diathesis-stress model proposes that it is the interaction between these vulnerabilities and stressful life events that leads to psychopathology. The model proposes that every individual has a degree of vulnerability to any given psychopathology, but that the development of a psychopathology or the time at which this development occurs also

depends on the stressors experienced by the individual and the interaction between his or her predisposing factors and experience of stress. The way in which this interaction is thought to take place varies between models, with some models proposing an additive relationship in which the vulnerabilities and stress are added together to lead to the disorder. Ipsative models, although not necessarily different from additive models, propose that the more stress an individual experiences, the fewer vulnerabilities are needed to lead to a disorder, and vice versa; an individual with many vulnerabilities could develop a disorder under minimally stressful conditions. Finally, the mega diathesis-stress model proposes that for some disorders, a high degree of both predisposing factors and stress are needed for the disorder to develop. However, the diathesis-stress model is used and has been developed for describing how/why poor/negative outcomes (i.e., psychopathology) come to be; it does not include the possibility of positive outcomes.

Two other competing hypotheses argue that individuals who are highly vulnerable may in negative environments or stressful contexts, have the poorest outcomes, as proposed by the diathesis-stress model; however, these same individuals may also be the ones who fare best in more supportive environments (Belsky & Pluess, 2009; Boyce & Ellis, 2005; Ellis, Essex, & Boyce, 2005; Plues & Belsky, 2009).

The differential susceptibility hypothesis proposes that individuals have differing levels of plasticity and susceptibility to environmental/contextual circumstances, and that these individuals are more susceptible to the effects of the environment, whether these are negative or positive (Belsy & Pluess, 2009). The biological sensitivity to context theory shares some similarities to the differential susceptibility theory in that it also proposes the need to not only look at adverse contexts, but also positive ones, and that those individuals who would fare more poorly in unfavourable environments, would also fare more positively

in supportive contexts. Boyce & Ellis (2005) focus on the stress response and propose that it calibrates itself based on early childhood environments, and in highly adverse conditions, becomes highly reactive, and vigilant in order to promote survival; but in especially supportive conditions, the highly reactive physiological response would allow the individual to maximally benefit from social resources and support.

The possible risk factors of childhood anxiety (e.g., Coryell, 1997; Coryell, Pine, Fyer, & Klein, 2006; Edwards, Rapee, & Kennedy, 2010; McLeod, Wood, & Weisz, 2007; Merikangas et al., 1999; Wood, McLeod, Sigman, Hwang, & Chu, 2003) have been categorized into temperamental factors (e.g., behaviour inhibition (BI), anxiety sensitivity, shyness, negative affectivity, harm avoidance), environmental factors (e.g., parenting behaviours, life events, peer-relationships, perinatal factors), and physiological factors (e.g., heart rate (HR), HRV, cortisol, startle responsivity) and could be described within one of these models, such that temperamental and physiological factors could be considered vulnerabilities (or diathesis), while environmental ones would include the context of the individuals, whether stressful or supportive. Although the aim of the dissertation is not to propose which of these models better explains the development of SAD, an understanding of the possible risk factors and how they may interact could help determine where to focus and who to target for specific prevention methods.

The temperamental characteristic most associated with greater risk of social anxiety in childhood, and anxiety in general, is behavioural inhibition (BI) (Broeren, Newall, Dodd, Locker, & Hudson, 2014; Chronis-Tuscano et al., 2009; Clauss & Blackford, 2012; Essex et al., 2010; Gladstone, Parker, Mitchell, Wilhelm, & Malhi, 2005; Hudson et al., 2011; Hudson et al., 2011; Lahat, Hong, & Fox, 2011; Muris, van Brakel, Arntz, & Schouten, 2011; Rapee, 2014; Schwartz, Snidman, & Kagan, 1999). According to Hirshfeld-Becker et

al., (2008), BI has been shown to predict later SAD, and possibly predict other anxiety disorders later in life. In their meta-analysis, Clauss and Blackford, (2013) found a four-fold increase in the risk of developing SAD in children with BI compared to those without. BI is described as a personality temperament that consists of facing new situations or persons with wariness and avoidance (Clauss & Blacford, 2012; Degnan, Almas, & Fox. 2010; Kagan, Reznick, & Snidman, Gibbons, & Johnson, 1988; Lahat et al., 2011; Rapee, 2014). Signs of BI can be identified as early as infancy and observed all the way to adulthood (Clauss & Blacford, 2012; Degnan et al., 2010; Kagan et al., 1988; Lahat et al., 2011; Rapee, 2014). Individuals with BI tend to be shy, fearful and cautious (Kagan & Snidman, 1999; Fox, Henderson, Marshall, Nichols, & Ghera, 2005).

Many studies have examined the role of BI in the physiological or subjective response to acute stress or to novel situations, as well as their relationship to the development of SAD (de Haan, Gunnar, Tout, Hart, & Stansbury, 1998; Essex et al., 2010; Gunnar, Tout, de Haan, Pierce, & Stansbury, 1997; Gunnar, Kryzer, Van Ryzin, & Phillips, 2011; Hastings et al., 2011; Kagan, Reznick, & Snidman, 1987; Kagan, Reznick, & Snidman, 1988b; Kagan & Snidman, 1991; Kertes et al., 2009; Nachmias, Gunnar, Mangelsdorf, Parritz, & Buss, 1996; Scarpa, Raine, Venables, & Mednick, 1997; Schmidt et al., 1997; Tarullo, Mliner, & Gunnar, 2011; Zimmermann & Stansbury, 2004). Longitudinal studies in this context have provided examples of the association between levels of BI and the activation of the physiological stress response, based on HPA axis or ANS functioning (Kagan et al., 1988; Reznick et al., 1986; Schwartz et al., 1999)

Kagan's group (1986, 1988, 1999) followed a group of 28 behaviourally inhibited and 30 uninhibited children originally assessed at either 21 or 36 months of age and followed until 7 years old and then again during adolescence. These participants were selected from a

group of 305 Caucasian children whose mothers had participated in a telephone interview. Among these participants, 117 mothers identified their children as either inhibited or uninhibited. They were then observed in a variety of unfamiliar situations at the Harvard University Infant Study Laboratory. Those who consistently showed signs of BI (i.e., long delay in interacting with adults, moving away from an unfamiliar person or object, discontinuation of play or vocalizations, clinging to mother, fretting or crying), or none of these symptoms represented the 28 inhibited and 30 uninhibited children selected respectively with each group representing approximately 10% of the original sample (Kagan et al., 1988; Reznick et al., 1986; Schwartz et al., 1999).

Kagan's group found that the physiological response to novelty in these inhibited participants tended to show a hyperarousal of the limbic system, based on increased salivary levels, laryngeal muscle tension, pupillary dilation, catecholamine levels, and a high and stable or accelerated heart rate (Kagan, Reznick, & Snidman, 1988). Moreover, follow-up studies with these same participants indicated that the BI differences originally observed, as well as heart rate and HRV, were mostly preserved when the children were 4, 5, and 7.5 years of age. For example, 75% of the original classifications between BI and behavioural uninhibition remained the same at 7.5 years of age (Kagan et al., 1988; Reznick et al., 1986). These same participants were also assessed at the age of 13; the children who had originally been identified as inhibited were more likely to experience SAD at this age (Schwartz et al., 1999).

Rosenbaum et al., (1991) assessed the siblings and parents of the participants in Kagan and colleagues longitudinal inhibited and uninhibited children as well as the parents and siblings of a group of uninhibited "normal" control children and found no differences in patterns of overall psychopathology in the siblings of these three groups. On the other hand,

they found that the parents of the inhibited group as compared to those of the uninhibited and control groups had significantly higher risk of having multiple anxiety disorders, SAD, and childhood avoidance and overanxious disorders.

A second longitudinal study examining the link between BI and child anxiety symptoms and disorders that included some physiological responses was completed by Fox and Colleagues (Calkins et al., 1996; Fox et al., 2001; and Fox et al., 2005 for review). They categorized infants, even younger than the children in Kagan and colleagues' study, on the basis of their motor response and affect towards novelty. They identified three groups, the first, labeled the negative group, showed a high motor response and a negative affect in response to novelty, the second, labeled the low group, showed very little motor response to novelty, and the third, labeled the positive group displayed high motor response and a positive affect to the novel stimuli. At 9 months of age, the children returned to the lab to have their brain electrical activity recorded (Calkins et al., 1996; Fox et al., 2001). As expected, Calkins et al., (1996) found that those infants who had been identified as being within the negative group, displayed greater activation of the right frontal region, and to their surprise, the positive group exhibited a pattern of higher left frontal activation. These children were also assessed at 1, 2, and 4 years of age, as well as in adolescence (Calkins et al., 1996; Chronis-Tuscano et al., 2009; Fox et al., 2001; Fox, 2005). At 14 months of age, those who had been classified as negative displayed higher BI, but this difference was not as clear at 24 and 48 months of age (Fox, 2005). Chronis-Tuscano et al., (2009) found that early and stable elevated levels of BI as measured throughout the longitudinal study were predictive of lifetime SAD, and that these early and stable elevated levels of BI were associated with almost four times increased odds of having SAD.

Although early longitudinal studies examining individuals with elevated BI have yielded significant differences in physiological responses to acute stress and novelty, other studies have generated mixed results (Calkins, Fox & Marshall et al., 1996; Fox et al., 2005; Gunnar, Sebanc, Tout, Donzella, & Dulmen, 2003; Gunnar et al., 2011; Kagan & Snidman, 1991; Scarpa et al., 1997; Schmidt et al., 1997; Tarullo, Mliner & Gunnar, 2011; Zimmermann & Stansbury, 2004). For example, similar to the results found in Kagan and Colleagues longitudinal studies described above, others have reported an activation of the physiological response in all individuals with BI (Rosen & Schulkins, 1998; Russ et al., 2012; Schmidt et al., 1997; Talge, Donzella, & Gunnar, 2008; Tarullo et al., 2011; Zimmermann & Stansbury, 2004), only in some individuals, or only in certain settings (home versus school) (de Haan et al., 1998; Nachmias et al., 1996) while others have found no differences in HPA axis or ANS functioning in individuals with and without BI (Buss, Davidson, Kalin, & Goldsmith, 2004; Essex et al., 2010; Gunnar et al., 1997; Hastings et al., 2011; Kagan et al., 1988; Kertes et al., 2009; Talge et al. 2008). For example, Nachmias et al., (1996) found elevated cortisol levels only for BI individuals who had an insecure attachment to their mother. Gunnar et al., (2011) found that BI moderated the link between cortisol activation and later child outcomes in anxiety symptoms and vigilance. Tarullo, Mliner & Gunnar (2011) found that over the course of the school year, only participants who were highly inhibited and more socially integrated (i.e., had more friends and showed more dominance) showed evidence of prolonged HPA activation throughout the school year. Finally, Talge et al., (2008) defined a larger stress response as greater sympathetic activation, parasympathetic withdrawal, and cortisol activation in response to a stressful task. They found that a fearful temperament was associated with an increase in cortisol, but they did not find the expected associations with the sympathetic and parasympathetic activations.

These are a few examples of the studies that have examined the physiological stress response in individuals with BI. Results indicate that the link between BI and the physiological stress response may be mediated or moderated by a number of other factors, such as attachment or social integration. Given the many possible interactions between heritability/genetic and environmental factors, the lack of a clear link between BI and physiological activation is not surprising.

Parental behaviours are environmental factors that have been examined as potential vulnerabilities for childhood anxiety. Most studies have found differences in parenting behaviours between parents with and without anxiety disorders, the former characterized by anxious behaviours, more criticism, less warmth, or overprotection (e.g., Dadds, Barrett, Rapee, & Ryan, 1996; Ginsburg, Grover, & Ialongo, 2004; Last & Strauss, 1990; Lieb et al., 2000; McClure, Brennan, Hammen, & Le Brocque, 2001; Whaley, Pinto, & Sigman, 1999). Some of these parenting behaviours have been associated with higher levels of anxiety disorders in their children (Ginsburg et al., 2004; Hirshfeld, Biederman, Brody, Faraone, & Rosenbaum, 1997; Whaley et al., 1999). However, it is unclear whether the association between parenting behaviours and child anxiety is unidirectional or bidirectional (Ganiban, Ulbricht, Saudino, Reiss, & Neiderhiser, 2011; Hudson & Rapee, 2002; Hudson, Comer, & Kendall, 2008). For example, many authors have questioned whether parenting behaviours lead to BI or whether the child's BI character gives rise to certain parenting behaviours or styles. Some also suggest that the amount of influence the child's characteristics has on the parenting style depends on the child’s temperament. That is, children who have higher levels of negative emotionality may have more of an impact on their parent's parenting styles than would be the case for shy children (Ganiban et al., 2011).

Parental bonding variables which include a care-rejection continuum and an autonomy granting-control continuum are among the parental behaviours or styles that have been extensively studied in the context of BI or anxiety (Dumas, LaFreniere, & Serketich, 1995; Giles & Price, Sep 2008; Hudson & Rapee, 2001; Kimbrel, Cobb, Mitchell, Hundt, & Nelson-Gray, 2008; Kimbrel, Mitchell, Hundt, Robertson, & Nelson-Gray, 2012; Meites, Ingram, & Siegle, 2012; Muris, Meesters, Merckelbach, & Hulsenbeck, 2000; Rubin, Nelson, Hastings, & Asendorpf, 1999; Silove, Parker, Hadzi-Pavlovic, Manicavasagar, & Blaszczynski, 1991; Siqueland, Kendall, & Steinberg, 1996; Spada et al., 2012; Stevenson-Hinde & Glover, 1996; Wood et al., 2003). Much of the early research on parental bonding variables was based on the parental bonding instrument (PBI) which is a questionnaire developed for adults to retrospectively recall their early-life parent-child interactions (Alnaes & Torgersen, 1990; Cox, MacPherson, & Enns, 2005; Ens, Cox &Clara, 2002; Kimbrel et al., 2008; Meites et al., 2012; Spada et al., 2012). These studies have consistently reported that young adults or adults with higher anxiety symptoms, or anxiety disorders, remember their parent-child interactions during their first 16 years of life as being less caring and more overprotective than that of individuals with no anxiety. This being said, some authors have criticized the use of retrospective studies given the likelihood of memory biases and argue that the behaviours recalled may not reflect actual past parenting behaviours, but they may be more closely related to the individual's current functioning (Gerlsma, Snijders, van Duijn, Marijtje, & Emmelkamp, 1997; Lewinsohn & Rosenbaum, 1987; Turgeon, O'Connor, Marchand, & Freeston, 2002; Wood et al., 2003).

More recent studies have examined parental bonding variables using child-report, parent-report, or observational measures (Dumas et al., 1995; Hudson & Rapee, 2001; Muris et al., 2000; Rubin et al., 1999; Siqueland et al., 1996; Stevenson-Hinde & Glover, 1996).

Wood et al., (2003) reviewed studies examining the link between parenting behaviours or styles and trait anxiety, anxiety disorders, or shyness. They found the best support for overprotection being associated with anxiety, but mixed results related to the care-rejection continuum. Although observational measures have been deemed to be more objective than self-report measures (Barrett, Fox, & Farrell, 2005; Barrett, Rapee, Dadds, & Ryan, 1996; Chorpita, Albano, & Barlow, 1996; Cobham, Dadds, & Spence, 1999; Shortt, Barrett, Dadds, & Fox, 2001; Wood et al., 2003); they also tend to reflect parenting behaviours at a specific time and in a particular situation instead of measuring a general parenting style or parenting behaviour (Ginsburg, Grover, Cord & Ialongo, 2006; Koszycki et al., 2013).

Very few studies examining the effects of parental bonding on the child's physiological response to stress have been done (Engert, Buss et al., 2010; Engert, Efanov et al., 2010; Sideridis & Kafetsios, 2008), and these tend to be limited to retrospective studies. For example, in a two part study, Sideridis and Kafetsios (2008) found that children's perception of their father and mother's caring was associated with lower fear of failure, anxiety, and depression symptoms prior to an important test at school. In a sample of college students, perceptions of parental caring were associated with lower stress and perceived parental overprotection was linked to increased fear and stress, based on a heart rate measure as well as performance scores during a class presentation (Sideridis & kafetsios, 2008).

Objectives of the Thesis

This thesis was designed to evaluate subjective and physiological stress responses in the context of the treatment and risk factors for SAD. Both studies included a subjective measure of anxiety symptoms and the physiological biomarkers cortisol and HRV. The first study explored the subjective and physiological stress response before and after either CBGT

or MBSR treatment for SAD. The second study examined the stress response among healthy children with varying levels of BI and parental bonding experiences.

Study 1:

As mentioned above, CBGT is the gold standard treatment for SAD; it has been deemed evidence-based and leads to significant improvements in functioning (Butler et al., 2006; Heimberg, 2002, Rodebaugh et al., 2004). However, many individuals with SAD do not respond to CBGT (Aderka, 2009; Eskildsen et al., 2010; Hofmann & Bogels, 2006; Rodebaugh et al., 2004) and other treatments have been investigated. Mindfulness based approaches have yielded positive results to that effect (Fjorback et al., 2011; Kocovski et al., 2009, 2013; Koszycki et al., 2007). This first study contributes to the literature by comparing CBGT and MBSR treatments for SAD on their effects to the response to an acute social stressor. Specifically, the objective was to examine whether the random assignment of SAD patients to a CBGT or an MBSR program would yield pre-post differences in subjective and/or physiological stress responses to a social speech task, and to explore how their responses would compare to those of healthy individuals.

Study 2:

The second study examined the subjective and physiological responses to the same acute stressor in a group of healthy children. It further explored whether temperamental (BI) and environmental (parental bonding variables) risk factors for SAD were associated with the magnitude of the stress response. The use of healthy children provided an opportunity to explore these risk factors and their possible interaction on the response to stress before any symptoms began to occur in order to guide prevention strategies.

Effects of CBT versus MBSR Treatment on Social Stress Reactions in Social Anxiety Disorder

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Abstract

Purpose: Cognitive behavioral group therapy (CBGT) has been reported to be more effective than a mindfulness-based stress reduction program (MBSR) in reducing symptoms of social anxiety disorder (SAD). The present study determined whether CBGT and MBSR differentially affected subjective anxiety and physiological response to a stressful speaking task. *Methods*: The sample comprised 38 medication free SAD patients who participated in a previously published trial comparing CBGT and MBSR; an additional 30 participants were healthy control (HC) volunteers. Patients performed a speech task before and after treatment while HC performed it only once. Subjective anxiety and core symptoms of SAD were assessed with visual analogue scales (VAS) and physiological responses included salivary cortisol and heart rate variability. *Results*: Prior to treatment the speech task induced greater increases in anxiety and SAD symptoms in patients compared to HC. After treatment, VAS ratings during the task decreased in both treatment groups. The most significant improvement overall was observed with CBGT, with their responses being comparable to that of HC. No physiological differences were found as a function of treatment. *Conclusion*: Although CBGT produced the best results, MBSR was nonetheless associated with a significant decrease in subjective anxiety and symptoms of SAD during the speech task.

Keywords: Social Anxiety Disorder, CBGT, MBSR, salivary cortisol, heart rate variability, acute social stress

Effects of CBT versus MBSR treatment on social stress reactions in social anxiety disorder

Social Anxiety Disorder (SAD) is one of the most common anxiety disorders (APA, 2000). It is described as an unrelenting fear of being embarrassed and/or evaluated in social interactions or performance situations (APA, 2000). In order to be diagnosed with SAD, patients must experience marked impairments (APA, 2000) in many domains including educational, social, and occupational (Acarturk, Smit, de Graaf, van Straten, ten Have, and Cuijpers, 2009ab; Schneier et al., 1994; Shields, 2004; Stein & Kean, 2000; Swinson, 2005; Vriends, Becker, Meyer, Michael, & Margraf, 2007; Wittchen, Fuetsch, Sonntag, Muller, & Liebowitz, 2000). It has also been linked to comorbid disorders, such as mood disturbances and other anxiety disorders (Acarturk, de Graaf, van Straten, ten Have, & Cuijpers, 2008; Acarturk et al., 2009; Kessler, 2003; Ruscio et al., 2008; Stein & Stein, 2008; Wittchen, Kessler, Pfister, & Lieb, 2000). Treatment for SAD includes pharmacotherapy and psychotherapy, alone or in combination. Among the psychotherapies, cognitive behavior therapy is considered a first-line treatment (Davidson et al., 2004; Eskildsen, Hougaard, & Rosenberg, 2010; Fedoroff & Taylor, 2001; Hofmann & Bogels, 2006). There is also growing interest in alternative interventions for SAD including mindfulness training (Aderka, 2009; Chiesa & Serretti, 2010; Eskildsen et al., 2010; Fjorback, Arendt, Ornbol, Fink, & Walach , 2011). The purpose of this study was to explore the physiological and subjective responses to an acute social stressor among individuals with SAD before and after completion of either cognitive behavioural group therapy (CBGT) or mindfulness based stress reduction (MBSR) program.

Stress response and social anxiety disorder

Anxiety and stress are closely related and many studies have examined the responses, both subjective and physiological, to stress among individuals with SAD (Furlan, DeMartinis, Schweizer, Rickels, & Lucki, 2001; Levin, Saoud, Strauman, & Gorman, 1993; Martel et al., 1999; Uhde, Tancer, Gelernter, & Vittone, 1994). It has been understood for some time that two physiological systems underlie the stress response (Adam & Gunnar, 2001; Porges, Doussard-Roosevelt, & Maiti, 1994; Stansbury & Gunnar, 1994). The first of these is the hypothalamic-pituitary-adrenal (HPA) axis. When a situation is perceived as dangerous or stressful, a cascade of events that are associated with the HPA axis is put into motion (Porges et al., 1994; Stansbury & Gunnar, 1994). One indicator of HPA axis functioning is the level of the hormone cortisol (Adam & Gunnar, 2001; Braarud & Stormark, 2006; Clow, Thorn, Evans, & Hucklebridge, 2004; Pruessner, Hellhammer, & Kirschbaum, 1999; van Veen et al., 2008) which can be extracted from saliva; salivary cortisol levels correlate well with that found in serum (Kirschbaum & Hellhammer, 1994). Salivary cortisol is frequently used to assess hormone levels in individuals with a chronically activated HPA axis (Adam & Gunnar, 2001; Gonzalez, Jenkins, Steiner, & Fleming, 2009; Uhde et al., 1994; van Veen et al., 2008).

The second system is the Autonomic Nervous System (ANS), which includes both sympathetic and parasympathetic branches (Kandel, Shawartz, & Jessell, 2000; Porges et al., 1994); it is activated when an individual perceives stress, or is in a state of arousal, vigilance, or emergency. The sympathetic related changes include increased heart rate, breathing rate, blood pressure, and sweating, a collection of symptoms commonly referred to as the fight or flight response. This contrasts with the parasympathetic branch, which is associated with rest, growth, and digestion. However, both branches function jointly to maintain balance and

homeostasis (Friedman, 2007; Kandel et al., 2000; Porges et al., 1994). Heart rate variability (HRV) is thought to be a good estimate of ANS status (Bazhenova & Porges, 1997; Friedman, 2007; Mezzacappa et al., 1997; Monk et al., 2001; Porges et al., 2004) . HRV is calculated through spectral analyses which yields different parameters including low frequency (LF) which corresponds mostly with sympathetic activity, high frequency (HF) which is mainly an index of parasympathetic activity, and the LF:HF ratio, an index of sympathovagal balance (Friedman, 2007).

The typical diurnal and acute stress-related reactions associated with both cortisol and HRV have been well-documented in healthy individuals; however, the bulk of the research has focused on the atypical responses to stress often associated with individuals undergoing chronic stress (Adam & Gunnar, 2001; Gonzalez et al., 2009; Uhde et al., 1994; van Veen et al., 2008) with generally inconsistent results. For example, in SAD patients, some individuals show either a hyper or hypocortisol pattern or longer recovery to baseline levels following exposure to an acute stressor (Condren, O'Neill, Ryan, Barrett, & Thakore, 2002; Elzinga, Spinhoven, Berretty, de Jong, & Roelofs, 2010; Furlan et al., 2001; Levin et al., 1993; Roelofs et al., 2009; Yoon & Joormann, 2012). Some studies examining cortisol responses in SAD patients have also found no differences in cortisol levels compared to a healthy control (HC) group (Elzinga et al., 2010; Martel et al., 1999; van Veen et al., 2008)

Similarly, studies have also noted atypical HRV responses (examples - lower HRV or higher heart rate) in anxiety disorders and panic disorder specifically (Friedman, 2007; Garakani et al., 2009; Licht, de Geus, Eco, van Dyck, & Penninx, 2009; Martinez, Garakani, Kaufmann, Aaronson, & Gorman, 2010). Among SAD patients, the results of studies assessing the ANS are mixed, with many studies showing no vagal tone differences among SAD patients versus controls (Hofmann, Moscovitch & Kim, 2006; Mauss, Wilhelm &

Gross, 2003; 2004) or increased sympathetic activation, but no parasympathetic activation (Gerlach, Wilhelm & Roth, 2001) or, only exaggerated vagal withdrawal with certain tasks, but not others (Stein & Asmundson, 1994) or finally, difference in females, but not in males (Grossman, Wilhelm, Kawachi & Sparrow, 2001). Atypical cortisol responses have been associated with cardiovascular and immune-related diseases (Antoni et al., 2005; Buske-Kirschbaum, Geiben, Hollig, Morschhauser, & Hellhammer, 2002; Jafarian-Tehrani & Sternberg, 1999; Mason, 1991; Sternberg et al., 1989), while lower HRV in individuals has been linked with increased mortality in coronary artery disease (Garakani et al., 2009; Licht et al., 2009; Martinez et al., 2010). Given these potential effects of atypical cortisol and HRV responses on individuals, it is critical that interventions be developed that can reduce the subjective and physiological responses to acute stress.

Treatments

Cognitive-behavioural therapy. CBT is the most commonly used treatment for SAD and often applied in its group form (CBGT) (Davidson et al., 2004; Eskildsen et al., 2010; Fedoroff & Taylor, 2001; Heimberg & Becker, 2002; Hofmann & Bogels, 2006). Many studies have examined the effects of CBT interventions on the response to an acute stressor in a variety of populations including healthy individuals, aggressive drivers, obese women with binge eating disorder, and woman waiting for assisted reproduction (Facchinetti, Tarabusi, & Volpe, 2004; Gaab, Sonderegger, Scherrer, & Ehlert, 2006; Gluck, Geliebter, & Lorence, 2004; Hammerfald et al., 2006) with mixed results. Some have found no significant differences on measures of cortisol between the CBT intervention group and a control group after treatment (Gluck et al., 2004; Taylor et al., 2009), others have reported an attenuated cortisol and/or heart rate response following a CBT intervention compared to a control group (Facchinetti et al., 2004; Galovski, Blanchard, Malta, & Freidenberg, 2003;

Griffin, Resick, & Galovski, 2012; Hammerfald et al., 2006; Rabe, Dorfel, Zollner, Maercker, & Karl, 2006), and still others have found this difference only in control, and not treatment groups (Gaab et al., 2006).

At least some of this variability across studies may be attributed to methodological differences including different cognitive behavioural interventions, psychological stressors, and populations. In spite of these concerns, CBT has long been the treatment of choice for SAD and it has been proven to be evidenced based (Butler, Chapman, Forman, & Beck, 2006; Heimberg, 2002; Rodebaugh, Holaway, & Heimberg, 2004), with meta-analyses estimating its effect size as being in the medium to large range compared to wait-list control and also psychological and pharmacological placebo groups (Butler et al., 2006; Hofmann & Smits, 2008). In fact, a meta-analysis by Acarturk et al., (2009) that included only randomized trials indicated that CBT was effective for the treatment of SAD with effect sizes varying based on the type of control group used for comparison and on whether participants met formal diagnostic criteria for SAD, or whether they had higher levels of subthreshold symptoms. The particular popularity of its group format is due to its time and cost-effectiveness, the normalization of symptoms within the group, the opportunities to learn from other's experiences, the social context for exposure and skills practice, encouragement from others, and compliance with treatment and homework completion due to social pressure (Aderka, 2009; Damer, Latimer, & Porter, 2010; McEvoy, 2007). This being said, most authors agree that some individuals simply do not respond to CBT or show only slight improvement and that alternative treatments need to be considered (Aderka, 2009; Eskildsen et al., 2010; Hofmann & Bogels, 2006; Rodebaugh & Heimberg, 2005; Rodebaugh et al., 2004).

Mindfulness based interventions. Research on mindfulness based interventions for anxiety disorders has been increasing rapidly in the past decade (Baer, 2003; Bishop, 2002; Chiesa & Serretti, 2010; Fjorback et al., 2011; Hofmann, Sawyer, Witt, & Oh, 2010; Proulx, 2003; Roemer & Orsillo, 2003; Toneatto & Nguyen, 2007). Mindfulness has been defined as a process in which one deliberately pays attention to or becomes aware of all the information in the present moment, without evaluating or judging it, but merely accepting it with an open and curious nature (Baer, 2003; Bishop, 2002; Chiesa & Serretti, 2010; Fjorback et al., 2011; Hofmann et al., 2010; Kabat-Zinn, 2003; Kocovski, Fleming, & Rector, 2009). Mindfulness is different from typical awareness or attention. It involves attending to the present moment in a very deliberate way (Brown & Ryan, 2003) and learning to think of thoughts and feelings as simply "existing" and realizing that they may or may not be true, instead of simply accepting thoughts and feelings as facts (Baer, 2003; Bishop, 2002; Fjorback et al., 2011; Roemer & Orsillo, 2003). In that way, attention can be directed to finding practical solutions or more effective methods of coping in situations perceived as stressful, including social ones (Baer, 2003; Bishop, 2002; Fjorback et al., 2011; Miller, Fletcher, & Kabat-Zinn, 1995; Proulx, 2003; Roemer & Orsillo, 2003).

The most extensively researched mindfulness intervention is MBSR developed by Kabat-Zinn (1990). MBSR involves 8 weekly sessions of 2.5 hours plus a full day retreat (Baer, 2003; Bishop, 2002; Kabat-Zinn, 1990). It also includes some psycho-education around the psychophysiology of stress and emotions and the learning and practice of meditation skills such as sitting meditation, body scan, mindful movement and mindful eating (Baer, 2003; Bishop, 2002; Kabat-Zinn, 1990; Melbourne Academic Mindfulness Interest Group, 2006). MBSR and other mindfulness-based approaches have been assessed in different populations including the general population, medically ill patients, and individuals

with psychiatric disorders (Baer, 2003; Chiesa & Serretti, 2010; Fjorback et al., 2011; Hofmann et al., 2010; Toneatto & Nguyen, 2007). Studies examining the effects of mindfulness-based interventions on anxiety and depressive disorders have yielded some mixed, but generally positive results (Baer, 2003; Chiesa & Serretti, 2010; Fjorback et al., 2011; Hofmann et al., 2010; Toneatto & Nguyen, 2007). Relatively few studies have explored the effects of a mindfulness based intervention in the context of SAD specifically (Bogels, Sijbers, & Voncken, 2006; Craske et al., 2014; Goldin, Ziv, Jazaieri, & Gross, 2012; Goldin, Ziv, Jazaieri, Hahn, & Gross, 2013; Goldin & Gross, 2010; Jazaieri, Goldin, Werner, Ziv, & Gross, 2012; Kocovski, Fleming, Hawley, Huta & Antony, 2013; Kocovski et al., 2009; Koszycki, Benger, Shlik, & Bradwejn, 2007; Piet, Hougaard, Hecksher, & Rosenberg, 2010) and most of these have combined mindfulness approaches with other techniques such as task concentration training (Bögels et al., 2006), cognitive strategies (Piet et al., 2010), as well as acceptance and exposure techniques (Kocovski et al., 2009). While methodological concerns have been raised in these studies, all have shown promising results, with ameliorations in measures of social anxiety symptoms that are maintained or even improved at follow-up.

The effects of mindfulness, based on either its training or by correlating levels of trait mindfulness, have been reported in the context of an acute natural and/or laboratory stressor in healthy college students, anxious participants, and patients with substance abuse disorders (Arch & Craske, 2006; Arch & Craske, 2010; Brewer et al., 2009; Weinstein, Brown, & Ryan, 2009). All found an association between levels of mindfulness and more positive stress appraisals and coping strategies. More specifically, Arch and Craske (2010) found that levels of trait mindfulness were associated with a lower subjective stress response to an acute stressor among both anxious and non-anxious individuals. To our knowledge, no

studies have specifically looked at the response to an acute stressor before and after treatment with MBSR in SAD patients.

Objectives and Hypotheses

The work described in this paper is the secondary aim of a larger study that compared CBGT and MBSR in patients with SAD (Koszycki et al. 2007). Although CBGT led to greater reductions in social anxiety symptoms compared to that of MBSR, the improvements on measures of mood, functionality, and quality of life were similar. In the paper described here, we examined whether CBGT and MBSR differentially affected subjective and physiological reactivity to a stressful speaking task in patients with SAD. We also compared response to the task in SAD patients versus HC with no psychiatric disorder. We expected that before treatment, SAD patients would show a greater subjective stress response compared to the HC group, and that there would also be differences between the SAD and HC groups on physiological measures. Additionally, we expected a change in scores from pre to post treatment such that the differences between patients and HCs would be reduced following treatment. More specifically, we predicted that scores on visual analogue scale (VAS) ratings of anxiety and core symptoms of SAD would be lower, that the sympathetic component of the HRV (i.e., LF) would show less of an increase, while the parasympathetic component (i.e., HF) would show a greater increase, thereby creating a better balance (i.e. LF/HF ratio) for both SAD groups following the treatment. Given the mixed results in the literature, no specific hypotheses were made regarding the direction of the cortisol differences between groups.

Methodology

Participants

Participants were individuals with SAD who participated in a previously published randomized trial comparing MBSR and CBGT (Koszycki et al. 2007). To be eligible for the trial patients had to meet DSM-IV criteria for SAD-generalized subtype confirmed by the Mini International Neuropsychiatric Interview and obtain a score ≥ 50 on the Liebowitz Social Anxiety Scale (LSAS), as well as a score ≥ 4 on the Clinical Global Impression-severity of Illness subscale (CGI-S). Patients were excluded from the trial if they had a comorbid disorder (for example, severe depression) that could interfere with adherence to treatment, a bipolar or psychosis disorder, a neurological disorder, were at high risk for suicide, or had participated in another form of therapy or stress reduction program at the time of or 12 months prior to assessment. Given the high frequency of comorbidity in this population, participants with certain comorbid psychological disorders were included (e.g., mild depression or other anxiety disorders), as long as they were secondary to the SAD. Patients on stable doses on psychotropic medication were allowed in the original trial. However, because of potential effects of different and combined medications on subjective and physiological measures of stress, only medication free patients were included in the current analysis. A comparison group of psychiatrically healthy controls (HC) was included to assess whether patients' response to the laboratory stressor normalized after treatment. The HC participants were included in the study if they had 1) no history of psychiatric illness as assessed by the non-patient version of the Structured Clinical Interview for DSM (SCID-NP), 2) no significant speech anxiety as measured by the LSAS, 3) no medical conditions that would alter their physiological response to the laboratory stressor, and 4) were not currently using any medications. All participants provided written informed consent.

Recruitment of all participants was done via advertisements in local media, and for patients, advertisements were also placed in physicians' offices as well as in outpatient clinics.

Procedure

Patients completed the speech task one to two weeks prior to treatment (please note that the speech task is also referred to as social stressor throughout the text). The task was completed between 1-3 pm to control for diurnal effects on cortisol secretion. Patients were informed of the task via a pre-recorded message which standardized delivery of task instructions. They were told that they had two minutes to prepare a ten minute speech on a topic of their choice, that the speech would be videotaped, and later evaluated by two raters (such evaluation did not actually take place). A research assistant was present throughout the procedure. Subjective ratings of anxiety and SAD symptoms were recorded 30 minutes before, just prior to (for rating of anxiety only), and 30 minutes following the task. Participants were also asked to rate their peak response during the task, that is, immediately after the task the participants were asked to rate the perception of their symptoms when they were at their worst during the speech task. Saliva samples were collected five minutes prior to the speech task, and 15, 30, 45, and 60 minutes thereafter. HRV was recorded at baseline and throughout the speech task. Refer to Figure 1 for diagram of the laboratory session time line. One to two weeks post treatment, patients completed a second speech task identical to the first with the exception that on this occasion, the participants did not choose their speech topic; instead they were provided with the topic. The HC comparison group completed the speech task on one occasion. In order to minimize confounding effects, participants were instructed to avoid smoking and consuming caffeine on the day of the speech task, and not to eat for at least one hour before their scheduled appointment. No instructions were given to participants about exercise.

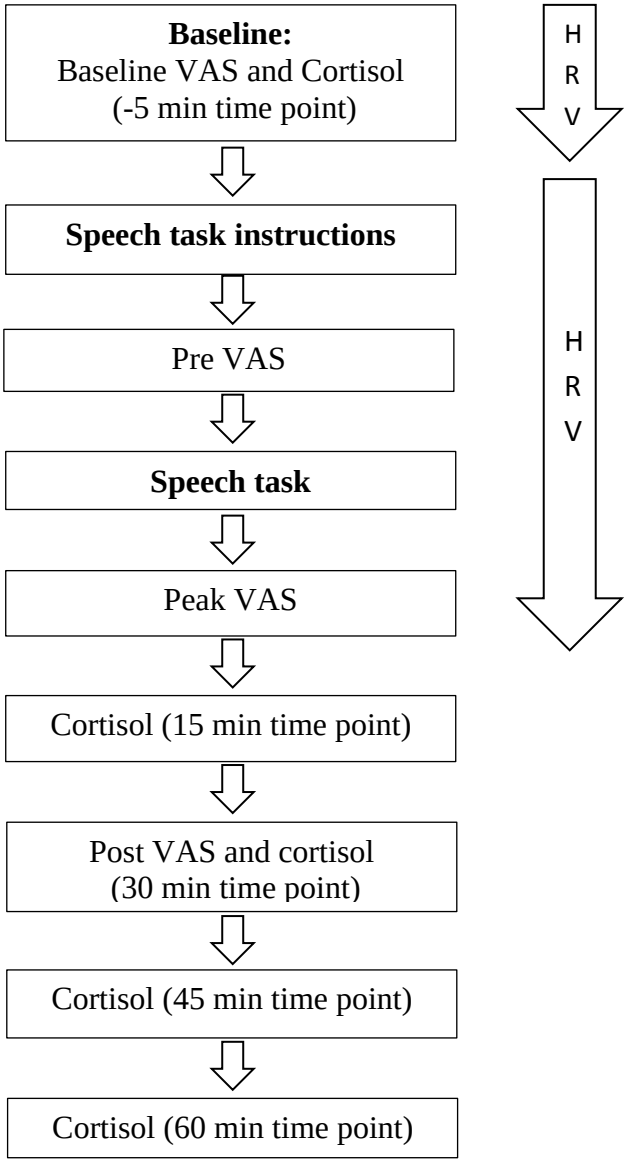

Figure 1. Timeline for data collection during laboratory session. VAS, Visual Analog Scale; HRV, Heart rate variability.

Study treatments

Cognitive behavioural group therapy. The CBGT treatment was based on Heimberg and Becker`s (2002) treatment manual. It was delivered to groups of 6-8 participants by a trained therapist for 12 weekly 2.5 hour sessions (30 hours in total) and included psychoeducation, exposure, cognitive restructuring, and homework assignments.

Mindfulness based stress reduction. The MBSR program was based on the manual developed by Kabat-Zinn and Santorelli (1993) and was not specifically adapted for SAD patients. It was delivered to groups of up to 12 participants by an instructor who completed professional training in MBSR and who has been teaching MBSR in the Ottawa area since 1995. The instructor also has a master's degree in Human Systems Intervention and is a certified yoga instructor. The program consisted of eight weekly 2.5 hour classes and one all day weekend meditation retreat (27.5 hours in total). It also included psychoeducation about stress, formal and informal meditation practices, as well as practice assignments for home.

All sessions in both treatment groups were videotaped and a random sample of tapes was reviewed to assess fidelity to the treatment protocols. Compliance to homework was determined each week.

Measures

Visual analogue scale. A 100 mm visual analogue scale (VAS) was used to measure subjective anxiety and core symptoms of SAD. To complete the VAS, participants were presented with a 100mm line above which one question per symptom was presented (i.e., how anxious do you feel? or how sweaty do you feel?). The line was labelled "Not at all" on one end, and "the most severe ever" on the other. The participants were asked to place a mark on the 100mm line to indicate the level of symptom experienced. The line was measured, and the score was the distance on the line in mm, ranging from 0-100. In this study, the VAS included a scale in which the participants rated their subjective anxiety and 11 other scales that measured specific social anxiety symptoms, including cognitive and physical symptoms (i.e., sweating, trembling/shaking, palpitations/rapid heart rate, blushing, shortness of breath, muscle twitching, upset stomach, feeling embarrassed/

humiliated, feeling judged, shaky voice and dry mouth). No total score were obtained. VAS's have been widely used for many decades (Wewers & Lowe, 1990; Williams, Morlock, & Feltner, 2010). They are brief and simple for participants to use and lend themselves to serial measurements (Scrimshaw & Maher, 2001; Wewers & Lowe, 1990; Williams et al., 2010). William et al., (2010) examined the psychometric properties of VAS ratings of anxiety and found adequate reliability as well as good convergent and divergent validity.

Cortisol. Saliva samples were collected via swabs that participants placed in their mouth; the swabs were stored at -20^{0}C until the analyses were performed. Salivary cortisol levels correlate well with serum cortisol levels (Kirschbaum &Hellhammer, 1994) and their collection is less invasive than that of blood samples. Cortisol was determined in duplicate using commercially available radioimmunoassay kits (MP Biochemicals) by a trained laboratory technician who was unaware of the treatment assignment and diagnostic category.

Heart rate variability. HRV was measured using mobile ECG monitors (model 8500 GE Marquette). Five self-adhesive electrodes were placed on the participant's chest, which allowed the heartbeats to be recorded on a cassette tape. The device was worn during the 30 minute baseline period and during the speech task. Subsequent analyses were conducted by the University of Ottawa Heart Institute. Standard arrhythmia evaluation was performed using a MARS 8000 workstation version 4.0A (GE Marquette) and after editing, spectral analysis were applied to the data which generated the following cardiac parameters: low frequency (LF) which reflects mainly sympathetic activity, high frequency (HF) which reflects mainly parasympathetic activity and the LF:HF ratio, an index of sympathovagal balance (Friedman, 2007). The HRV analyses were conducted by a technician who was blind to the treatment assignment and diagnostic category.

Statistical analyses

At the outset, data were screened for outliers, skewness, and kurtosis in order to determine violations to the assumption of normality. Outliers in the VAS variables with a standard z score >± 2.59 were dealt with using a winsorized procedure (Tabachnick & Fidell, 2007), which replaces the highest outliers with the next highest value, and replaces the lowest outliers with the next lowest values. This method was chosen because it was deemed important to not eliminate the higher levels of anxiety while adjusting for problems posed by outliers. The outliers and missing values in the cortisol data were dealt with by replacing them with the column average given that this value was judged to be the most representative (no more than 8% of scores). Because the VAS distributions were found to be skewed, the scores were subjected to a square root transformation which normalized the distributions.

Following routine inspections of the descriptive data, mixed Analyses of covariance (ANCOVAs) were applied to the data obtained on each of the 11 VAS symptoms and on the VAS subjective anxiety scale in order to determine group, task, time, and interaction effects. The independent "group" factor had three levels - CBGT, MBSR and HC, the repeated "task" factor had two levels – pre-treatment and post-treatment, and finally, the analysis included the repeated "time" factor with three or four levels - baseline, pre-speech (only for subjective anxiety VAS), peak-speech, and post-speech.

Three types of analyses were conducted on each VAS scale. The first was performed on the data obtained from patients before treatment and HC in order to determine the level of subjective anxiety in each group at baseline. The second compared the VAS responses during the speech task before and after treatment for both CBGT and MBSR groups; in this case, the HC participants were excluded as they performed the speech task only once. Finally, the purpose of the third analysis was to compare the post-treatment data of both

treatment groups to the VAS scores associated with the HC group. The alpha level was set at 0.05, Huynh-Feldt corrections were applied for violations to sphericity, and family-wise error rate controlled for multiple comparisons. Initial analyses took gender into consideration, but as no differences were found, the data presented here combined male and female scores. Age was used as a covariate in our parametric analyses.

Due to the high variability associated with the physiological measures - cortisol and HRV related measures (LF, HF and LF/HF) - a non-parametric approach was used to analyze these data. Mann-Whitney U (two group comparisons) and Kruskal-Wallis (three group comparisons) tests were used to assess group and time differences on each variable and to compare the SAD group to the HC group before treatment as well as the individual treatment groups to ensure no baseline differences. Post-treatment analyses compared treatment groups to each other and to the HC group.

In the case of cortisol, both area under the curve (AUC) (calculated using trapezoidal integration) and delta change scores (peak-baseline/baseline) were analyzed. For heart-rate data, delta change scores were computed for LF, HF, and their ratio, LF/HF. Wilcoxon test for related samples was performed separately for each group in order to compare the pre-treatment variables to their post-treatment counterparts for each of the cortisol and HRV variables (for example, pre-treatment change LF to post-treatment change LF). Finally, physiological responses to the speech task itself were analyzed separately for each group. These included a within-group comparison of baseline versus peak levels related to cortisol and all heart rate data. Because the physiological data were subjected to multiple comparisons, we used a critical alpha level of 0.01 to assess significance.

Results

Demographics

Twenty patients were randomized to CBGT and 18 to MBSR. The descriptive data are presented in Table 1. With the exception of the HC participants who were significantly younger than the CBGT group ($p = 0.004$), all other demographic variables were statistically similar between groups.

Attrition

Of the 38 patients who performed the first speech task, 11 did not finish treatment and therefore did not complete the second speech task (n = 7 CBGT, 4 MBSR).. Therefore, the final sample size of participants who performed both speech tasks included 27 patients with SAD, 13 in the CBGT group and 14 in the MBSR group. Thirty HC volunteers also completed one speech task. There was a difference in gender and age at onset of SAD between those who did and did not complete the second speech task, with more females in the latter group and a slightly younger age of this group overall at the time of diagnosis for SAD (16.19 ±10.67 vs 11.00 ±4.05). No other significant differences between those who completed either one or both speech tasks were found on demographic and clinical variables, including length of illness, severity of social anxiety, or on response to the pre-treatment speech task. Reasons for not completing treatment included scheduling conflicts (n = 6 CBGT, n = 2 MBSR), need for other psychological treatment (n = 1 CBGT), and dissatisfaction with treatment (n = 2 MBSR).

Finally, due to insufficient saliva, cortisol values were not obtained for three participants (two CBGT and one MBSR) during the first speech task and one CBGT participant during the second speech task. Thus, there were cortisol data for both speech tasks from 12 CBGT and 14 MBSR participants.

Table 1

Group differences on demographic variables

	CBGT (n = 13)		MBSR (n = 14)		HC (n = 30)	
	$\overline{X}$	SD	$\overline{X}$	SD	$\overline{X}$	SD
Age (years)	39.31*	10.40	36.64	16.15	29.77*	12.77
Age at onset	15.54	7.57	16.79	13.19	-	-
Length of illness	22.89	12.70	24.27	16.96	-	-
Severity of SAD						
LSAS-T	69.08	3.26	81.00	16.35	-	-
SIS	44.15	10.50	44.29	11.61	-	-
SPS	29.54	12.64	33.86	13.87	-	-
		%		%		%
Gender						
Females		38.5		35.7		36.7
Males		61.5		64.3		63.3
Ethnicity						
Caucasian		84.6		85.7		86.7
Black		7.7		-		6.7
Asian		-		7.1		6.7
Biracial		7.7		7.1		-
Education						
High School		-		7.1		13.3
University (in progress)		23.1		42.9		36.7
University (completed)		61.5		42.9		23.3
Some Graduate School		15.4		7.1		26.7
Comordid disorder		15.4		21.4		-

* $p < .05$. $\overline{X}$, mean; SD, Standard Deviation; CBGT, Cognitive-Behavioural Group Therapy; MBSR, Mindfulness-Based Stress Reduction; HC, Healthy control; SAD, Social Anxiety Disorder ; LSAS-T, Liebowitz Social Anxiety Scale - Total; SIS, Social Interaction Scale; SPS: Social Phobia Scale.

Pre-Treatment Analyses

VAS anxiety scores. Figure 2 (plot A) shows the untransformed VAS scores on the general anxiety scale for the HC and SAD (all patients before random assignment) groups before treatment. A significant group difference was found ($F(1, 64) = 130.823$, $p < .001$) with HC reporting lower levels of anxiety than patients; comparison of the treatment groups alone revealed no significant difference ($p = 0.256$). During the first speech task, all groups showed an increase in anxiety in anticipation of and during the speech task which returned to baseline levels 30 minutes following administration of the social stressor – significant effect of time ($F(2.698, 172.689) = 30.65$, $p < .001$); however, this effect was greatly attenuated in the HC group (significant interaction ($F(2.698, 172.689) = 7.771$, $p < .001$) such that the SAD group showed more anticipatory anxiety and more peak anxiety than the HC group.

VAS SAD symptoms. Figure 3 shows untransformed VAS ratings for individual SAD symptoms for the HC group and patients before treatment (i.e, dark blue, dark pink and black lines, for CBGT, MBSR and HC groups, respectively). A significant main effect of group was found for each symptom ($p < .001$ across symptoms) due to higher scores in both treatment groups versus the HC group. In most cases, VAS ratings were not significantly different between the CBGT and MBSR groups; however, dry mouth was higher in MBSR- versus CBGT-treated patients. A significant effect of time was found in the case of each symptom due to increases over the course of the social stress procedure. This increase was less pronounced for the HC group in every case (significant interactions).

Physiological measures. Figures 4 and 5 depict the cortisol and HRV data respectively, with the dark blue, dark pink, and black lines in Figure 4 referring to the pre-treatment CBGT, MBSR, and HC groups respectively, and the red bars in Figure 5 indicating

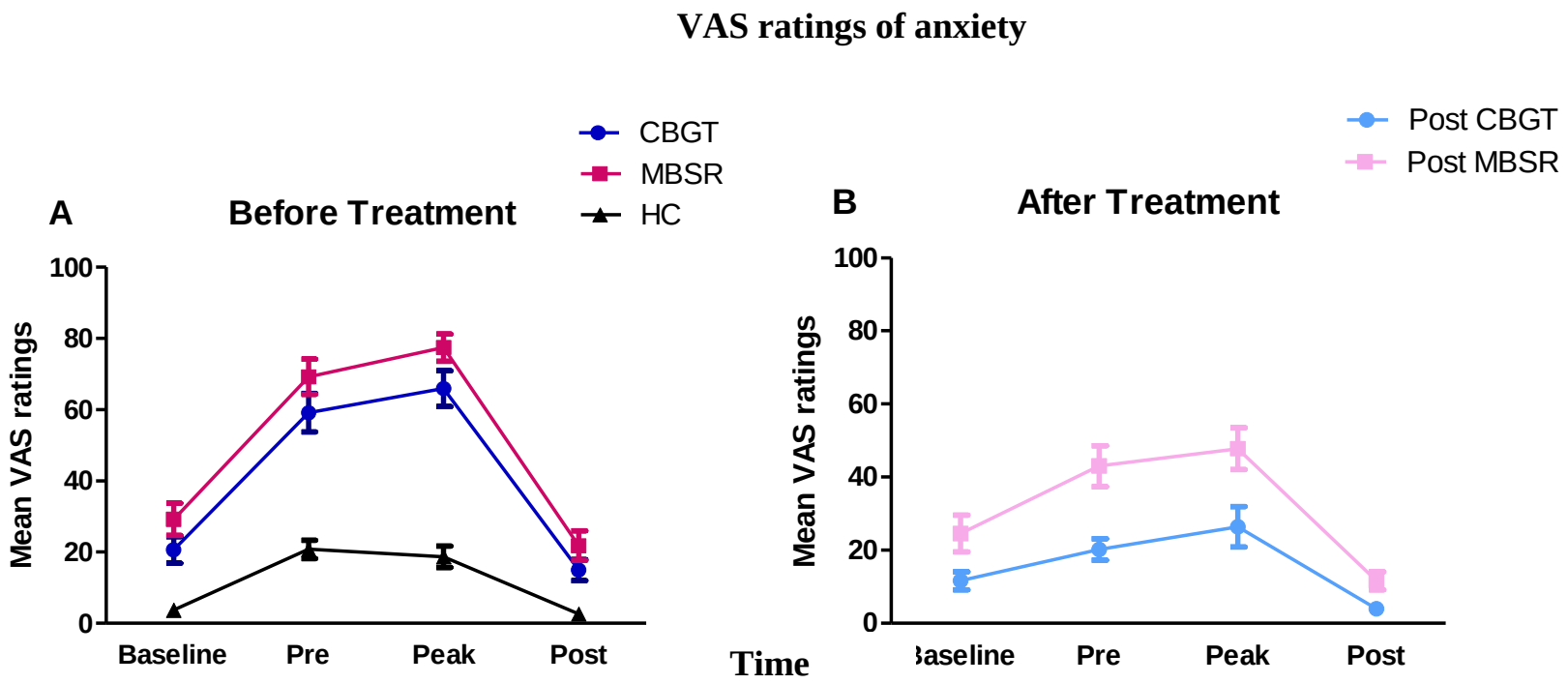

Figure 2. Mean scores ± SEM on the VAS general anxiety scale for all groups before (plot A) and after (plot B) treatment at four different time points – upon arrival to the laboratory (Baseline), after task instructions (Pre), at subjective peak anxiety levels (Peak), and 30 minutes following the task (Post). VAS, Visual Analog Scale; CBGT, Cognitive-Behavioral Group Therapy; MBSR, Mindfulness-Based Stress Reduction; HC, Healthy Control.

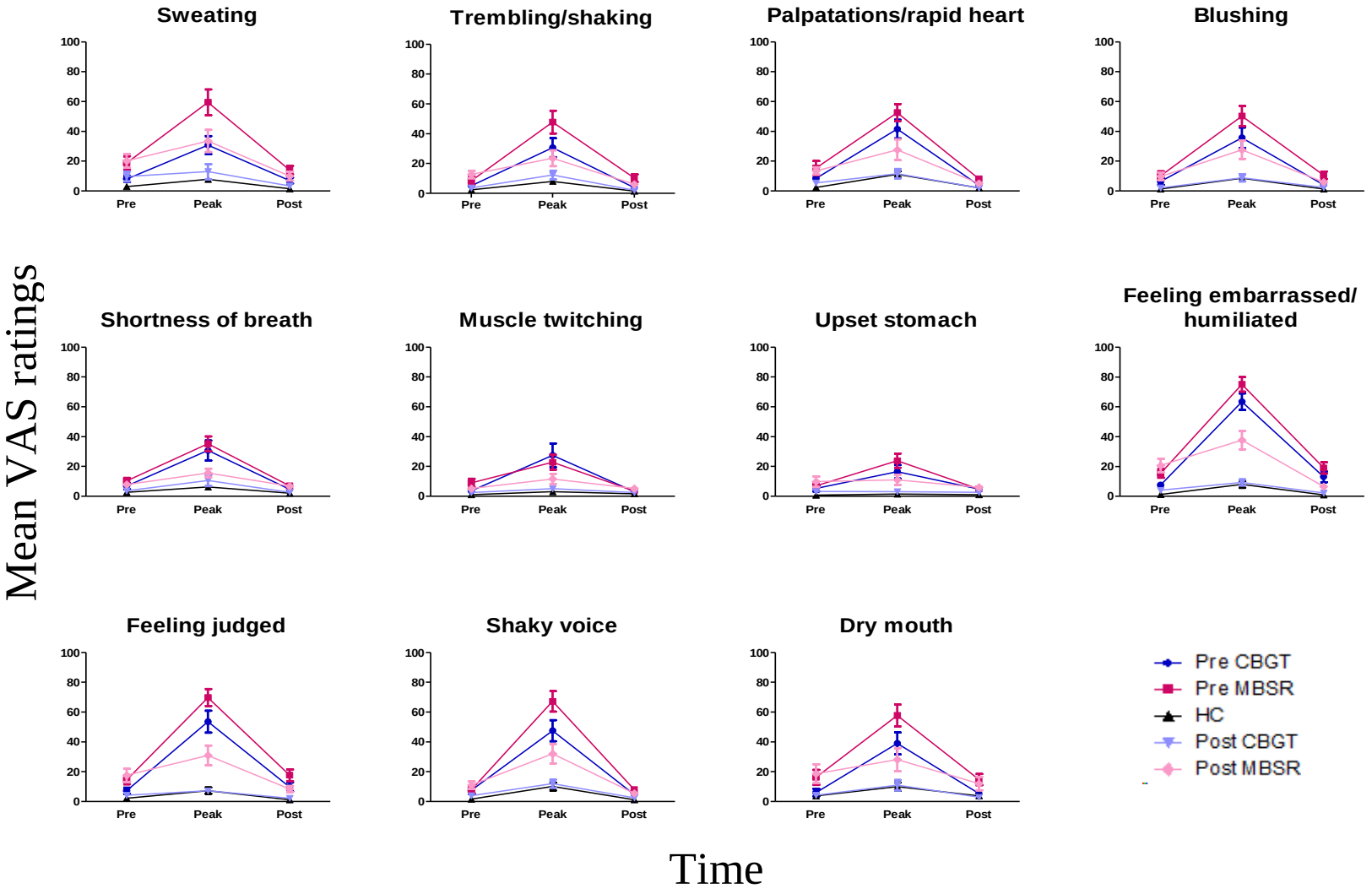

Figure 3. Mean scores ± SEM on the VAS symptom scale for all groups before and after treatment at three different time points – before task (Pre), at subjective peak anxiety levels (Peak), and 30 minutes following the task (Post). CBGT, Cognitive-Behavioral Group Therapy; MBSR, Mindfulness-Based Stress Reduction; HC, Healthy Control; VAS, Visual Analog Scale.

pre-treatment data. There were no group differences in the pre-treatment levels of cortisol as indexed by AUC ($z = -2.092$, $p = 0.036$) or change scores ($z = -1.270$, $p = 0.204$). Note that AUC values for cortisol and change scores for all physiological measures appear in Table 2.

No significant differences were found on change scores between SAD and HC groups at pre-treatment on any of the HRV variables ($z = -.652$, $p = 0.514$; $z = -1.331$, $p = 0.183$; $z = -1.904$, $p = 0.057$, respectively for change LF, HF and LF/HF ratio). However, a comparison of the separate treatment and HC groups revealed a significant difference in the LF/HF ratio ($X^2 = 9.187$, $p = 0.010$) due to differences between MBSR and HC values ($z = -3.072$, $p = 0.003$) before treatment. MBSR change scores were lower during the speech task while in both HC and CBGT groups, the ratios increased (see Figure 5C).

In analyses of the speech task, only the LF levels varied from baseline to speech for the SAD group ($z = -2.763$, $p = 0.006$) and the HC group ($z = -2.378$, $p = 0.001$) and were higher during the speech task than at baseline. The LF/HF ratio was significantly higher during the speech task than during baseline, but only for the HC group ($z = -3.243$, $p = 0.001$). Cortisol levels and HF did not significantly vary between baseline and speech time-points.

Pre-Post Treatment Differences Between Treatment Groups

VAS anxiety scores. These data appear in Figure 2, plots A and B. There were pre-post treatment differences in VAS anxiety ratings generated by the speech task ($F (1, 23) = 47.909$, $p < .001$), with lower scores reported during the second speech task. The MBSR group showed higher overall anxiety scores during the stressor following treatment compared to the CBGT group (Figure 2B) ($F (1, 23) = 6.668$, $p = 0.017$). The lack of a significant interaction indicates that both groups showed a similar degree of change although there was a trend towards a greater difference in the CBGT group ($F (1, 23) = 3.689$, $p = 0.067$).

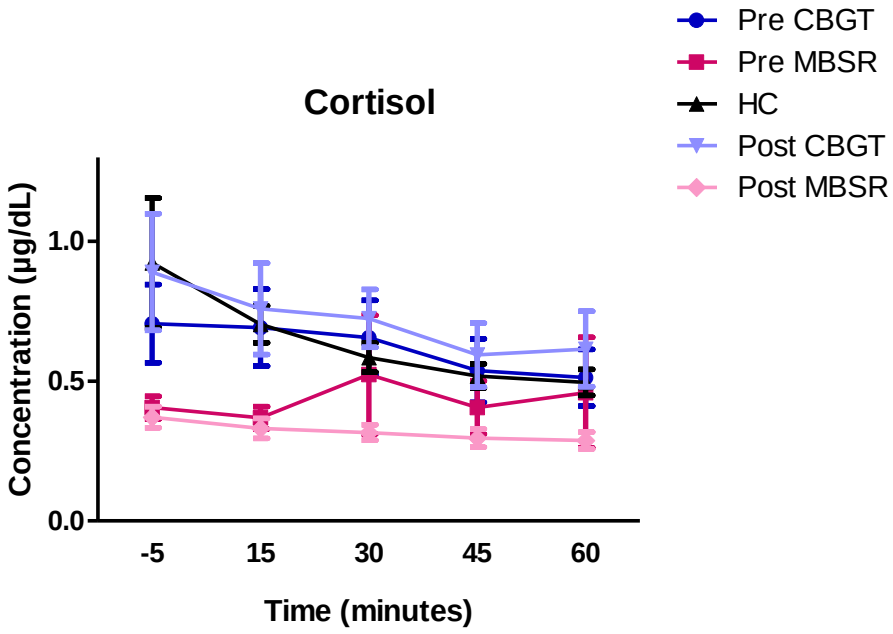

Figure 4. Cortisol concentrations mean scores ± SEM for all groups before and after treatment at five different time points – five minutes before the start of the social stress task and at 15, 30, 45, and 60 minutes thereafter. CBGT, Cognitive-Behavioral Group Therapy; MBSR, Mindfulness-Based Stress Reduction; HC, Healthy Control.

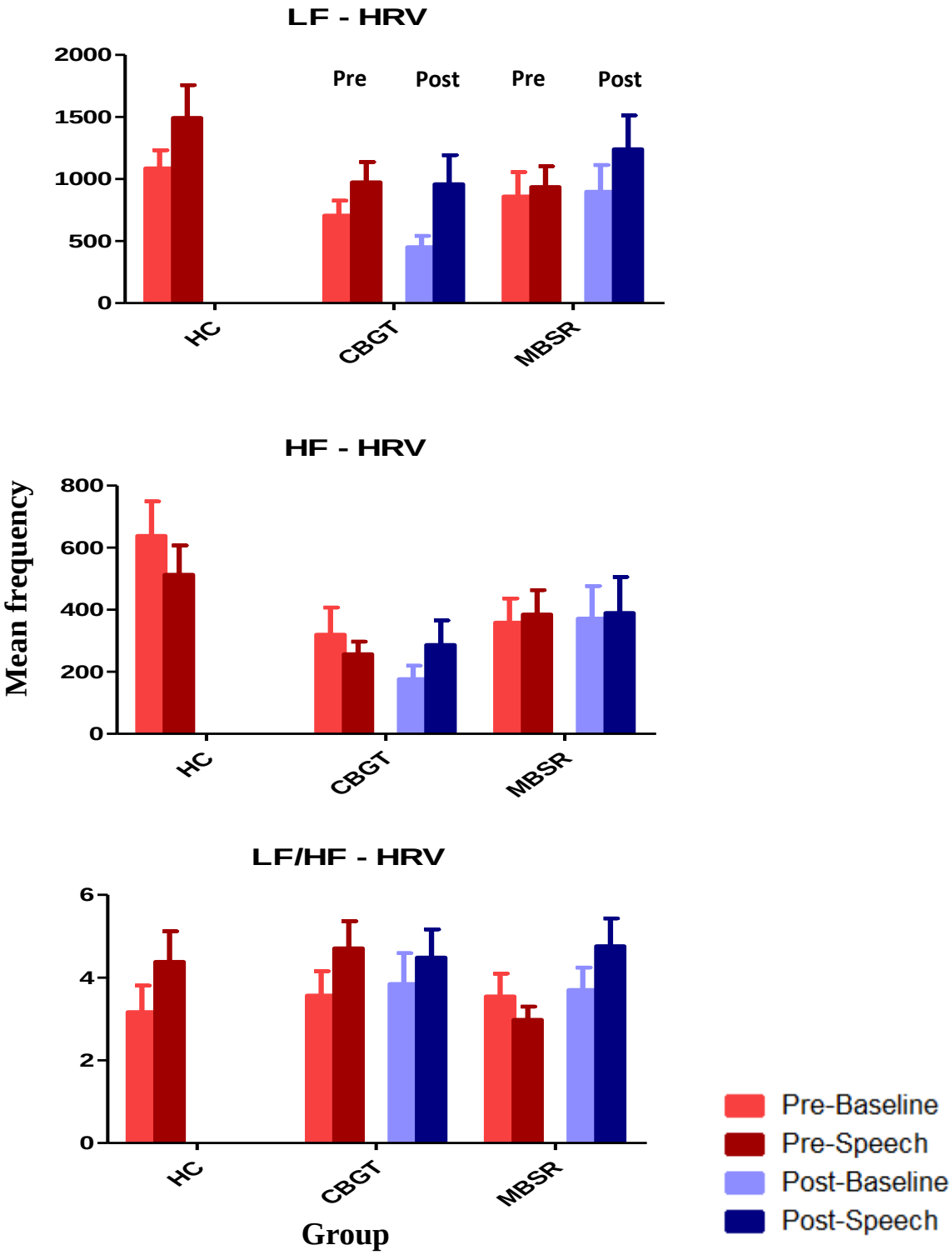

Figure 5. Mean heart rate variability ± SEM expressed as low frequency (plot A), high frequency (plot B), and the ratio of low to high frequency (plot C) for all treatment groups. The values obtained at baseline and during the speech are displayed pre (HC, CBGT, and MBSR) and post treatment (CBGT and MBSR). LF, Low frequency; HF, High frequency; CBGT, Cognitive-Behavioural Group Therapy; MBSR, Mindfulness-Based Stress Reduction; HC, Healthy control.

Table 2

Mean and standard deviation of cortisol area under the curve and physiological change scores

Group	Variable	Pre treatment $\bar{X}$ (SD)	Post treatment $\bar{X}$ (SD)
CBGT	LF change score	1.15 (2.05)	1.77 (2.43)
	HF change score	.46 (1.13)	1.05 (1.70)
	LF/HF change score	.58 (.84)	.58 (1.25)
	Cortisol change score	.28 (.55)	.53 (1.37)
	Cortisol AUC	2.50 (1.98)	2.83 (1.83)
MBSR	LF change score	.36 (.53)	.64 (.72)
	HF change score	.66 (1.29)	.36 (1.00)
	LF/HF change score	.06 (.57)	.46 (.68)
	Cortisol change score	.52 (1.54)	.26 (.66)
	Cortisol AUC	1.73 (1.82)	1.27 (.38)
HC	LF change score	.68 (1.19)	
	HF change score	.10 (.66)	
	LF/HF change score	.66 (.83)	
	Cortisol change score	.03 (.41)	
	Cortisol AUC	2.52 (1.36)	

AUC, Area under the curve; $\bar{X}$, mean; SD, Standard Deviation; CBGT, Cognitive-Behavioural Group Therapy; MBSR, Mindfulness-Based Stress Reduction; HC, Healthy control; LF, Low Frequency; HF, High Frequency.

Further analyses indicated that the pattern observed in the CBGT group following treatment was similar to that of the HC group ($p = 0.669$); however the same comparison between MBSR and HC groups was significant ($p < .001$) due to higher post-treatment anxiety scores in the MBSR group relative to that of the CBGT group.

VAS SAD symptoms. Figure 3 illustrates these data. For all 11 symptoms, with the exception of sweating, scores were significantly reduced following treatment in both groups. In a few cases, significant group differences were found due to lower ratings in the CBGT group (p values for each symptom rating are reported in Table 3).

Table 3

Significance levels of task and group differences in symptom levels

	Task differences			Group differences		
	Pre TM $\overline{X}$ (SD)	Post TM $\overline{X}$ (SD)	*p* values	CBGT $\overline{X}$ (SD)	MBSR $\overline{X}$ (SD)	*p* values
Sweating	3.9 (2.5)	3.1 (1.9)	.285	2.7 (2.1)	4.2 (2.1)	.078
Trembling/Shaking	3.4 (1.7)	2.6 (1.2)	.002	2.5 (1.3)	3.5 (1.3)	.045
Palpitations/Rapid heart rate	3.8 (1.6)	2.7 (1.3)	.005	2.7 (1.3)	3.7 (1.3)	.059
Blushing	3.4 (1.9)	2.4 (1.2)	.049	2.2 (1.4)	3.6 (1.4)	.022
Shortness of breath	3.0 (1.3)	2.3 (1.2)	.002	2.3 (1.1)	3.0 (1.1)	.107
Muscle twitching	2.5 (1.3)	1.9 (1.2)	.001	1.9 (1.1)	2.4 (1.1)	.277
Upset stomach	2.3 (1.4)	2.0 (1.3)	.030	1.7 (1.1)	2.5 (1.1)	.088
Feeling embarrassed/humiliated	4.6 (1.1)	3.0 (1.2)	< .001	3.0 (1.1)	4.5 (1.1)	.001
Feeling judged	4.3 (1.3)	2.9 (1.3)	< .001	2.9 (1.2)	4.3 (1.2)	.005
Shaky voice	3.8 (1.3)	2.7 (1.3)	< .001	2.7 (1.2)	3.7 (1.2)	.045
Dry mouth	3.8 (1.7)	2.8 (1.9)	.003	2.5 (1.6)	4.0 (1.6)	.026

· $\overline{X}$, mean; SD, Standard Deviation; TM, Treament; M, mean; SD, Standard deviation, CBGT, Cognitive-Behavioural Group Therapy; MBSR, Mindfulness-Based Stress Reduction.

Physiological measures. These data appear in Figures 4 (cortisol) and 5 (HRV). None of the physiological measures gave rise to significant pre-post treatment differences in either the CBGT or MBSR groups. After treatment, the speech task induced a significant increase from baseline in LF power in the MBSR group ($z = -2.982$, $p = .003$). The same was

not found in the CBGT group after applying a Bonferroni correction ($z = -2.411$, $p = 0.016$) which adjusted the alpha level to 0.01.

Following treatment, group differences in cortisol levels based on AUC or change scores were not significant ($z = -1.955$, $p = .051$; $z = -.772$, $p = 0.440$, respectively).

Discussion

The primary aim of this study was to compare the effects of two treatments, CBGT and MBSR, on the subjective and physiological responses to an acute social stress in individuals diagnosed with SAD. As expected, both treatments improved subjective anxiety scores and related symptoms, albeit a trend for greater reduction was observed in the CBGT group; in fact, at the end of treatment, anxiety scores for participants in the CBGT group were not distinguishable from that of the HC group. In all groups, the results were consistent with the idea that the speech task induced symptoms of SAD as peak increases were associated with the delivery of the speech itself. However, these findings were generally not paralleled by physiological changes with few exceptions.

This study improved on several of the MBSR methodological issues highlighted in the literature review (Baer, 2003; Bishop, 2002; Chiesa & Serretti, 2010; Fjorback et al., 2011; Hofmann et al., 2010; Proulx, 2003). First, the random assignment to the treatment group reduced the risk of a self-selection bias and helped ensure that groups were similar before treatment on the

general anxiety scores and all symptom patterns. Second, the design included a treatment comparison group (CBGT) as well as a healthy control group.

Other studies that have specifically examined the effects of MBSR on the response to a stressor have not done so in the context of SAD. Nonetheless, some studies have shown

that higher levels of mindfulness are associated with better coping strategies and more positive stress appraisal (Arch & Craske, 2006; Arch & Craske, 2010; Brewer et al., 2009; Weinstein et al., 2009). Other studies have shown that inducing mindfulness through therapy or other means (e.g., with MBCT) can improve coping skills and some attentional processes (Arch & Craske, 2006; Brewer et al., 2009; Kaviani, Javaheri, & Hatami, 2011). The results of this study partly support these findings in the context of anxiety disorders in that following the MBSR intervention, patients did subjectively feel less anxious and reported fewer SAD symptoms during the speech task, but the specific mechanisms behind this difference cannot be confirmed given that levels of mindfulness were not assessed in this study. It is therefore difficult to know whether the individuals within the MBSR group were actually more mindful following the intervention.

In general, outcome studies suggest MBSR is a promising intervention for stress reduction in many populations (Baer, 2003; Bishop, 2002; Carlson, Speca, Faris, & Patel, 2007; Fjorback et al., 2011; Hofmann et al., 2010; Klatt, Buckworth, & Malarkey, 2009; Proulx, 2003). The same conclusion applies to studies that specifically evaluate the effects of mindfulness training for SAD (Bogels et al., 2006; Goldin, 2010, 2012, 2013; Kocovski et al., 2009; Koszycki et al., 2007; Piet et al., 2010). Two studies compared mindfulness techniques to CBGT, the first using MBSR (Koszycki et al., 2007) and the second using mindfulness based cognitive therapy (Piet et al., 2010). Generally greater reductions in anxiety levels were found with the CBGT group, but significant improvements were found from pre- to post-treatment with the mindfulness interventions in both cases. Two other studies have examined mindfulness techniques in combination with other interventions (i.e., task concentration training and acceptance and commitment therapy) in SAD patients using pre-post designs (Bögels et al., 2006; Kocovski et al., 2009). Both of these found reductions

in anxiety levels after treatment, but it is unclear whether the effects were due to the mindfulness intervention itself or to the additional components incorporated in the therapy. Goldin et al., (2010, 2012 and 2013) have also found greater reductions in negative self-views in individuals with SAD who received MBSR versus those who participated in an aerobics exercise program. These studies also yielded significant differences between the MBSR and aerobics exercise groups on certain brain activities including greater increases in attention-related parietal cortical regions and in brain responses in the posterior cingulate cortex in the MBSR group (Goldin et al., 2010, 2012, 2013).

In our study, the reduction in levels of subjective anxiety and social anxiety symptoms during the speech task was larger in the CBGT than the MBSR group, but both groups improved. These results parallel those found in the clinical trial in that after treatment, the CBGT group showed the greatest improvement on measures of SAD (Koszycki et al. 2007). A number of factors could have accounted for the differences between the MBSR and CBGT groups from pre to post treatment. First, MBSR was not developed as a specific treatment for any disorder, whereas the CBGT intervention was designed for patients with SAD. Therefore, it is not surprising that the improvements are greater in the CBGT group. If MBSR is to be used as a "treatment" for SAD or any other disorder, it needs to be adapted for the disorder in question and incorporate specific techniques that target social anxiety specifically. This possibility should be investigated further.

Second, the exposure to social situations component in CBGT, both in session and during homework, which was not present for the MBSR group is likely to have prepared the participants for the post-treatment speech task and may be the critical element responsible for the reduction in subjective anxiety and other symptoms. In fact, studies aimed at delineating

the effects of CBT techniques for patients with SAD all agree that exposure is a key component of its success (Damer et al., 2010; Fedoroff & Taylor, 2001; Heimberg, 2002; Ponniah & Hollon, 2008; Rodebaugh et al., 2004). Exposure allows individuals to learn to tolerate their feelings of anxiety, in this case, of performing in public and to realize that such exposure is not associated with negative effects. (Camart et al., 2006; Leahy & Holland, 2000; Heimberg, 2002; Rodebaugh et al., 2004). This, in turn, may result in changing the cognition and appraisal of the situation. Given that participants in the CBGT group had lower overall ratings of subjective anxiety than that of the MBSR group following the treatment suggests that they may have begun the process of desensitization to public speaking.

Third, CBGT and MBSR interventions approach symptoms differently. Unlike CBGT, which aims to identify and change negative thoughts and sensations, mindfulness highlights as its goal not to reduce symptoms per se, but rather to help sufferers accept their symptoms and reduce their impairment (Proulx, 2003; Roemer & Orsillo, 2003). According to this view, participants may not feel the need to report reduced symptoms and although symptoms may be felt, they may generate less distress. While measures of the degree of distress or impairment stemming from the levels of subjective anxiety and symptoms experienced in response to the stressor were not included here, in the original study (Unidentifed), improvements on measures of quality of life, mood, and functionality following treatment were similar in both CBGT and MBSR groups. It is possible that participants in the MBSR group were less distressed by their symptoms. More research is needed to assess this possibility.

Fourth, some investigators question whether mindfulness training works best as a stand-alone treatment or in combination with other techniques, such as mindfulness-based cognitive therapy with the addition of some cognitive therapy techniques, or acceptance and

commitment therapy and dialectic behavioural therapy which are other types of interventions that include mindfulness techniques (Baer, 2003; Fjorback et al., 2011; Roemer & Orsillo, 2003). Some authors suggest that MBSR involves a substantial time commitment to master the practice of mindfulness which makes it less practical to incorporate with other treatments (Baer, 2003; Roemer & Orsillo, 2003). Therefore, it is possible that mindfulness training as a stand-alone intervention is not as effective for some participants and that combining it with other therapies would yield better outcomes.

Finally, the question as to whether the effectiveness of mindfulness treatments is a product of the technique itself or in part related to the participants who choose it has been raised in the literature (Fjorback et al., 2011). Because participants in this study did not select their treatment, they may not have wholly identified with it and therefore, may not have benefited from it to the same degree as individuals who seekout this treatment. This being said, the participants in the current study did complete the MBSR program which suggests that it was an acceptable treatment to them. Treatment preference and credibility was not assessed in the current study; therefore, it is impossible to tell if some of the patients assigned to CBGT would have preferred the MBSR program or vice-versa. Further investigation of the effects of treatment preference and credibility are needed.

The results of the physiological markers were negligible. Before treatment, SAD patients had lower but not significantly different levels of cortisol based on AUC compared to HC; no significant differences were observed on the change score measures on cortisol data or on any of the HRV variables. The literature on physiological responses to an acute stress is mixed. While some studies have found no difference in the physiological response to acute stress in individuals with SAD as compared to a healthy control sample (Levin et al., 1993; Martel et al., 1999; Elzinga et al., 2010), other studies report an increase in cortisol

reactivity to social or psychological stressors in individuals with SAD compared to HC volunteers (Condren et al., 2001; Furlan et al., 2001; Roelofs et al, 2009).

In the pre-post treatment analyses, no significant differences were found on any of the physiological measures. To our knowledge, there are no such comparisons in the literature specifically in SAD individuals. However, there are parallels in other populations such as healthy adults (e.g., university students, health care professionals, working adults), breast and prostate cancer outpatients, patients with anxiety or depression (Burg , Wolf & Michalak, 2012; Carlson et al., 2007; Klatt et al., 2009; Kuehner et al., 2009; Libby, Worhunsky, Pilver & Brewer., 2012; Lou Galantino et al., 2005; Manzaneque et al., 2011; Marcus et al., 2003; Pace et al., 2009; Robert-McComb et al., 2009; Witek-Janusek et al., 2008; Zgierska et al., 2008) and most of these studies find no differences in cortisol concentrations before and after treatment with MBSR (Carlson et al., 2004, 2007; Klatt et al., 2009; Kuehner et al., 2009; Lou Galantino et al., 2005; Manzaneque et al., 2011; Pace et al., 2009; Robert-McComb et al., 2009; Zgierska et al., 2008). However, in one study, Witek-Janusek et al. (2008) found that before treatment with MBSR, breast-cancer survivors (10 days post-surgery) had significantly higher levels of cortisol than a cancer-free control group. At follow-up, reductions in cortisol were only seen in the MBSR group compared to the assessment only control group. Similarly individuals undergoing treatment for substance abuse as well as a MBSR intervention (Marcus et al., 2003), had lower awakening cortisol levels after the MBSR intervention compared to baseline measures. Studies have also shown improvements in HRV measures following a mindfulness intervention in participants attempting to quit smoking (Libby et al., 2012) and with healthy undergraduate psychology students (Burg et al., 2012).

In our study, the fact that both SAD and HC individuals displayed similar levels of cortisol before treatment commenced suggests little reason to expect any treatment effect. Although we anticipated some reaction in all groups in response to the stressor itself, only LF-HRV and the subjective ratings were consistently elevated during the speech task in all groups relative to baseline values. The type of stressor used was selected to evoke social anxiety symptoms and although similar to the Trier Social Stress Test, the gold standard for inducing an acute stress response (Allen, Kennedy, Cryan, Dinan & Clarke, 2014), the physiological reactions were generally quite variable across patients. Perhaps other biomarkers would be more sensitive in this context, such as salivary alpha-amylase (Nater et al., 2005; Nater & Rohleder, 2009; van Veen et al., 2009).

Finally, SAD is among the anxiety disorders that show very mixed results in studies of HRV (Friedman, 2007). In most studies of this nature, the consensus is that individuals with panic disorder show most consistently a specific HRV response which reflects the types of symptoms present in this disorder (Friedman, 2007). It is likely that different anxiety disorders yield different physiological responses to stress. Moreover, the lack of physiological responses to the stressor in the SAD group is consistent with the model of SAD that highlights the role of cognitive mechanisms, such as attention and information processing biases, over actual differences in physiological activation (Clark & McManus, 2002; Mauss et al., 2003). According to this theory, SAD patients may overestimate their physiological responses when self-reporting due to cognitive biases in information processing. In fact, many studies fail to find physiological differences between SAD patients and control participants or only find minimal differences (Edelmann & Baker, 2002; Friedman, 2007; Grossmann et al., 2001; Mauss et al., 2003; 2004).

There were some shortcomings in the present study. First, it did not assess how enduring the improvements are. Future studies should explore whether the benefits of the treatment are long lasting, that is, whether they remain in response to a social stressor at follow-up time points. Second, the HC participants only underwent one speech task and thus the effects of practice could not be delineated from the effects of the treatments. There have been very few reports of practice effects in this context and only using very brief intervals between administration – one or eight days (Gerra et al., 2001; Kirschbaum. Pirke & Hellhammer, 1995; Kirschbaum et al., 1995). These studies suggest individual differences in habituation to the acute stressors, with some individuals showing habituation (referred to as low responders) and others not (high responders). While the effects observed in this study may be due, in part, to a practice effect, given the degree of improvement following treatment and the long interval between both speech tasks, it is unlikely that it could be accounted for entirely by a practice effect. Third, it is also important to note that the pre and post treatment speech tasks were not identical given that the participants were allowed to choose their topic during the first task and were appointed a topic during the second task. This variation was necessary in order to avoid participants choosing the same topic and rehearsing before the second speech task as well as to introduce a degree of novelty and stress during the second task. To our knowledge, no study has examined whether the response to a speech task would differ based on whether the participants can choose their topic or not. Fourth, additional factors not taken into account in the current study may have influenced the results. For example, non-specific therapy factors such as therapeutic alliance, treatment expectation, or treatment preference may certainly have affected outcome in the clinical trial as discussed in the previous study (Koszycki et al. 2007). Such results could have also impacted results from the current study, but to our knowledge very little research

has explored if these factors would have an impact on the response to an acute stressor. One such study (Stratford et al., 2014) indicated that changes in HRV over six therapy sessions paralleled those found on objective and subjective measures of therapeutic alliance. However, it is unclear what this link suggests and authors agree that more research is needed on the topic in order to reach clear conclusions. Other additional factors that have been known to impact cortisol reactivity, at least in some populations, include menstrual cycle, exercise, education, certain foods, smoking and caffeine use (Fiocco, Joober, & Lupien, 2007; Kirschbaum et al., 1999; Kudielka, Gierens, Hellhammer, Wust, & Schlotz, 2012). Although some instructions were provided in order to minimize the effects of some of these factors, compliance to these instructions was not measured. The impact of education is likely negligible given the fact that our sample was relatively well educated with 94% of the full sample having at least some post-secondary education. In addition, future studies should include a no treatment control group of SAD patients (e.g., wait-list control group, or psycho-educational group) in order to measure spontaneous symptom reduction over time, and to evaluate long-term treatment efficacy via follow-up data.

Studies assessing the effects of mindfulness-based interventions continue to increase and many methodological and conceptual issues are being addressed. Although our comparison of MBSR to CBGT on reactivity to a stressful speaking task did not yield any physiological differences between treatments, the results do suggest improvements on the subjective responses to an acute social stressor for both treatment groups. This was greater for CBGT, the more traditional treatment for anxiety disorders; nonetheless, significant gains in symptoms observed in response to the stressor in the MBSR group suggest its potential as an alternative treatment, particularly for CBGT non-responders. In fact, the individuals in the MBSR did improve following treatment on subjective measures of anxiety, albeit less so

than the CBGT group, despite the fact that the instructor was not a mental health professional, the MBSR program not being adapted to SAD, and with its' participants having likely had less exposure to public speaking than those in the CBGT group who may have chosen this practice as part of the hierarchy of exposures. MBSR is relatively easily accessible and may be preferred by those looking for a more holistic approach.

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The relationship between behavioural inhibition, parental bonding, and the response to a social stressor in healthy children

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Abstract

Objectives: This study examined the extent to which behavioural inhibition (BI) and parental bonding, influence the subjective and physiological responses to an acute stressor, a speech task. *Design and Methods*: 153 healthy children completed measures of BI and parental bonding, including maternal and paternal care and overprotection scores. Subjective and physiological measures taken during the speech task included visual analog scales of subjective anxiety, salivary cortisol, and heart rate variability (HRV). *Results:* Compared to children with low BI, those with higher levels of BI exhibited more subjective anxiety to the stress task, but no physiological group differences were observed. Parental bonding analyses yielded no group differences on subjective or physiological measures. The speech task consistently produced a subjective stress response in anticipation of and during the task, while little physiological responses to the task itself were noted, other than HRV changes which were considered unrelated to the task itself. *Conclusion:* This study contributes to the literature by examining both temperamental and environmental factors in the context of an acute stressor.

Keywords: Behaviour inhibition, parental bonding, salivary cortisol, heart rate variability, acute social stress

The relationship between behavioural inhibition, parental bonding, and the response to a social stressor in healthy children

Social anxiety disorder (SAD) is characterized by persistent fear and avoidance of social and performance situations. It is among the most common anxiety disorders with prevalence estimates varying roughly between 2 and 13% (Acarturk, Smit, de Graaf, van Straten, ten Have et al., 2009; Chartrand, Cox, ElGabalawy, & Clara, 2011; Ruscio, Brown, Chiu, Sareen, Stein, & Kessler, 2008). SAD is associated with marked distress and functional impairment in a variety of domains including social, educational, and occupational ones (e.g., Acarturk, Smit, de Graaf, van Straten, ten Have et al., 2009; Acarturk et al., 2009; Swinson, 2005; Vriends, Becker, Meyer, Michael, & Margraf, 2007). SAD is also frequently co-morbid with mood and other anxiety disorders (Acarturk, de Graaf, van Straten, ten Have, & Cuijpers, 2008; Acarturk et al., 2009; Ruscio et al., 2008; Stein & Stein, 2008; Wittchen, Kessler, Pfister, & Lieb, 2000). It typically has an early onset (Ruscio et al., 2008; Wittchen & Fehm, 2003), is chronic, and often persists into adulthood (Chartrand et al., 2011; Wittchen, Fuetsch, Sonntag, Muller, & Liebowitz, 2000; Wittchen & Fehm, 2003). Given the personal and societal difficulties associated with SAD, identifying individuals who are at increased risk of developing SAD before symptoms emerge would allow for the development and implementation of targeted prevention methods.

Behaviour inhibition (BI) is described as a heritable, temperamental trait that is characterized by a wary or avoidance response to new situations, people, and places (Clauss & Blackford, 2012; Degnan, Almas, & Fox, 2010; Essex et al., 2010; Kagan et al., 1988; Lahat, Hong, & Fox, 2011; Rapee, 2014). It is relatively stable over time and can be observed in children, adolescents, and adults. Children and adolescents who display BI tend

to be shy, fearful, and cautious (Kagan & Snidman, 1999; Fox et al., 2005). They show greater vigilance in new contexts and reticence in speaking and interacting with unfamiliar peers and adults, or in the case of infants, unfamiliar objects (Degnan et al., 2010; Fox et al., 2005; Kagan & Snidman, 1991; Lahat et al., 2011). Signs of BI in infants include negative emotions and motor reactivity to novel stimuli (Kagan et al., 1987).

BI is a well-documented risk factor for SAD (Broeren et al., 2014; Chronis-Tuscano et al., 2009; Clauss & Blackford, 2012; Essex et al., 2010; Gladstone, Mitchell, Wilhelm, & Malhi, 2005; Hudson et al., 2011ab; Lahat et al., 2011; Muris et al., 2011; Rapee, 2014; Schwartz et al., 1999). BI and SAD are frequently identified at different time points, BI at a young age and SAD during adolescence, for example, (Rapee, 2014). In their meta-analysis, Clauss and Blackford (2012) found that BI is associated with a fourfold increase in the risk of developing SAD (Clauss & Blackford, 2013). BI also strongly predicts higher social anxiety developmental trajectories (Broeren, Muris, Diamantopoulou & Baker, 2013). It is estimated that approximately 15 to 20% of children display extreme BI (Clauss & Blackford, 2012; Fox et al., 2005), and that close to half of these children go on to develop SAD (Clauss & Blackford, 2012).

Stress response and behavioural inhibition

Many authors have examined the subjective and physiological stress response in different populations such as mothers, breast cancer survivors, postpartum women, and individuals with SAD (Adam & Gunnar, 2001; Couture-Lalande, Lebel, Bielajew, 2014; Gonzalez, Jenkins, Steiner, & Fleming, 2009; Lightman, 2008; Tsigos, & Chrousos, 2002; Uhde, Tancer, Gelernter, & Vittone, 1994; van Veen et al., 2008; Weiss, 2007). Two physiological systems, the hypothalamic-pituitary-adrenal (HPA) axis and the autonomic nervous system (ANS), have long been recognized as playing a central role in mediating a

stress response (Adam & Gunnar, 2001; Porges, Doussard-Roosevelt, & Maiti, 1994; Stansbury & Gunnar, 1994). Cortisol is a hormone that can be extracted from saliva and is known to index HPA axis functioning (Adam & Gunnar, 2001; Braarud & Stormark, 2006; van Veen et al., 2008). Heart rate variability (HRV) is often used as an estimate of ANS status and its sympathetic and parasympathetic branches (Bazhenova & Porges, 1997; Friedman, 2007; Porges et al., 1994). It is measured based on spectral analytical techniques and is associated with the following parameters: low frequency (LF), which corresponds mostly to sympathetic activity; high frequency (HF), which is mainly an index of parasympathetic activity; and the LF:HF ratio, a signal of sympathovagal balance (Friedman, 2007).

Some authors have suggested associations between elevated cortisol levels and the development of social anxiety symptoms (Schiefelbein & Susman, 2006; Smider et al., 2002). For example, Schiefelbein & Susman (2006) assessed serum cortisol levels of 106 youths at three time points - beginning, middle, and end of the calendar year. They found that, in girls but not boys, higher cortisol increases during the year predicted both general and social anxiety symptoms at the end of the year.

The link between BI and the physiological response to stress or novelty as a possible risk factor for developing SAD has also been extensively studied in a variety of contexts including during transition to preschool, transition to school, the well known Ainsworth stranger situation, or in the presence of strangers (de Haan et al., 1998; Essex et al., 2010; Gunnar et al., 1997; 2011; Hastings et al., 2011; Kagan et al., 1987; 1988; Kagan & Snidman, 1991; Kertes et al., 2009; Nachmias et al., 1996; Tarullo, Mliner & Gunnar, 2011; Zimmermann & Stansbury, 2004). Children with BI have shown increases in stress-related physiological indices including greater pupil dilation, higher heart rate, decreased HRV, and

increased salivary cortisol concentrations (Kagan et al., 1987; Reznick et al., 1986; Rosen & Schulkins, 1998; Russ et al., 2012; Schmidt et al., 1997; Schwartz et al., 1999; Talge, Donzella, & Gunnar, 2008; Tarullo et al., 2011; Zimmermann & Stansbury, 2004). For example, Kagan et al., (1987) studied two cohorts of children longitudinally. They were observed at 21 or 36 months during exposure to new rooms, people, and objects. Those who appeared to be extremely cautious and shy were identified as inhibited and tended to show the same BI tendencies at 4.5 and 5 years of age. In addition, they displayed higher heart rate, lower heart rate variability, higher cortisol levels (before and after 90 minutes of cognitive testing in a laboratory setting and at home during three consecutive mornings), and more pupil dilation. Moreover, those children identified as BI at either 21 or 36 months who showed the lowest physiological symptoms were found to display less BI at 4.5 to 5 years. In contrast, those who were identified as uninhibited early on, but displayed higher physiological symptoms, were more likely to be identified as behaviourally inhibited later on.

However, not all investigators in this context report a relationship between BI and physiological stress mechanisms (Calkins, Fox & Marshall et al., 1996; Fox et al., 2005; Kagan & Snidman, 1991; Scarpa et al., 1997; Schmidt et al., 1997; Tarullo et al., 2011; Zimmermann & Stansbury, 2004). For example, while many studies indicate an activation of physiological symptoms in individuals with BI (Kagan et al., 1987; Rosen & Schulkins, 1998; Russ et al., 2012; Schmidt et al., 1997; Tarullo et al, 2011; Zimmermann & Stansbury, 2004), others have observed this relationship only in certain groups or settings – for example, in behaviourally inhibited infants with insecure attachment or in home versus school (de Haan et al., 1998; Nachmias et al., 1996). Yet others observe no activation of the HPA axis or the ANS in preschool and school age children with varying levels of temperamental

inhibition, approach, shyness, or fear-related behaviours during start of school, interaction with strangers, or in novel social and non-social events (Buss et al., 2004; Gunnar et al., 1997; Hastings et al., 2011; Kagan et al., 1988; Kertes et al., 2009; Essex et al., 2010; Talge et al. 2008).

Given the somewhat tenuous association between BI and stress reactivity (Buss et al., 2004; de Haan et al., 1998; Gunnar et al., 1997, 2011; Hastings et al., 2011; Kagan et al., 1988; Kertes et al., 2009; Nachmias et al., 1996; Stevenson-Hinde & Marshall, 1999; Talge et al. 2008; Tarullo, Mliner & Gunnar, 2011), and the fact that some individuals with extreme levels of BI do not develop SAD (Clauss & Blackford, 2012; Rapee, 2014; Lahat et al., 2011), some researchers have explored other factors that may help identify individuals at risk of SAD, or at risk of displaying a maladaptive response to stress. In this vein, there have been studies examining gender (Essex et al., 2010), social experiences/competence (Gunnar et al., 1997; Tarullo et al., 2011), attachment security (Nachmias et al., 1996; Shamir-Essakow et al., 2005), maternal anxiety/stress (Essex et al., 2010; Hudson et al., 2011), parenting behaviours and/or rearing strategies (Fox et al., 2005; Hastings et al., 2011; Kertes et al., 2009), and child care settings (Gunnar et al., 2011). For example, in a study that measured the cortisol response of toddlers in a novel situation, only those who were inhibited and had an insecure attachment showed elevated cortisol levels (Nachmias et al., 1996). In another study that examined the link between BI, attachment, and risk of anxiety disorder in children, inhibited children with an insecure attachment style and who had anxious mothers reported the highest levels of anxiety (Shamir-Essakow et al., 2005). Kertes et al., (2009) found that parenting quality buffered the cortisol elevation in children who were socially inhibited. Parenting variables therefore seem to have an impact on the association between

BI and activation of the stress response and it may be that this relationship is an important risk factor for SAD development.

Parental bonding

Parental bonding is a variable that has been extensively researched in retrospective studies examining the association between parental bonding and psychopathology. The results suggest that low levels of care and high levels of overprotection (or parental control) are linked to emotional disorders such as depression and anxiety (Gladstone & Parker, 2005). Enns, Cox, and Clara (2002) examined the relationship between parental bonding and 13 common psychological disorders. They found that parental bonding had significant, but nonspecific associations with adult mental health disorders. In general, a lack of care was most consistently connected to the development of a psychological disorder, and overall, parental bonding significantly explained a small amount, up to 5%, of the variance in occurrence of a disorder.

There have been studies that specifically looked at the link between parental bonding and anxiety disorder or anxiety symptoms (Meites, Ingram & Siegle, 2012; Parker, 1979; Silove, Parker, Hadzi-Pavlovic, Manicavasagar, & Blaszcynski, 1991; Spada et al., 2012). In general, patients with anxiety disorders also perceive their parents as having been less caring and more overprotective. Silove et al., (1991) found a pattern for patients with panic disorder showing more affectionate constraint parenting (i.e., high care and high overprotection) compared to those with generalized anxiety disorder, who had a higher risk of remembering parents within each of the three more negative styles, including affectionless control style (i.e., low care and high overprotection). Only a few studies have examined parental bonding in the context of SAD, and have generally found parenting characterized by a lack of warmth

and overprotection (Arrindell, Emmelkamp, Monsma, & Brilman, 1983; Arrindell et al., 1989; Essau, Sasagawa, Chen, & Sakano, Feb 2012).

Much of the research described above on parental bonding stems from retrospective studies using adult populations which lend themselves to memory biases (Gerlsma et al., 1997; Lewinsohn & Rosenbaum, 1987; Turgeon et al., 2002; Wood et al., 2003). Only a few studies have examined the relationship between parental bonding and childhood anxiety using children or adolescent current self-report (Dumas et al., 1995; Hale et al., 2006; Hudson & Rapee, 2001; McLeod, Wood & Weisz, 2007; Muris et al., 2000; Rubin et al., 1999; Siqueland et al., 1996; Stevenson-Hinde & Glover, 1996; van der Bruggen et al., 2008). Wood et al., (2003) specifically reviewed articles examining the association between parenting styles, behaviours, and childhood anxiety (i.e., trait anxiety, anxiety disorders or shyness), excluding studies that used retrospective measures of parenting behaviours. They found that evidence for the association between parent acceptance and control and childhood anxiety yielded relatively mixed results, especially in studies using differing informant sources and measurements of parenting behaviours, based on questionnaires or observations.

Although the studies using children or adolescent self-report are an improvement on retrospective studies, they also have their limitations. In fact, the presence of anxiety or other disorders can impact an individual's perception of the parenting style they currently receive (Bogels & van Melick, 2004) which can lead to biased reports of parental behaviours. Many of the more recent, non-retrospective studies on the relationship between parental bonding and anxiety are cross-sectional in nature and do not offer information on the direction of the association between parental bonding and anxiety. For example, does the over controlling parenting style lead to child anxiety, or does the child's symptoms or worry lead to more controlling parents in an attempt to minimize the child’s distress. Only a few studies have

examined parental bonding and child anxiety over time in longitudinal designs (Hudson & Dodd, 2012; Lewis-Morrarty et al., 2012) or with an experimental manipulation (de Wilde & Rapee, 2008). In their study, de Wilde & Rapee (2008) asked mothers to interact with their child with either low or high control during the child's preparation and delivery of a speech task; children whose mothers had been overly controlling had higher state anxiety scores when they were asked to perform another speech task.

There has also been limited research exploring parental bonding and BI (Degnan et al., 2008; Giles & Price, 2008; Kimbrel et al., 2008; 2012; Lewis-Morrarty et al., 2012; Rubin, Burgess & Hastings, 2002; Rubin, Hastings, Stewart, Henderson & Chen, 1997; Williams et al., 2009). Kimbrel et al., (2012) found that both BI and approach mechanisms interacted with an affectionless control (i.e., low care and high overprotection) parenting style to predict the development of a cluster A personality disorder. The same group (Kimbrel et al., 2008) also found an interaction between high sensitivity to punishment which they explained as a measure of the BI system, and low maternal care as predicting SAD symptoms. In a study examining whether a variety of factors was linked to the stability of BI over time, Degnan et al., (2008) found that parental warmth and control, among other aspects, were associated with maintenance of BI from infancy to middle childhood. Some studies have also identified a moderation effect of maternal control on the relationship between BI and social reticence or anxiety, such that individuals with high BI only go on to be socially reticent or anxious if they were also exposed to high maternal control, but not if low control is perceived (Lewis-Morrarty et al., 2012; Rubin et al., 2002).

Stress response and parental bonding

The effects of parental bonding on the physiological response to stress has been well-documented in different populations (Engert, Buss et al., 2010; Engert, Efanov et al., 2010;

Gerra et al., 2009; Luecken, 2000; Narita et al., 2012; Pruessner, Vracotas, Joober, Pruessner, & Malla, 2013; Sideridis & Kafetsios, 2008). For example, in their study, Engert et al., (2010) identified three groups - low, medium, and high early-life maternal care - based on the participant's response to the parental bonding instrument. They assessed stress responsivity via cortisol, heart rate, and subjective psychological responses to the twice repeated administration of the Trier Social Stress Task (TSST). Below normal levels of cortisol were found only in the participants who reported low and high levels of maternal care. No group differences in heart rate or psychological stress responses were noted. However, the psychological profile between those reporting low and high maternal care was different, with the group reporting low maternal care displaying higher levels of depression and anxiety symptoms as well as lower levels of self-esteem. Again, these studies include adults who retrospectively remembered their early-life parental bonding experience. To our knowledge, no studies have examined the relationship between parental bonding and an acute response to a stressor among children or adolescents who have reported current parental bonding experiences.

To summarize, in studies assessing parental bonding retrospectively, certain patterns of early parental bonding (i.e. low care and high overprotection when they were children) have been found in adults who currently have a psychological disorder, including SAD. These studies have also provided some evidence of a link between BI and early parental bonding. The latter may be associated with later subjective and physiological responses to stress (Sideridis & Kafetsios, 2008; Engert, Buss et al., 2010; Engert, Efanov et al., 2010). However, studies examining parental bonding through other means including child and adolescent report of current parental bonding, or observations of parenting behaviours, have yielded mixed results vis-a-vis its link with anxiety.

Objectives and hypotheses

The aim of the current study was to explore the relationship between BI, parental bonding, and physiological stress responses in a group of healthy children. An acute laboratory stressor (speech task) was administered to elicit reactive cortisol secretion, HRV, and a subjective anxiety response. The goal was to study the interaction between these variables and their relationship to subjective and physiological stress responses.

Methodology

Participants

Participants in this study were recruited as part of a larger study investigating risk markers in healthy children with and without a history of parental anxiety (including panic disorder, social anxiety disorder or generalized anxiety disorder) (see Bilodeau, Bradwejn, & Koszycki, 2014 and Koszycki et al., 2013 for previously published papers using part of this sample). The participants included 153 healthy children aged 7 - 18 years old. The exclusion criteria were the following: 1) a history of or current symptoms reaching threshold or sub-threshold levels for either an Axis I disorder, or medical conditions such as cardiovascular, respiratory, hematological, endocrine, and neurological disease, 2) regular use of medications that affect the peripheral or central nervous system, and 3) having participated in a drug study in the three months prior to the initial visit. Participants were recruited through advertisements in local newspapers and flyers posted at the University of Ottawa and community centers. Parents of potential participants called the laboratory for a telephone screening to assess preliminary eligibility criteria (i.e., by gathering information regarding the history of the child's psychiatric symptoms, medical illnesses and medication use as well as the psychiatric history of both biological parents). The families deemed eligible then came

to a first laboratory session during which further assessments were performed to confirm diagnosis eligibility and lack of symptomatology. Written consent was obtained from each parent and children 16 years and older, and assent was obtained from younger children. Individuals were compensated 25 Canadian dollars for their first session and 30 Canadian dollars for the laboratory session for their participation.

Procedure

Initial session. During the first session, children were interviewed, based on the child version of the Anxiety Disorders Interview Schedule (Silverman & Albano, 1996), to confirm absence of psychopathology based on threshold or subthreshold manifestation. During this time, their parents were independently interviewed to gather information regarding the child's developmental, social, medical, and academic functioning histories as well as past and current stressors. The mother's prenatal and postnatal history was also obtained. If inclusion criteria were met, participants completed self-report measures, including the childhood self-report of inhibition and the parental bonding instrument, with the assistance of the research assistant if needed, especially in the case of younger children.

Acute stressor. Within two weeks of the first visit, participants returned to the laboratory for the acute stress portion of the study. Electrodes were positioned along the bottom of the participants' left rib cage and collar bone to measure HRV throughout the session. Participants were instructed to sit for 20 minutes and then stand for 10 minutes in order to obtain baseline values for the HRV functioning given that the position change from sitting to standing can vary between individuals and obtaining both measures provides a more complete baseline picture. The purpose was to compare the difference between the relaxed sitting and the standing positions since participants were standing when performing the speech. Respiration was also monitored during HRV collection. Participants were given

two minutes to prepare a ten minute speech on a topic of their choice and then required to deliver it in front of two to three research assistants.

During this task, saliva samples were obtained at baseline (5 minutes before instruction of the task), and 15, 30, 45, and 60 minutes after the speech task in order to assess cortisol response and its duration. Visual analog scale (VAS) ratings of subjective levels of anxiety were also obtained at baseline, after speech preparation, and following speech delivery. HRV was recorded continuously during the baseline period and during the speech.

Measures

Childhood Self-Report of Inhibition - Version 2 (CSRI). The CSRI is a self report questionnaire that consists of 30 items designed to assess BI. Its items directly parallel that of the adult self-report, Retrospective Childhood Inhibition Scale (RCIS), but written using language appropriate for 7 year old children. Items are rated on a 5-point Likert scale. Research on the RCIS (Reznick, Hegeman, Kaufman, Woods, & Jacobs, 1992) with undergraduate students indicates that the internal consistency of the scale is high (Cronbach's coefficient range from 0.79 to 0.91). In addition, there is good agreement between the RCIS and parent report and the RCIS correlates with an adult measure of BI. Cronbach's alpha for the CSRI in the current sample was 0.80, which indicates good internal consistency.

Parental Bonding Instrument. The Parental Bonding Instrument (PBI) is a 25 item questionnaire that is completed by the child for each parent separately. It yields two scores: a care and an overprotection score. High levels of the care score reflect warmth and care, while low rates point to rejection and coldness. A high overprotection score indicates control and intrusiveness, and low scores, psychological autonomy (Enns et al., 2002; Parker, 1990). Note that some authors have suggested that the overprotection scale could be further divided

into protectiveness and authoritarianism (Gladstone & Parker, 2005). Results from the PBI can also be seen as falling within one of four quadrants including optimal parenting (i.e., high care and low overprotection), affectionate constraint (i.e., high care and overprotection), affectionless control (i.e., low care and high overprotection), and neglectful parenting (i.e., low care and low overprotection) (Parker, 1990). The PBI was developed as a retrospective instrument for adults to reflect back on the parental bonding they experienced during the first 16 years of their lives (Parker, 1990). In an editorial, Parker (1990) commented on a decade of research on the PBI and highlighted its reliability and validity. Several studies have used the PBI with children and adolescents (Canetti & Bachar; 1997; Fendrich, Warner, & Weissman, 1990; Stein et al., 2000) and they have all reported acceptable to good internal consistency. In a study examining whether the PBI (Greek version) was appropriate with children respondents, Tsaousis, Mascha, & Giovazolias (2012) found that measurement invariance between adult and children respondents suggested promising results; however, they cautioned the reader regarding the possibility that children and adults may have a different conceptual understanding of the measure. In the current sample, Cronbach`s alpha was calculated as follows: .811 on measures of maternal care, .724 for maternal protection, .860 for paternal care, and .791 for paternal protection, indicating acceptable to good internal reliability.

Visual analogue scale. VASs have been used for many decades (Wewers & Lowe, 1990; Williams et al., 2010). In this study, a VAS was used to measure subjective anxiety at different time points given its suitability for serial measurements (Scrimshaw & Maher, 2001; Wewers & Lowe, 1990; Williams et al., 2010). William et al., (2010) examined the psychometric properties of VAS ratings of anxiety and found adequate reliability as well as good convergent and divergent validity.

Cortisol. Saliva samples for extracting cortisol were collected via oral swabs placed in the mouth for three minutes. The swabs were stored in vials and kept at -20^{0}C, then centrifuged to remove particulate matter, and the supernatant liquid stored in Eppendorf tubes at -80^{o}C until analyses. A trained laboratory technician, unaware of the study objectives, performed the analyses in duplicate using the protocol and enzyme-linked immunosorbent assay cortisol kits from Salimetrics, Inc.

Heart rate variability. HRV was measured using mobile Seers MC (GE Medical Systems) ECG monitors. Participants wore the monitor throughout the session and scores obtained were based on the 20 minute sitting and 10 minute standing baseline conditions, and the 10 minute speech task. Data were analyzed at the Arrythmia Monitoring Center of the University of Ottawa Heart Institute. Standard arrhythmia evaluation was performed using a MARSSPC system (GE Marquette) and after editing, spectral analytical techniques were applied to the data which generated the following cardiac parameters: low frequency (LF) which reflects mainly sympathetic activity, high frequency (HF) which reflects mainly parasympathetic activity and the LF:HF ratio, an index of sympathovagal balance (Friedman, 2007). The HRV analyses were conducted by an Ottawa Heart Institute technician who was unaware of the study objectives.

Respiration. Respiration was measured with the PS-2133 Respiration Rate Sensor (PASCO Scientific), which is an inflatable belt wrapped around the participant's chest. The respiration was measured continuously during the procedure, but scores were obtained for each of the time points described in the HRV measures, that is, during 20 minutes (2 x 10 minutes) of baseline siting, 10 minutes of baseline standing, 10 minutes of speech task, as well as 20 minutes (2 x 10 minutes) of post speech task measures. The score for each time period is the mean respiration rate for that time.

Statistical Analyses

Before conducting the statistical analyses, data were screened for outliers, skewness, and kurtosis. Two participants had cortisol levels that were too high (beyond the range of detection) and thus their data were removed from the analyses. No other outliers were found. Missing values were dealt with by replacing them with the variable mean; roughly 6% of scores were imputed in this manner. Because most variable distributions were skewed, log transformations were applied on the dependent variables for the analyses of variance described below, which provided more normalized distributions. However, given that log transformations did not normalize the parental bonding variables, square root transformations were applied to measures used in the multiple regression analyses, which included the parental bonding variables.

In preliminary analyses, the relationship between BI, parental bonding variables (i.e., maternal care, maternal overprotection, paternal care, paternal overprotection), and the outcome variables, including the subjective and physiological stress response variables (VAS anxiety score, cortisol concentration, and LF, HF and LF:HF ratio) at each time point as well as the area under the curve associated with each of the five stress measures were assessed via correlational analyses. The lack of significant correlations between the predictor and outcome variables indicated that analyses of covariance were not suitable (Tabachnick and Fidell, 2007). Similar results were noted for possible confounding variables such as age, gender and body mass index (BMI), and correlations between these factors and the dependent variables were largely non significant and therefore, not suitable for covariate analyses. Preliminary analyses were also conducted in order to determine if a moderation effect of age existed on the association between BI and the responses to stress, and if these associations were different in males and females. No significant interaction between BI and

age were noted on the responses to stress and these scores were not different when analysing males and females separately. Therefore, age and gender were not included in subsequent analyses. Respiration values were also explored as a possible covariate for HRV, but correlations between respiration and HRV scores were equal to or less than 0.225 and thus did not meet the criterion for covariate selection (Tabachnick & Fidell, 2007). Therefore, subsequent analyses focused on the extreme upper and lower 25% of each independent variable to determine if the physiological stress responses were different at these extremes.

Given that some of the children in the current sample were siblings, additional analyses were conducted to determine whether family ID should be included as a random effect factor in the analyses. First, we explored the variability of the predictor and outcome measures between the group that did and did not include siblings. The conservative F_{max} test for homogeneity of variance was not significant on any of the measures; both sets of variances were negligibly different. Second, the analyses described below were also performed using an average score per family, typically based on two and infrequently three siblings. The results using average sibling score were no different than that based on the individual child's data. Consequently, there was no need to use family as a random effect factor.

Five two-way mixed ANOVAs with time or condition as the repeated measure and group as the independent factor (high and low BI scores) were performed. The dependant variables were VAS, cortisol, LF, HF, and their ratio. VAS scores were collected before the speech task, after preparation of the speech, and after its delivery. Cortisol levels were measured at five time points including baseline, 15, 30, 45, and 60 minutes after the speech task. The HRV measures (i.e., LF, HF and LF:HF ratio) were collected in three different conditions - at baseline, while sitting, then standing, as well as during the speech.

Five two-way mixed ANOVAs were also performed independently on each of the parental bonding variables (i.e., maternal care, maternal overprotection, paternal care and paternal overprotection). Again, group was the between factor and included the extreme upper and lower 25% scores on each variable. The repeated measure and dependent variables were the same as described above for the BI analyses. For all analyses, the alpha level was set at 0.05, Huynh-Feldt corrections were applied for sphericity violations (Tabachnick and Fidell, 2007), and family-wise error rate controlled for multiple comparisons.

Finally, as a last step, multiple regressions were performed in order to determine if BI, parental bonding, or their interaction predicted any of the stress responses. Five separate multiple regressions were performed using the AUC of each of the dependent variables, that is, the AUC associated with VAS, cortisol, LF, HF, and the LF:HF ratio. Predictor variables for each of these were BI, maternal care, maternal protection, paternal care, and paternal protection entered in a first block, and the interaction of BI and each of the parental bonding scales entered in a second block, for a total of nine predictors per analysis.

Results

Demographics

Participants included 153 healthy children (75 girls and 78 boys) between the ages of 7 and 18 years old (*M* age = 12.46, *SD* = 3.21). Descriptive data for the predictor and demographic variables are presented in Table 1. Most participants reported receiving the optimal parenting style from their mother and father (53.8% and 54.2%, respectively). The remainder was distributed among the other parenting styles including affectionate constraint, affectionless control, and neglectful parenting. Roughly two-thirds of the sample reported high maternal and paternal care and low maternal and paternal protection. Some of the

Table 1

Descriptive data on predictor and demographic variables

Variable	*N*	$\overline{X}$	*SD*
Predictor variables			
Behaviour Inhibition	153	1.87	0.37
Maternal Care	119	29.05	5.78
Maternal Protection	119	11.40	6.13
Paternal Care	118	26.79	6.72
Paternal Protection	118	11.10	6.43
		%	
Maternal Parenting Style			
Optimal Parenting		53.8	
Affectionate Constraint		14.3	
Affectionless Control		16.8	
Neglectful Parenting		15.1	
Paternal Parenting Style			
Optimal Parenting		54.2	
Affectionate Constraint		19.5	
Affectionless Control		19.5	
Neglectful Parenting		6.8	
Demographic variables			
Age Categories			
7-12		46.4	
13-18		53.6	
Gender			
Females		49.0	
Males		51.0	

N, Number of participants; $\overline{X}$, mean; SD, standard deviation.

analyses included the top and bottom 25% of scores for the predictor variables. Descriptive data for these extreme groups are presented in Table 2.

Correlational analyses

Results from the correlation analyses are presented in Table 3. Scores from the CSRI scale were negatively associated with age (r = -.357, p <.001), body mass index (r = -.204, p =.011) and maternal care (r = -.203, p = .026) and positively associated with maternal and paternal overprotection (r = .266, p = .003; r = .267, p = .004, respectively) as well as with the VAS AUC (r = .405, p < .001). BI was not correlated with any of the physiological responses.

In the case of the PBI, all pairwise correlations between subscales were significant, as would be expected. Parental bonding subscales were not correlated with any of the stress response measures with little exception; maternal care was correlated with the LF and HF AUC (r = .247, p =.008; r = .223, p = .017, respectively).

Behavioural inhibition extreme scores and stress responses

Figure 1 depicts the results for each of the analyses based on high and low BI. The VAS analyses (Figure 1, plot A) yielded significant main effects of time and group with no interaction. Table 4 provides all statistical values and sample sizes. Follow-up analyses revealed significant differences between each time point, the pattern indicating that the VAS response was highest just before the speech, and lowest at baseline (baseline VAS vs pre VAS and post VAS, p < .001 and p = .006, respectively and pre VAS vs post VAS, p = .010) and that individuals with high BI reported significantly higher anxiety scores than did individuals with low BI.

No group differences were observed in any of the analyses based on the physiological

Table 2:

Descriptive data for the top and bottom 25% scores of each predictor variable.

	BI		mCare		mProtect		pCare		pProtect	
	Low	High	Low	High	Low	High	Low	High	Low	High
Age $\bar{x}$ (SD)	13.9* (2.3)	10.7* (3.0)	12.1 (3.5)	12.8 (2.8)	13.2 (2.9)	11.6 (3.8)	12.2 (3.6)	11.9 (2.9)	13.0 (3.1)	11.6 (3.8)
Age categories	%		%		%		%		%	
7-12	24.3*	67.6*	48.5	44.4	41.4	54.8	45.5	55.6	45.5	51.9
13-18	75.7*	32.4*	51.5	55.6	58.6	45.2	55.2	44.4	54.5	48.1
Gender										
Female	40.5	40.5	39.4	48.1	51.7	45.2	51.7	51.9	39.4	63.0
Male	59.5	59.5	60.6	51.9	48.3	54.8	48.3	48.1	60.6	37.0

* $p < .05$; BI, Behaviour inhibition; mCare, maternal Care; mProtect, maternal protection; pCare, paternal Care; pProtect, paternal protection, N, Number of participants; $\bar{X}$, mean; SD, standard deviation.

Table 3

Correlations between predictor, outcome, and control variables

Variable	2	3	4	5	6	7	8	9	10	11	12
Predictor Variables											
1. Behavioural Inhibition	-.185*	.294**	NS	.272**	.357**	NS	NS	NS	NS	-.379**	-.205*
2. Maternal Care		-.476**	.294**	-.348**	NS	.206**	.205**	NS	NS	NS	NS
3. Maternal Overprotection			-.210*	.552**	NS	NS	NS	NS	NS	NS	NS
4. Paternal Care				-.430**	NS	NS	NS	NS	NS	NS	NS
5. Paternal Overprotection					NS	NS	NS	NS	NS	NS	NS
Outcome Variables											
6. VAS, AUC						NS	NS	NS	NS	NS	NS
7. HRV, LF, AUC							.855**	NS	NS	NS	NS
8. HRV, HF, AUC								-.604**	NS	NS	NS
9. HRV, LF:HF, AUC									NS	.320**	NS
10. Cortisol, AUC										NS	.215**
Control Variables											
11. Age											.556**
12. Body Mass Index											

** $p < .01$; *$.01 < p < .05$; NS, non significant; VAS, visual analog scale; AUC, area under the curve; HRV, heart rate variability; LF, low frequency; HF, high frequency

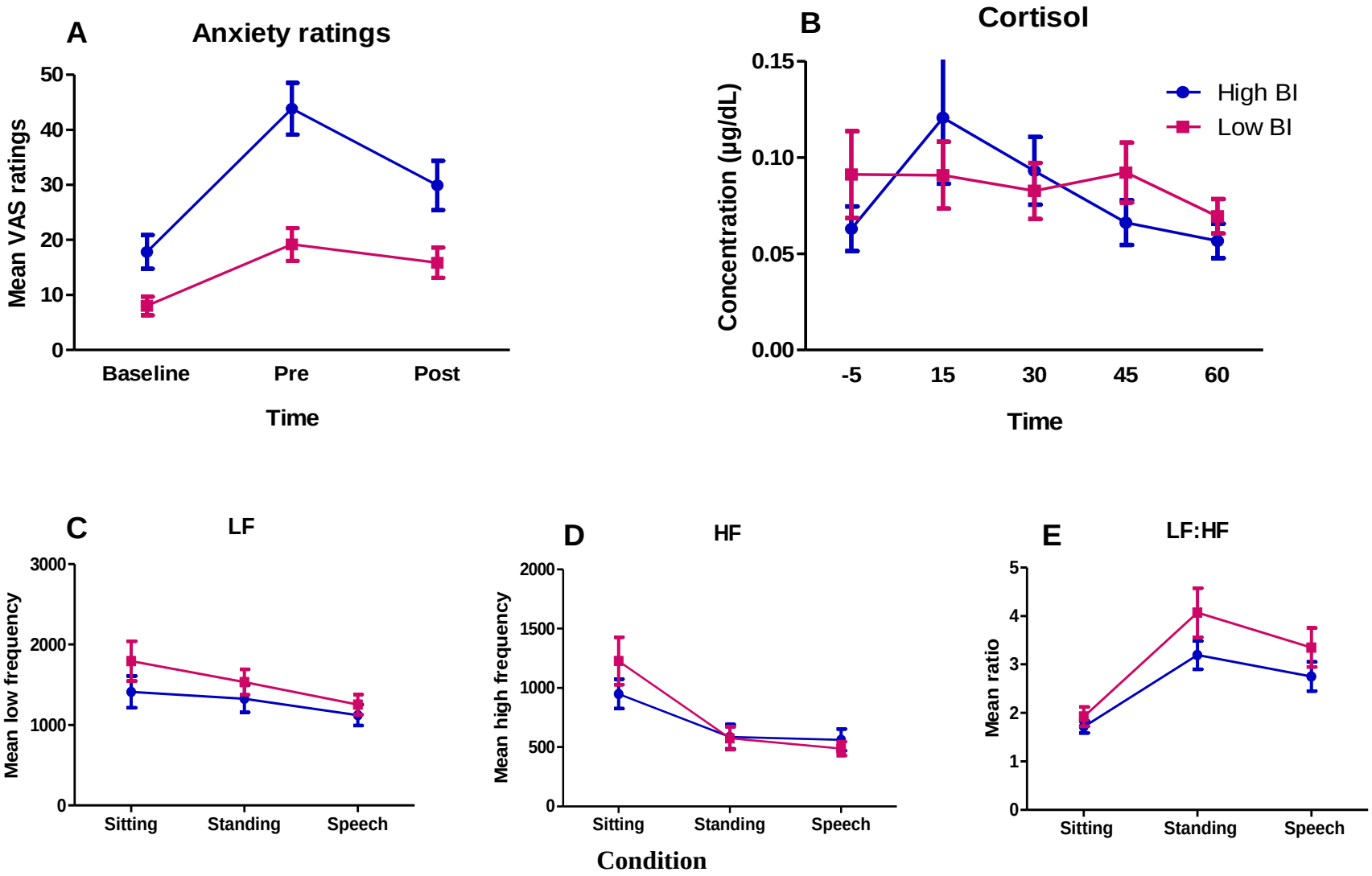

Figure 1. Mean scores ± SEM on the VAS symptom scale (plot A), for cortisol concentrations (plot B), and heart rate variability expressed as low frequency (plot C), high frequency (plot D) and the ratio of low to high frequency (plot E) for high and low behaviour inhibition groups at the different time points and conditions. VAS, Visual Analog Scale; BI, Behavioural inhibition; LF, Low frequency; HF, High frequency.

Table 4

Results of ANOVAs on behavioural inhibition and parental bonding variables, including number of participants in each group per analysis, significance and effect sizes.

	Outcome variables (N = Low, High)	Time		Group		Time by Group	
		p	η^2	p	η^2	p	η^2
Behavioural Inhibition	VAS (N = 37, 37)	< .001**	.223	.002**	.130	.692	.005
	Cortisol (N = 30, 27)	.029*	.054	.723	.002	.134	.033
	LF (N = 32, 35)	.011*	.067	.291	.017	.832	.003
	HF (N = 32, 35)	< .001**	.396	.864	.000	.315	.018
	LF/HF (N = 32, 35)	< .001**	.432	.184	.027	.455	.012
Parental Bonding							
Maternal Care	VAS (N = 33, 27)	< .001**	.237	.144	.036	.803	.004
	Cortisol (N = 26, 19)	.232	.033	.726	.003	.298	.028
	LF (N = 33, 24)	.027*	.064	.045*	.071	.851	.003
	HF (N = 33, 24)	< .001**	.438	.074	.057	.248	.025
	LF/HF (N = 33, 24)	< .001**	.387	.567	.006	.429	.015
Maternal overprotection	VAS (N = 29, 31)	< .001**	.200	.089	.049	.606	.009
	Cortisol (N = 20, 26)	.058	.055	.943	.000	.309	.027
	LF (N = 27, 29)	.033*	.061	.125	.043	.430	.016
	HF (N = 27, 29)	< .001**	.479	.341	.017	.612	.008
	LF:HF (N = 27, 29)	< .001**	.485	.737	.002	.786	.004
Paternal Care	VAS (N = 29, 27)	< .001**	.231	.582	.006	.941	.001
	Cortisol (N = 23, 18)	.045*	.063	.512	.011	.311	.029
	LF (N = 27, 27)	.014*	.084	.296	.021	.121	.041
	HF (N = 27, 27)	< .001**	.412	.221	.029	.208	.030
	LF:HF (N = 27, 27)	< .001**	.410	.399	.014	.225	.028
Paternal overprotection	VAS (N = 33, 27)	< .001**	.174	.539	.007	.865	.002
	Cortisol (N = 19, 22)	.345	.028	.951	.000	.558	.018
	LF (N = 33, 26)	.007**	.085	.913	.000	.166	.032
	HF (N = 33, 26)	< .001**	.410	.918	.000	.979	.000
	LF/HF (N = 33, 26)	< .001**	.417	.914	.000	.312	.021

** p < .01; *.01 < p < .05; N, Number of participants; $\overline{X}$, mean; SD, standard deviation; LF, Low frequency; HF, High frequency.

measures; only a main effect of time was found in each case. See Figure 1, plots B to E for data and Table 4 for statistical values. Note that analyses were also performed on the normalized values of LF and HF, and although the pattern of results over time was somewhat different, there were no group differences. Post-hoc analyses indicated that for the HF and LF:HF ratio, significant differences were found between the baseline sitting position, and both the baseline standing and the speech conditions (HF: sitting VS standing: $p < .001$; HF: sitting VS speech: $p < .001$; LF:HF: sitting VS standing: $p < .001$; LF/HF: sitting VS speech: $p < .001$). For LF scores, the difference between the sitting position and the speech condition was not significant ($p = .013$) taking into account the correction for multiple comparisons. The analysis of the cortisol data gave rise to a significant main effect of time; follow-up trend analyses revealed a significant quadratic trend (p=.035) in the case of the high BI group only (See Figure 1, plot B for cortisol data).

Parental bonding extremes and stress response

All data pertaining to parental bonding variables are portrayed in Figures 2-5. Similar results were found using the upper and lower 25% scores of each of the four parental bonding subscale (maternal care and overprotection, as well paternal care and overprotection). With little exception, only time was significant for each of the stress-related variables (see Table 4 for values). Follow-up analyses of these effects indicated that VAS baseline scores were significantly lower than pre-task scores for all four parental bonding variables, and significantly lower than post-task scores except for paternal protection. Pre- and post-task VAS scores were significantly different for maternal and paternal protection variables, but not for the care variables. For HRV, the HF and ratio variables yielded significant differences between the sitting position and both the standing position and speech condition in all four analyses ($p < .001$ in each case). For LF, none of the specific time points

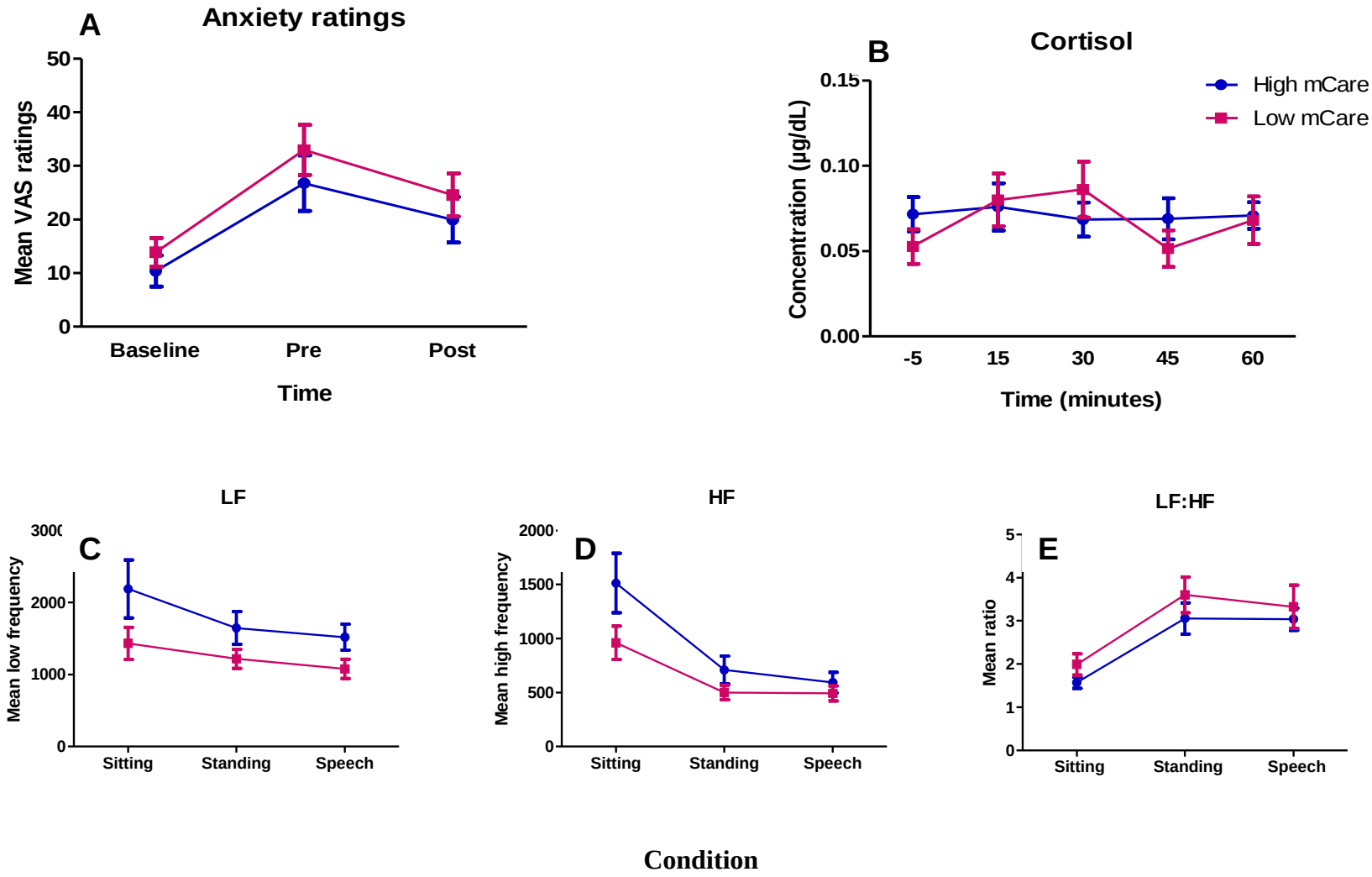

Figure 2. Mean scores ± SEM on the VAS symptom scale (plot A), for cortisol concentrations (plot B), and heart rate variability expressed as low frequency (plot C), high frequency (plot D) and the ratio of low to high frequency (plot E) for high and low maternal care groups at the different time points and conditions. VAS, Visual Analog Scale; mCare, maternal care; LF, Low frequency; HF, High frequency.

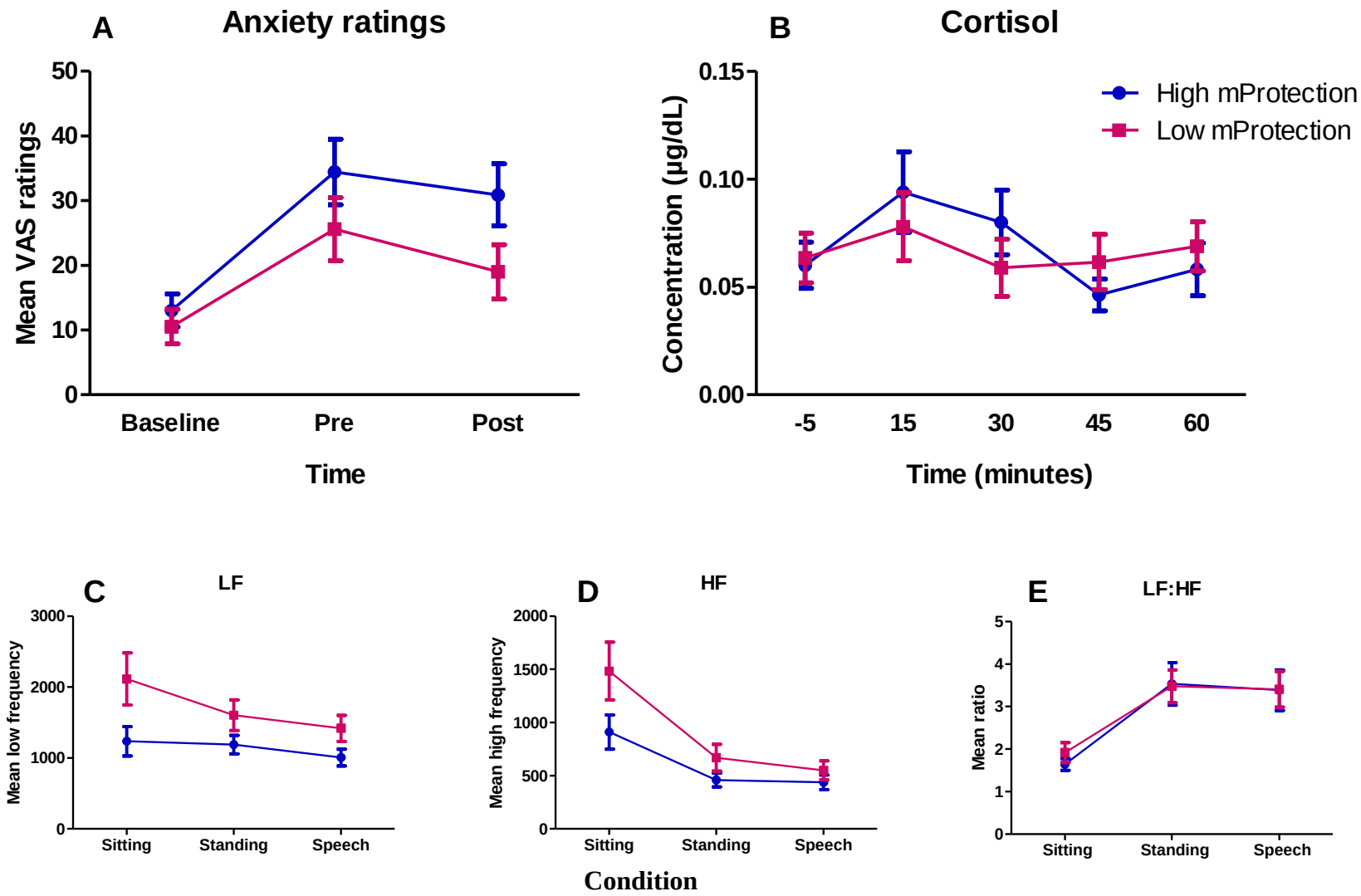

Figure 3. Mean scores ± SEM on the VAS symptom scale (plot A), for cortisol concentrations (plot B), and heart rate variability expressed as low frequency (plot C), high frequency (plot D) and the ratio of low to high frequency (plot E) for high and low maternal protection groups at the different time points and conditions. VAS, Visual Analog Scale; mProtection, maternal protection; LF, Low frequency; HF, High frequency.

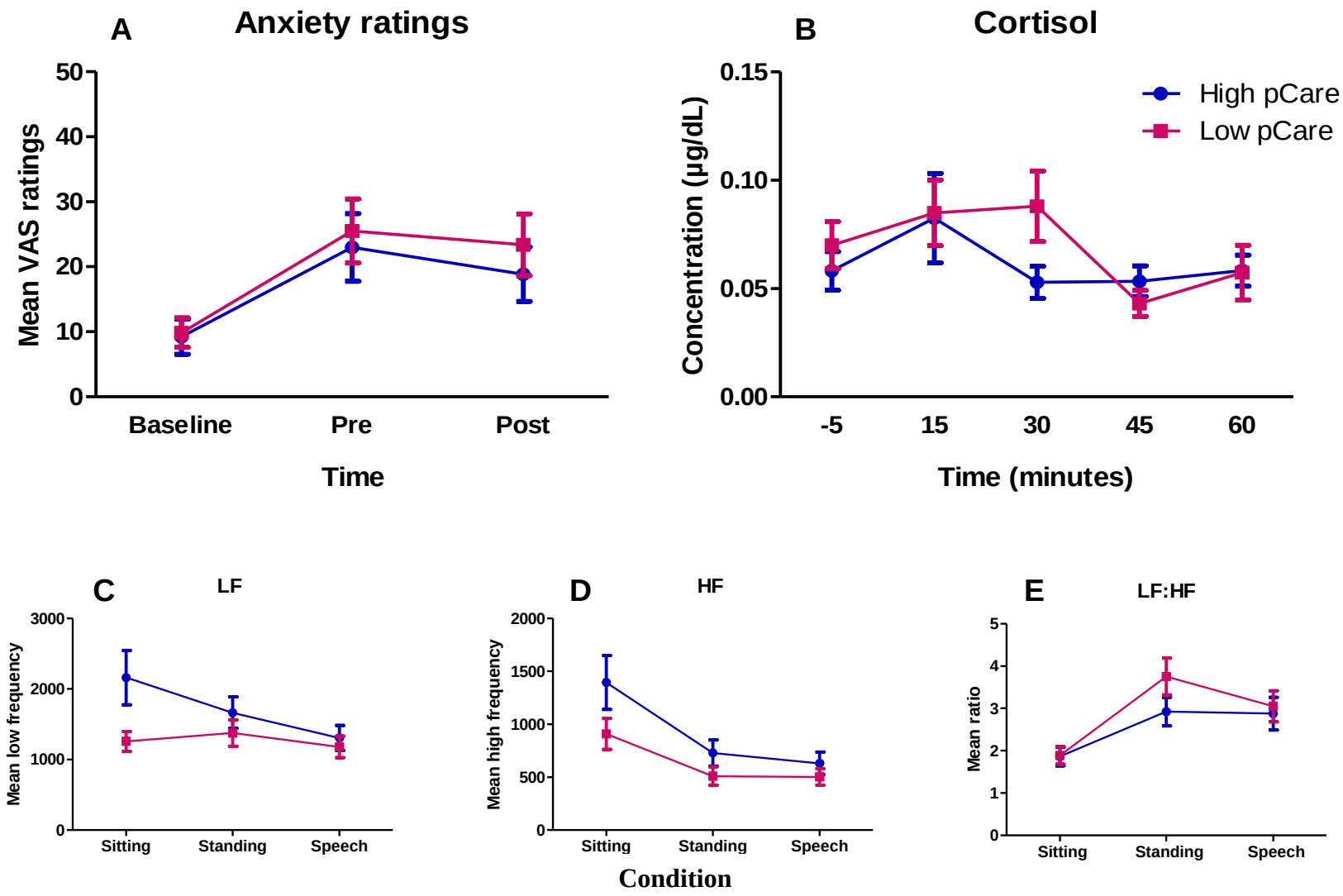

Figure 4. Mean scores ± SEM on the VAS symptom scale (plot A), for cortisol concentrations (plot B), and heart rate variability expressed as low frequency (plot C), high frequency (plot D) and the ratio of low to high frequency (plot E) for high and low paternal care groups at the different time points and conditions. VAS, Visual Analog Scale; pCare, paternal care; LF, Low frequency; HF, High frequency.

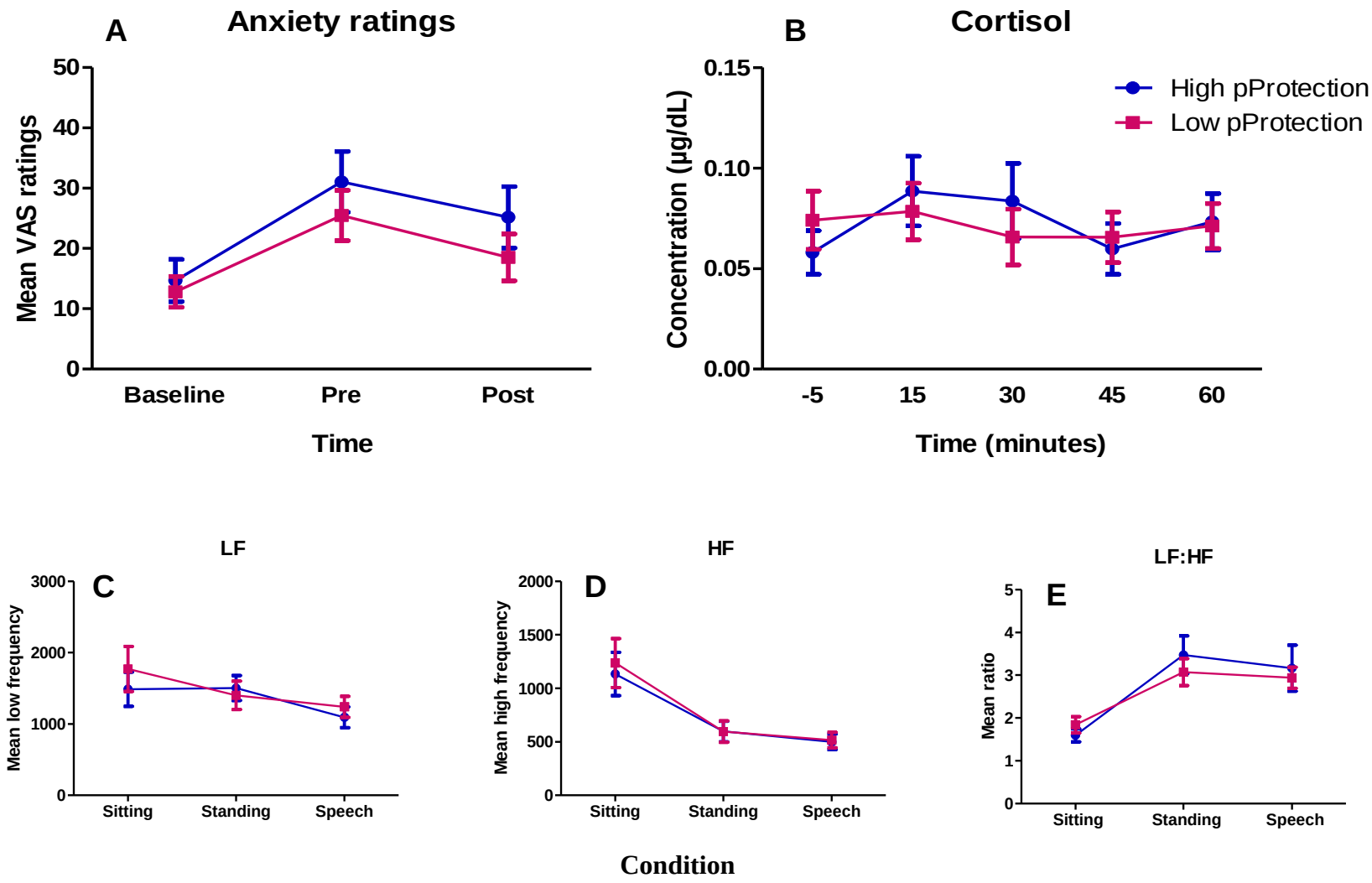

Figure 5. Mean scores ± SEM on the VAS symptom scale (plot A), for cortisol concentrations (plot B), and heart rate variability expressed as low frequency (plot C), high frequency (plot D) and the ratio of low to high frequency (plot E) for high and low paternal protection groups at the different time points and conditions. VAS, Visual Analog Scale; pProtection, paternal protection; LF, Low frequency; HF, High frequency.

yielded significant differences from each other following the correction for multiple comparisons. A main effect of time on cortisol data was only evident for paternal care analyses and no longer met significance when the family-wise error rate was considered (p = .045). No significant group differences were found on any of the subjective or physiological measures.

Multiple regression analyses

Multiple regression analyses were performed in order to determine if BI, the parental bonding variables, or their interaction predicted the subjective or physiological responses to the speech task. Only the analyses on the VAS AUC yielded significant results ($F = 3.677$, $p = .004$) for its first model (excluding the interactions). Examination of the coefficients indicated that higher levels of BI predicted higher levels of VAS AUC ($t = 3.742$, $p < .001$). No other variable contributed to this effect. Models assessing the prediction of the physiological measures of stress, cortisol, LF, HF, and LF:HF ratio were not significant.

Discussion

The primary aim of this study was to explore the effects of internal (BI temperament) and environmental (parental bonding) factors, as well as their interaction, on the subjective and physiological response to stress in a group of healthy children. The current study is unique in that it assessed the effects of these risk factors on the response to a laboratory stressor. The goal of studying a healthy sample was to reduce the chances of biases and confounding variables that would be inherent in a study including children with some symptoms of anxiety.

An important feature of this study was the fact that children reported their own BI and current perceived parental style. In comparison to retrospective reports from young adults, the assessment of current parental bonding experience is associated with fewer

memory biases (Gerlsma et al., 1997; Lewinsohn & Rosenbaum, 1987; Turgeon et al., 2002; Wood et al., 2003). For example, the PBI was developed to be completed retrospectively by adults remembering their early life experience, specifically their first 16 years of life, with their parents. Many authors have questioned whether these recalled experiences reflect actual past parenting behaviours or are biased by the individual's current functioning state (Gerlsma et al., 1997; Lewinsohn & Rosenbaum, 1987; Turgeon et al., 2002; Wood et al., 2003). Gerlsma et al., (1997) found that there was typically limited agreement between family members, both siblings and parents, of adults with psychiatric disorders on their individual ratings of early parenting behaviours.

Correlational results

As expected and reported in our earlier work using part of the current sample (Koszycki et al., 2013), parental bonding variables were related to levels of BI. These results confirm the findings from other studies that have examined this link (Degnan et al., 2008; Giles & Price, 2008; Kimbrel et al., 2008; 2012; Lewis-Morrarty et al., 2012; Rubin et al., 1997). We found that higher BI levels were associated with lower maternal care scores and higher maternal and paternal overprotection scores. BI levels were only related with subjective responses as measured by VAS AUC and not with any of the physiological AUC measures - cortisol, LF, HF, and LF:HF ratio. The parental bonding subscales were not related to any of the stress response variables.

Subjective anxiety response

Group differences were found on self-rated anxiety when extreme BI scores were considered, but not when exploring extreme levels of any of the parental bonding variables. The speech task consistently produced subjective stress responses in anticipation of and following the speech task. The result that BI was associated with VAS scores in a predictive

manner, that is, the children who rated themselves as more behaviourally inhibited also experienced higher levels of subjective anxiety during the speech task is in line with the many studies describing a link between BI and anxiety symptoms or disorders (Broeren et al., 2014; Chronis-Tuscano et al., 2009; Clauss & Blackford, 2012; Essex et al., 2010; Gladstone et al., 2005; Hudsonet al., 2011ab; Lahat et al., 2011; Muris et al., 2011; Rapee, 2014; Schwartz et al., 1999). Studies examining stress reactivity per se (Buss et al., 2004; de Haan et al., 1998; Gunnar et al., 1997, 2011; Hastings et al., 2011; Kagan et al., 1988; Kertes et al., 2009; Nachmias et al., 1996; Stevenson-Hinde & Marshall, 1999; Talge et al. 2008; Tarullo, Mliner & Gunnar, 2011) have focused on the physiological response and not the subjective reactivity.

No group differences on any of the parental bonding variables were found on the VAS scores. This differs from studies linking parental bonding variables to anxiety (Hale et al., 2006; Hudson & Dodd, 2012; Lewis-Morrarty et al., 2012) and is not entirely surprising given that only a relatively small portion of the variability in anxiety or other psychological disorders is explained by parental bonding variables in other studies (Enns et al., 2002; McLeod et al., 2007). The VAS score in the current study represents a state anxiety response to a task while much of the research on parental bonding variables has examined anxiety disorders or anxiety symptoms in general. As discussed regarding BI, studies assessing stress reactivity in the context of parental bonding tend to rely on physiological measures (Engert, Buss et al., 2010; Engert, Efanov et al., 2010; Gerra et al., 2009; Luecken, 2000; Narita et al., 2012; Pruessner et al., 2013; Sideridis & Kafetsios, 2008). One study by de Wilde & Rapee (2008) found a higher self-reported state anxiety in response to a speech task in a group of children whose mother had been instructed to be highly controlling during a previous speech task. However, this study involved a manipulation of maternal control specifically meant to

convey the idea that the task was too difficult for the children to perform on their own. Perhaps the link between a subjective anxiety response to a stressor and a more general, every-day life, parenting style is different.

Physiological response

No group differences based on high and low BI and parental bonding variables were identified on any of the physiological responses. The significant HRV changes that occurred during the task, when significant were explained by the fact that participants were standing during the task, rather than by the speech itself. The cortisol pattern associated with the participants in the high BI group yielded a significant quadratic pattern indicating a cortisol response to the speech task for this group, while those reporting low BI displayed a flat profile.

Although many studies have examined differences in physiological responses to stress for inhibited compared to uninhibited children such as greater pupil dilation, higher heart rate, decreases in HRV, and elevated cortisol levels (Kagan et al., 1987; Schmidt et al., 1997; Tarullo et al., 2011; Zimmermann & Stansbury, 2004), the results have generally been mixed (Buss et al., 2004; de Haan et al., 1998; Gunnar et al., 1997; Hastings et al., 2011; Kagan et al., 1987, 1988; Kertes et al., 2011; Essex et al., 2010; Nachmias et al., 1996; Rosen & Schulkins, 1998; Russ et al., 2012; Schmidt et al., 1997; Talge et al., 2008; Tarullo et al., 2011; Zimmermann & Stansbury, 2004). Findings from studies examining the physiological stress response in individuals with SAD specifically have also not been consistent (Condren et al., 2001; Elzinga et al., 2010; Furlan et al., 2001; Levin et al., 1993; Martel et al., 1999; Roelofs et al, 2009). Some of the reasons for this may explain the lack of physiological effects in the current study. First, studies stemming from Kagan's group's longitudinal research are based on samples of children chosen specifically for their extreme

and stable levels of BI or "behavioural uninhibition" (Kagan et al., 1988; Reznick et al., 1986; Schwartz et al., 1999), while the current study was based solely on healthy children. It is possible that individuals with the most extreme levels of BI would have developed symptoms of anxiety and therefore not have met the inclusion criteria for the current study. The scores on the CSRI in our sample ranged from 1.23 to 2.97 out of 5 with a mean of 1.87, well below the upper limit of the scale.

Second, many different methods have been used to measure BI and parental bonding, including self-report, parent report, and observation (Chronis-Tuscano et al., 2009; Ginsburg et al., 2006; Kagan et al., 1987, 1988; Koszycki et al., 2013; Wood et al., 2003). Although observational measures have clear advantages due to their objective nature (Barrett et al., 1996, 2005; Chorpita et al., 1996; Cobhamet al., 1999; Shortt et al., 2001; Wood, 2003), they tend to only reflect the behaviour of the parent at a specific time point and in a particular situation (Ginsburget al., 2006; Koszycki et al., 2013). Self-report measures, such as those included in this study, measure children's perception of their behaviour and their parents' behaviour in general, over several situations, and in day to day life.

Third, there are likely other variables at play. Although the current study did not yield an interaction between parental bonding and BI on physiological responses to the speech task, it could be that stressful life events (Broeren et al., 2013), maternal or paternal anxiety (Hudson et al., 2011ab; Shamir-Essakov et al., 2005) or other environmental factors, for example, that were not analyzed here, would distinguish group differences (Degnan et al., 2010).

Fourth, given that many of the analyses used only the data associated with the extreme groups, it is possible theat there was insufficient power to detect significant differences.

Finally, the way children answer questionnaires is based on their understanding of the questions (Tsaousis et al., 2012); in our case, help was offered to the participants if necessary and questions were formulated using language appropriate for seven year olds. However, it has been argued that children, adolescents, and adults may not have the same understanding of the concept of parental bonding and that their responses lead to differing factor structures to the same questionnaires (Tsaousis et al., 2012). Further exploration of the psychometric properties of the CSRI and of the use of the PBI for children, especially their validity, is warranted.

To our knowledge, no study has examined the link between BI and parental bonding variables in the context of a stress response. We questioned if an interaction between BI and parental bonding variables would be linked to the stress response and if this response would later be found to be associated with increased anxiety. Although the latter part of this hypothesis could not be tested here, our results failed to show an interaction between BI and parental bonding variables. In their review of the literature on the development and management of child and adolescent anxiety, Rapee, Schniering, & Hudson, (2009) discuss the state of the research on BI and parental bonding variables among other risk factors for anxiety disorders. They discuss the theoretical argument that parent-child interactions would be important in the development of anxiety disorders or problems. Some authors support this latter view (Kimbrel, Cobb, Mitchell, Hundt, & Nelson-Gray, 2008; Kimbrel, Mitchell, Hunt, Robertson, & Nelson-Gray, 2012; Rubin et al., 2002; Tani, Ponti, & Smorti, 2014), while others argue that the factors produce an additive effect instead of interacting with each other (Hudson et al., 2011 ab; Moore, Whaley, & Sigman, 2004; Muris, van Brakel, Arntz, & Schouten, 2011; Shamir-Essakow et al., 2005). Moderating effects of parental bonding variables on the association between BI and anxiety or internalizing problems have also been

noted (Lewis-Morrarty et al., 2012; Rubin et al., 2002; Williams et al., 2009). This moderating effect may be present for anxiety, but the current study does not support this link for the response to a stressor in a sample of healthy children. This potential relationship should nonetheless be explored further in a sample of children who display even more extreme levels of the variables in question.

Rapee, Schniering, & Hudson, (2009) and others (Barrett et al., 2005; Hudson & Rapee, 2002) comment on the difficulty in determining the direction of the association between parenting practices and childhood anxiety. For example, overprotective parenting could lead to anxiety in children, or anxiety in children can bring forth overprotective parenting. Our earlier study found that healthy children with and without a parent with an anxiety disorder did not differ in their perception of parental anxiety (Koszycki et al., 2013). However, other studies propose that parenting style may not depend on the child characteristics, but could be more a result of parents' own anxiety. For example, studies of anxious children and their siblings (Barrett et al., 2005; Hudson & Rapee, 2002) have found that parenting styles were similar between anxious children and their non-anxious siblings, with little exception. Therefore, it may not be the specific interaction per se that has an effect or influence on later SAD development.

Limitations and future directions

Our findings should be interpreted within the shortcomings of the study. First, although current assessment of the child or adolescent's perception of their own BI and of the parental bonding variables allowed for a reliable estimate of the individual's current perception free of memory biases, the child's perception can also be biased by their current functioning. For example, anxious children may report or perceive certain parenting styles due to the cognitive biases they hold. Although the children in this study were healthy

children and may not have displayed biases to the extent that would be expected in a sample of anxious children, it is possible that individual's temperament as measured by the CSRI could impact how they perceive their parent's style. Future studies should include multi-informant measures (i.e., from the child, parent, sibling, etc) as well as observational measures in order to tease apart the biases from each respondent, the extent to which everyday behaviours are reflected in behavioural observations, and the differential influence of each measure or of an integrative score combining each value. In addition, the use of only one informant (the child) for multiple measures such as the BI, the parental bonding, and subjective anxiety score may also lead to an inflation of correlations found due to the shared method variance (Campbell & Fiske, 1959; Wood et al., 2003).

Despite these limitations, the fact that no physiological differences were found even when comparing high and low levels of the risk factors should be viewed in a positive light. The participants in this study were healthy and the absence of differences between the extremes within the sample suggests that many of them may remain healthy. Nonetheless, it is critical that early risk factors continue to be identified in order to develop targeted prevention strategies given the significant personal and societal consequences associated with SAD (Acarturk et al., 2009ab; Beesdo et al., 2009; Nutt et al., 2008). Studies should include healthy individuals with and without known risk factors, as well as individuals with emerging symptoms and/or full threshold symptoms. Such designs would allow for the rigorousness of a "clean sample" with the statistical benefits of heterogeneity within samples.

In the last decade or so, psychological interventions have begun to move away from manualized evidenced-based treatment towards evidenced-based techniques and modular approaches (Chorpita, Taylor, Francis, Moffitt, & Austin, 2004; Chorpita et al., 2013; Day et al., 2011; Weisz et al., 2012). The latter is one that is child centered, uses different evidence-

based techniques, and allows for the flexibility of choosing when to use specific techniques in order to meet the clients' current needs. It would be advantageous to apply this approach to prevention strategies. Research on risk factors for SAD have highlighted a clear link between high levels of BI and later development of SAD (Broeren et al., 2014; Chronis-Tuscano et al., 2009; Clauss & Blackford, 2012; Essex et al., 2010; Hudson et al., 2011ab; Lahat et al., 2011; Muris et al., 2011; Rapee, 2014; Schwartz et al., 1999), as well as between parenting style and subsequent anxiety (Hudson & Dodd, 2012; Lewis-Morrarty et al., 2012). Other possible risk factors, such as attachment security or parental anxiety have also been identified (Essex et al., 2010; Hudson et al., 2011; Nachmiaset al., 1996; Shamir-Essakow et al., 2005). Although many children with high levels of BI or with a parent who suffers from anxiety do not go on to develop SAD, certain prevention strategies could be focused on these individuals even if the complex mechanisms or interactions are not fully understood. For example, relatively inexpensive specifically targeted prevention techniques tied to these risk factors, such as providing information or creating easily accessible curriculum-based learning, could be developed and be beneficial for all, and essential for some. This being said, disentangling the complexities and interactions of the different risk factors does remain important for the development of more targeted interventions.

GENERAL DISCUSSION

The aim of the two studies in this dissertation was to examine the subjective and physiological responses to a social stress task taking into consideration treatment options and risk factors for SAD. In the first study, the response to an acute stressor was explored in adults with SAD before and after treatment with CBGT or MBSR, while in the second study, the focus was on the stress reaction of a group of healthy children with varying levels of BI and parental bonding, variables thought to be risk factors for later SAD.

General results

In general, SAD and its risk factor, behavioural inhibition, were both associated with increased subjective anxiety levels, but no change in physiological indicators to the acute stressor were observed. One possible explanation for this finding lies in the tendency for SAD patients to display cognitive biases instead of physiological symptoms per se (Clark & McManus, 2002; Heeren, Lange, Philoppot, & Wong, 2014; Hirsch and Clark, 2004; Mauss et al., 2003). For example, individuals diagnosed with SAD have been shown to evaluate social situations as being more threatening than they actually are (Heeren et al., 2014; Hirsch and Clark, 2004).

There are many factors that may influence HPA or ANS functioning in this context. For instance, some studies have reported increased cortisol reactivity in SAD patients with a history of child abuse (Elzinga et al., 2009) or in those with increased social avoidance tendencies (Roelofs et al., 2008). Other environmental factors that have been studied in the context of BI and or anxiety, but not as they relate to the stress response, include stressful life events (Broeren et al., 2013) attachment (Shamir-Essakov et al., 2001), and maternal or paternal anxiety (Hudson et al., 2011ab). For example, Broeren et al., (2013) observed that BI and stressful life events act as additive risk factors for the development of anxiety in

children as does maternal anxiety and attachment (Hudson et al., 2011ab). It would be important to explore if the interaction of BI with these factors produces differential stress responses and how their combination relates to social anxiety.

There are significant methodological differences between designs that may explain the failure to observe consistent results across studies; these include the types of stressors used, whether naturalistic or laboratory-based ones, and the measures used, including self-report, parent-report, or observational ones (Barrett et al., 1996; Chorpita et al., 1996; Cobham et al., 1999; Chronis-Tuscano et al., 2009; Ginsburg et al., 2006; Kagan et al., 1987, 1988; Koszycki et al., 2013; Shortt et al., 2001; Wood et al., 2003). For example, a meta-analysis on the association between parenting and child anxiety found that the former accounted for only 4% of the variability in anxiety, but that this number varied significantly based on the way each variable was conceptualized and assessed (McLeod et al., 2007). In fact, whether parenting was evaluated through questionnaires, observations, or interviews influenced the degree of association between parenting and child anxiety (McLeod et al., 2007).

In both studies of this thesis, the subjective anxiety scores tracked the components of the speech task, with scores increasing in anticipation of and during the speech task and returning to baseline following the task, indicating that the speech task did provoke anxious reactions in the participants, whether healthy adults, healthy children, or adults with SAD. In contrast, no particular physiological changed were observed during the speech task. Although some studies do find similar patterns of subjective and physiological stress responses in anxious individuals (see review by Friedman, 2007), studies involving SAD have often failed to notice an association between subjective responses and physiological ones (Gerlach et al., 2003; Friedman, 2007; Mauss et al., 2003, 2004). These authors propose

that the influence of cognitions in this population may override physiological responses; for example, patients with SAD may overestimate their physiological responses.

In the second paper, parental bonding variables were found to be unrelated to both the subjective and physiological stress response, and they also failed to interact with BI to influence these responses to the social stressor. Although studies exploring the interaction between BI and parental bonding on the development of anxiety or social wariness have not yielded definitive findings (Degnan et al., 2008; Giles & Price, 2008; Hudson et al., 2011a; Kimbrel et al., 2008; 2012; Lewis-Morrarty et al., 2012; Rubin et al., 2002; Rubin et al., 1997; Williams et al., 2009), it has been suggested that maternal control moderates the relationship between BI and social reticence or anxiety (Lewis-Morrarty et al., 2012; Rubin et al., 2002; Williams et al., 2009). To our knowledge, no study has considered this interaction in the context of the physiological stress response and only a few have investigated the effects of parental bonding on the physiological response to an acute stressor (Sideridis & Kafetsios, 2008; Engert et al., 2010ab); those that have tended to rely on retrospective questionnaire data. In one study with university students asked to remember early parental bonding, perceived parental care was associated with lower stress based on heart rate during a class presentation, while perceived parental overprotection was linked to higher stress (Sideridis & Kafetsios, 2008). The awareness of parental caring, especially that of the father's, was more predictive of stress and performance than was the perception of overprotection. Therefore, measures of parental caring may be more predictive of stress and performance during public speaking than are levels of overprotection.

In study two, the absence of physiological differences could be due, in part, to its sample. It included healthy children who mostly had been exposed to an optimal parenting style and therefore the sample was restricted to a small range of scores and displayed little

variability. In fact, the extreme levels of the BI and of the parental bonding variables were likely not as pronounced as would be expected in a clinical or even subclinical population.

There are three competing hypotheses that propose how temperamental factors or individual characteristics and environmental ones interact to explain the development of psychopathology; these include the diathesis-stress model, the differential susceptibility hypothesis, and biological sensitivity to context hypotheses (Belsky & Pluess, 2009; Boyce & Ellis, 2005; Ellis et al., 2005; Ingram & Luxton, 2006). The diathesis-stress model is well known and has received substantial support in the literature (Ingram & Luxton, 2006). It suggests that individuals have varying degrees of vulnerabilities, either biological/genetic, or psychological, and that these factors interact with environmental characteristics or stressful events in varying ways to contribute to the development of psychopathology. According to this model, some types of psychopathology would develop if the individual has many vulnerability factors under minimal stress, or vice versa, that is, if an individual with limited vulnerability undergoes significant stress, while other types of psychopathology would require high levels of both vulnerabilities and stress to develop.

The diathesis-stress model does not address positive outcomes and other hypotheses were developed to take this possibility into account. The differential susceptibility (Belsky & Pluess, 2009) and the biological sensitivity to context (Boyce & Ellis, 2005; Ellis et al., 2005) hypotheses are relatively similar in that they both argue that one group of individuals would be more susceptible to the environmental influences, and would either fare best or worst depending on whether these were positive or negative, while another group, less vulnerable to context, would cope well in either type of environment. The main difference between these two hypotheses is the factor that produces the vulnerability. The differential susceptibility hypothesis suggests that the plasticity of individuals is what differs and makes

them more or less susceptible to the effects of the environment. Belsky & Pluess (2009) further argues that certain factors may be related to a person's plasticity level. They proposed temperament as one of these factors, such that those with, what they refer to as a more difficult and highly negative temperament would be more affected by their environment, whether positive or negative, and those with "easier" temperaments would fare well regardless of the context.

The biological sensitivity to context hypothesis (Boyce & Ellis, 2005; Ellis et al., 2005) argues that it is the stress response system that reacts to the vulnerabilities, instead of differences in plasticity. Individuals who are highly reactive to stress would be most susceptible to the environment, whether positive or negative, and therefore more likely to either have the best or poorest outcomes; comparatively, those less reactive to stress would cope well regardless of the environment. Although beyond the scope of our study, it is possible that our group of healthy children represent those who would manage well no matter the milieu, either because of less reactive stress responses, or less susceptibility to their environment. This would explain their lack of physiological responses to the stressor.

Summing up larger issues - Implications

There are several implications of the general findings that warrant discussion. First, as mentioned briefly above, much of the research on SAD has emphasized the informational processes involved in SAD and suggests that it may be related more to cognitive biases than physiological changes. Many recent studies have examined some of these cognitive biases among patients with SAD (Clark & McManus, 2002; Heeren et al., 2014; Hirsch and Clark, 2004; Mauss et al., 2003). In their review, Hirsch and Clark (2004) discussed the research on the possible information processing biases in individuals with SAD. Their review suggests that SAD patients tend to predict or anticipate more negative and less positive social events;

they also interpret situations more negatively, such that they will judge their own performance more harshly than others would, and they more often interpret ambiguous situations as negative. There is some evidence to suggest that individuals with SAD selectively remember the negative more than the positive information about a social situation, and they may also have more negative imagery about their performance (e.g., imagining themselves performing poorly in a social situation) (Hirsch and Clark, 2004). Given that BI is a well established risk factor for SAD, studies examining whether behaviourally inhibited individuals also display similar informational processing would be interesting. An indication of cognitive biases as an outcome measure should be included in future studies of this nature. For example, further analysis of what the participants experience as they complete the speech task, such as what thoughts are going through their mind, how they estimate their performance, how they interpret the symptoms they felt during the task, whether these thoughts change with treatment, and finally, if the rate of change differs depending on the treatment followed. Work that specifically examines the mechanisms of change in different treatments at least partly starts to address these questions.

Some recent studies (Craske et al., 2014; Kocovski et al., 2015; Niles et al., 2014) have explored possible mechanisms of change, mediators and moderators in therapies that are the same or similar to those in our first study, which had participants in either CBGT or MBSR treatment groups. Kocovski et al., (2015) examined three mechanisms of change: cognitive reappraisal, mindfulness, and acceptance, and whether these applied to both CBGT and Mindfulness and Acceptance Group Therapy (MAGT) or whether they were uniquely associated to one or the other treatment. Results indicated that cognitive reappraisal was more relevant for CBGT than for MAGT, but that mindfulness was equally relevant for participants in both treatments. Increases in acceptance were also observed in CBGT and

MAGT, but the differences between treatment modalities could not be clearly delineated. Niles et al., (2014) found that the rate of change in negative cognitions at the beginning of treatment predicted improvement for both CBT and acceptance and commitment therapy, while change in experiential avoidance at the beginning of treatment was specific to the latter.

Such a focus on specific mechanisms of change in treatments or specific risk factors for certain disorders could lead to the development of several evidenced-based techniques such as behaviour activation, cognitive restructuring, or psychoeducation as opposed to complete manualised treatment or prevention programs. Many studies have referred to the need for flexibility and fit within a treatment plan, while endorsing the need for evidenced-based treatments (Brunt, 2000; Chorpita et al., 2004, 2013; Day et al., 2011; Weisz et al., 2012). The Modular Approach to Treatment of Children with anxiety, depression, or conduct problems was developed with this goal in mind and comprises several modules that represent specific evidenced-based treatments with guidelines about the order in which they can be delivered; however, each module can be administered independently, making it possible and easy to change the order depending on the client's needs (Chorpita et al., 2004, 2013; Weisz et al., 2012). In their randomized effectiveness trial, Weisz et al., (2012) found faster improvements on measures of brief problem checklist and top problem assessment for children and adolescents with anxiety, depression, or conduct difficulties being treated with their modular approach compared to those undergoing standard treatments or usual care. Moreover, they emphasized that the modular approach addressed the need for treatments that work with individuals typically seen in clinics who often have complex needs and comorbid disorders and for clinicians who have clinically diverse caseloads. Whether the introduction

of mindfulness modules or "active agents" of other types of treatments would contribute positively to such a modular approach needs to be determined.

This type of modular approach can also be adopted in prevention strategies. For example, certain risk and protective factors may be associated with one or more disorders, in which case, prevention strategies can be developed to address them. Such techniques could be relatively inexpensive to implement and be beneficial for everyone, while serving a prevention need for others.

Methodological and conceptual issues identified in the literature are also worth addressing. Many authors have questioned whether mindfulness and acceptance based approaches are similar or different from CBT (Arch & Craske, 2008; Carey & Mansell, 2009; Hayes, 2008; Hofmann & Asmundson, 2008). The topic is somewhat controversial and will likely continue to be discussed for some time. For example, both treatments seem to refer to cognitions differently, such that the former identify private behaviours which include cognitions, while the latter describes them as thought processes. The difference also lies in the fact that acceptance and commitment therapy and other similar programs work to change cognitions, by encouraging their acceptance, while CBT aims to alter their content (Hoffman & Asmundson, 2008). Some suggest that this attention placed on the content of cognitions increases the potential for rumination or inadvertently teaches individuals to suppress thoughts (Arch & Craske, 2008; Hayes, 2008; Roemer & Orsillo, 2003).

Some authors also present differences in the way each of these treatments relate to emotions, suggesting that acceptance and mindfulness-based approaches focus on acceptance, or counteracting a maladaptive response such as thought suppression (Arch & Craske, 2008; Hofman & Asmundson, 2008), while CBT aims to increase predictability and control, and is an approach that is centered on adaptive responses to antecedents or triggers

(Arch & Craske, 2008; Hofman & Asmundson, 2008). Finally, most authors agree that the philosophical foundations of both types of treatment are different and suggest distinctions in terms of treatment outcomes as being symptom reduction for CBT and valued living for acceptance and commitment therapy (Arch & Craske, 2008; Hayes, 2008; Hoffman & Asmundson, 2008).

It has also been suggested that there are a number of similar processes embedded in both types of treatments. For example, Arch & Craske (2008) argue that CBT may include some aspects of acceptance, while acceptance may incorporate certain aspects of predictability and control. Moreover, they also suggest that exposure hierarchies likely encompass some value-based behaviours given that participants choose their hierarchy based on what is important to them or causes them the most distress (Arch & Craske, 2008). In his commentary to Arch & Craske, (2008) about the claims that acceptance and commitment therapy may not be so different from CBT, Hayes (2008) discusses the tendency for proponents of a well established dominant theory to view newer concepts within the lens of their older more established theory. In fact, Hayes (2008) argues that the newer concept, in this case, acceptance and commitment therapy, is evaluated within a framework that includes the purposes, assumptions, and assessments of the older paradigm, CBT, instead of fully comprehending the fine distinctions of the newer approach.

Limitations and future directions

Bringing to light the shortcomings within research guides the interpretations that can be made from specific studies, and draws attention to promising future directions. First, both studies in this dissertation, to varying degrees, lacked appropriate control or comparison groups. Although the first study included healthy control volunteers, this group only completed the speech task once; therefore, the impact of the repetition of the task could not

be assessed. However, the relatively long interval (12 weeks) between the two speech tasks completed by the treatment groups likely diminished a practice effect, if any. Relatively few researchers have examined the effects of repeated stress tasks (Engert et al., 2010; Gerra et al., 2001; Kirschbaum et al., 1995; Schommer et al., 2003). Their studies have revealed that some but not all individuals do begin to habituate to the stress task based on physiological indices. Schommer et al., (2003) found that measures of the HPA axis functioning habituated relatively quickly, while the SNS response was mostly stable throughout the trials. Moreover, repetition of the speech task in these studies was relatively close together, including five exposures in five days, two exposures in eight days, and three exposures in four weeks. It is unknown whether similar habituation would be noted in a longer interval such as the one in our study. It would have also been useful to include a patient control group with no treatment or a waitlist control group to assess the extent to which subjective and physiological responses would have changed after approximately 12 weeks without treatment in this population.

In the second study, the participants were all healthy children who were divided into high or low BI and parental bonding variables. A comparison with individuals who had began to display signs of anxiety or who had more extreme levels of BI, parental overprotection, or parental care than that represented in our sample would have allowed for greater variability and increased the possibility of detecting significant differences.

Second, no follow-up data were included in either of the studies. Although the effects of treatment on different outcomes immediately following an intervention is important, it is also essential to assess whether the improvements are long-lasting, and remain even after treatment is discontinued. Evidence for the long-term effects of CBGT has been reported (Acarturk et al., 2009; Butler et al., 2006; Fedoroff & Taylor, 2001; Taylor, 1996), although

not all individuals maintain their gains at follow-up. Research on the durability of the effects of mindfulness-based techniques have been limited (Brown, Ryan & Creswell, 2007; Fjorback et al., 2011); however, in his review of the literature, Baer (2003) indicated that a large number of individuals who have undergone mindfulness-based intervention continue to practice mindfulness techniques after the end of the program. Future studies should explore whether the benefits observed with mindfulness techniques are long-lasting, whether it be effects on the symptoms, the stress response, quality of life, cognitive biases, or others. Longitudinal or follow-up studies are also quite informative when exploring child and adolescent development and potential risk factors for certain disorders. Note that the healthy children reported in this dissertation are currently being followed and their data intended for analysis as part of future studies.

The physiological stress response has been widely studied in many populations and the different factors that affect its response and rhythmicity have been identified. These include menstrual cycle, exercise, education, certain foods, smoking, alcohol and caffeine to name a few (Fiocco, Joober, & Lupien, 2007; Kirschbaum et al., 1999; Kudielka, Gierens, Hellhammer, Wust, & Schlotz, 2012). In our studies, some instructions were provided to participants in an attempt to eliminate or minimize the effects of certain factors; however, there was no formal monitoring of compliance to instructions on the day of the laboratory session, and some of the factors mentioned above were not considered. For example, information was not collected on women's menstrual cycle and no instructions were given regarding exercise. Studies that measure cortisol stress reactions should explore such variables and the extent to which they influence cortisol concentrations and patterns, perhaps leading towards a more standardized collection method in order to reduce any potential confounding variables.

Longitudinal research on different risk factors related to SAD in an attempt to understand their relationship and further the development of models and hypotheses about these risk factors would be important. These studies should, as much as possible, include multi-informant and multi-modal measurement. The possibility of an integrative score of these measures, either for BI or parental bonding, should be investigated. Further exploration of additional factors that can influence treatment or selection of treatment, and/or impact effects of BI and parental bonding variables is also warranted and could help target intervention and prevention methods or techniques. Given the high incidence of SAD and its associated personal, societal, and economic burdens, continued efforts towards an understanding of the complexities of its risk factors and their interactions and finding evidenced-based treatments is crucial.

REFERENCES

Acarturk, C., Cuijpers, P., van Straten, A., & de Graaf, R. (2009). Psychological treatment of social anxiety disorder: A meta-analysis. *Psychological Medicine, 39*(2), 241-254. doi:10.1017/S0033291708003590

Acarturk, C., de Graaf, R., van Straten, A., Have, M. T., & Cuijpers, P. (2008). Social phobia and number of social fears, and their association with comorbidity, health-related quality of life and help seeking: A population-based study. *Social Psychiatry and Psychiatric Epidemiology, 43*(4), 273-279. doi:10.1007/s00127-008-0309-1

Acarturk, C., Smit, F., de Graaf, R., van Straten, A., Ten Have, M., & Cuijpers, P. (2009). Economic costs of social phobia: A population-based study. *Journal of Affective Disorders, 115*(3), 421-429. doi:10.1016/j.jad.2008.10.008

Acarturk, C., Smit, F., de Graaf, R., van Straten, A., ten Have, M., & Cuijpers, P. (2009). Incidence of social phobia and identification of its risk indicators: A model for prevention. *Acta Psychiatrica Scandinavica, 119*(1), 62-70. doi:10.1111/j.1600-0447.2008.01275.x

Adam, E. K., & Gunnar, M. R. (2001). Relationship functioning and home and work demands predict individual differences in diurnal cortisol patterns in women. *Psychoneuroendocrinology, 26*(2), 189-208.

Aderka, I. M. (2009). Factors affecting treatment efficacy in social phobia: The use of video feedback and individual vs. group formats. *Journal of Anxiety Disorders, 23*(1), 12-17. doi:10.1016/j.janxdis.2008.05.003

Akselrod, S., Gordon, D., Ubel, F. A., Shannon, D. C., Berger, A. C., & Cohen, R. J. (1981). Power spectrum analysis of heart rate fluctuation: A quantitative probe of beat-to-beat cardiovascular control. *Science, 213*(4504), 220-222.

Allen, A. P., Kennedy, P. J., Cryan, J. F., Dinan, T. G., & Clarke, G. (2014). Biological and psychological markers of stress in humans: Focus on the trier social stress test. *Neuroscience and Biobehavioral Reviews, 38*, 94-124. doi:10.1016/j.neubiorev.2013.11.005; 10.1016/j.neubiorev.2013.11.005

Alnaes, R., & Torgersen, S. (1990). Parental representation in patients with major depression, anxiety disorder and mixed conditions. *Acta Psychiatrica Scandinavica, 81*(6), 518-522.

Angst, J., & Vollrath, M. (1991). The natural history of anxiety disorders. *Acta Psychiatrica Scandinavica, 84*(5), 446-452.

Antoni, M. H., Cruess, D. G., Klimas, N., Carrico, A. W., Maher, K., Cruess, S., . . . Schneiderman, N. (2005). Increases in a marker of immune system reconstitution are predated by decreases in 24-h urinary cortisol output and depressed mood during a 10-week stress management intervention in symptomatic HIV-infected men. *Journal of Psychosomatic Research, 58*(1), 3-13. doi:10.1016/j.jpsychores.2004.05.010

Antoni, M. H., Lechner, S., Diaz, A., Vargas, S., Holley, H., Phillips, K., . . . Blomberg, B. (2009). Cognitive behavioral stress management effects on psychosocial and physiological adaptation in women undergoing treatment for breast cancer. *Brain, Behavior, and Immunity, 23*(5), 580-591. doi:10.1016/j.bbi.2008.09.005; 10.1016/j.bbi.2008.09.005

APA. (2000). *Diagnostic and Statistical Manual of Mental Disorders (4th Ed.- Text Revision).Xxvii, 943 Pp. Arlington, VA, US: American Psychiatric Publishing, Inc.; US.*

Arch, J. J., & Craske, M. G. (2006). Mechanisms of mindfulness: Emotion regulation following a focused breathing induction. *Behaviour Research and Therapy, 44*(12), 1849-1858. doi:10.1016/j.brat.2005.12.007

Arch, J. J., & Craske, M. G. (2008). Acceptance and commitment therapy and cognitive behavioral therapy for anxiety disorders: Different treatments, similar mechanisms? *Clinical Psychology: Science and Practice, 15*(4), 263-279.

Arch, J. J., & Craske, M. G. (2010). Laboratory stressors in clinically anxious and non-anxious individuals: The moderating role of mindfulness. *Behaviour Research and Therapy, 48*(6), 495-505. doi:10.1016/j.brat.2010.02.005; 10.1016/j.brat.2010.02.005

Argyropoulos, S. V., Hood, S. D., Adrover, M., Bell, C. J., Rich, A. S., Nash, J. R., . . . Nutt, D. J. (2004). Tryptophan depletion reverses the therapeutic effect of selective serotonin reuptake inhibitors in social anxiety disorder. *Biological Psychiatry, 56*(7), 503-509. doi:10.1016/j.biopsych.2004.07.006

Arrindell, W. A., Emmelkamp, P. M., Monsma, A., & Brilman, E. (1983). The role of perceived parental rearing practices in the aetiology of phobic disorders: A controlled study. *The British Journal of Psychiatry : The Journal of Mental Science, 143*, 183-187.

Arrindell, W. A., Kwee, M. G., Methorst, G. J., van der Ende, J., Pol, E., & Moritz, B. J. (1989). Perceived parental rearing styles of agoraphobic and socially phobic in-patients. *The British Journal of Psychiatry : The Journal of Mental Science, 155*, 526-535.

Ashbaugh, A., Antony, M. M., Liss, A., Summerfeldt, L. J., McCabe, R. E., & Swinson, R. P. (2007). Changes in perfectionism following cognitive-behavioral treatment for social phobia. *Depression and Anxiety, 24*(3), 169-177. doi:10.1002/da.20219

Asmundson, G. J., & Stein, M. B. (1994). Vagal attenuation in panic disorder: An assessment of parasympathetic nervous system function and subjective reactivity to respiratory manipulations. *Psychosomatic Medicine, 56*(3), 187-193.

Baer, R. A., Smith, G. T., & Allen, K. B. (2004). Assessment of mindfulness by self-report: The kentucky inventory of mindfulness skills. *Assessment, 11*(3), 191-206. doi:10.1177/1073191104268029

Baer, R. A., Smith, G. T., Hopkins, J., Krietemeyer, J., & Toney, L. (2006). Using self-report assessment methods to explore facets of mindfulness. *Assessment, 13*(1), 27-45. doi:10.1177/1073191105283504

Baer, R. A. (2003). Mindfulness training as a clinical intervention: A conceptual and empirical review. *Clinical Psychology: Science and Practice, 10*(2), 125-143.

Barnes, S., Brown, K. W., Krusemark, E., Campbell, W. K., & Rogge, R. D. (2007). The role of mindfulness in romantic relationship satisfaction and responses to relationship stress. *Journal of Marital and Family Therapy, 33*(4), 482-500. doi:10.1111/j.1752-0606.2007.00033.x

Barrett, P. M., Fox, T., & Farrell, L. J. (2005). Parent-child interactions with anxious children and with their siblings: An observational study. *Behaviour Change, 22*(4), 220-235.

Barrett, P. M., Rapee, R. M., Dadds, M. M., & Ryan, S. M. (1996). Family enhancement of cognitive style in anxious and aggressive children. *Journal of Abnormal Child Psychology, 24*(2), 187-203.

Baumeister, R. F., & Tice, D. M. (1990). Anxiety and social exclusion. *Journal of Social and Clinical Psychology, 9*(2), 165-195.

Bazhenova, O. V., & Porges, S. W. (1997). Vagal reactivity and affective adjustment in infants. convergent response systems. *Annals of the New York Academy of Sciences, 807*, 469-471.

Beaton, E. A., Schmidt, L. A., Ashbaugh, A. R., Santesso, D. L., Antony, M. M.,. . . Schulkin, J. (2006). Low salivary cortisol levels among socially anxious young adults: Preliminary evidence from a selected and a non-selected sample. *Personality and Individual Differences, 41*(7), 1217-1228.

Beck A. T., & Emery G. (1985). *Anxiety disorders and phobias: a cognitive perspective*. New York: Basic Books.

Beesdo, K., Knappe, S., & Pine, D. S. (2009). Anxiety and anxiety disorders in children and adolescents: Developmental issues and implications for DSM-V. *The Psychiatric Clinics of North America, 32*(3), 483-524. doi:10.1016/j.psc.2009.06.002; 10.1016/j.psc.2009.06.002

Beesdo, K., Pine, D. S., Lieb, R., & Wittchen, H. U. (2010). Incidence and risk patterns of anxiety and depressive disorders and categorization of generalized anxiety disorder. *Archives of General Psychiatry, 67*(1), 47-57. doi:10.1001/archgenpsychiatry.2009.177; 10.1001/archgenpsychiatry.2009.177

Belsky, J., & Pluess, M. (2009). Beyond diathesis stress: Differential susceptibility to environmental influences. *Psychological Bulletin, 135*(6), 885-908. doi:10.1037/a0017376; 10.1037/a0017376

Berger, M., Bossert, S., Krieg, J. C., Dirlich, G., Ettmeier, W., Schreiber, W., & von Zerssen, D. (1987). Interindividual differences in the susceptibility of the cortisol system: An important factor for the degree of hypercortisolism in stress situations? *Biological Psychiatry, 22*(11), 1327-1339.

Bilodeau, C., Bradwejn, J., & Koszycki, D. (2014). Impaired facial affect perception in unaffected children at familial risk for panic disorder. *Child Psychiatry and Human Development,* doi:10.1007/s10578-014-0513-z

Bishop, S. R. (2002). What do we really know about mindfulness-based stress reduction? *Psychosomatic Medicine, 64*(1), 71-83.

Bittner, A., Egger, H. L., Erkanli, A., Jane Costello, E., Foley, D. L., & Angold, A. (2007). What do childhood anxiety disorders predict? *Journal of Child Psychology and Psychiatry, and Allied Disciplines, 48*(12), 1174-1183. doi:10.1111/j.1469-7610.2007.01812.x

Blanco, C., Heimberg, R. G., Schneier, F. R., Fresco, D. M., Chen, H., Turk, C. L., . . . Liebowitz, M. R. (2010). A placebo-controlled trial of phenelzine, cognitive behavioral group therapy, and their combination for social anxiety disorder. *Archives of General Psychiatry, 67*(3), 286-295. doi:10.1001/archgenpsychiatry.2010.11

Blomhoff, S., Haug, T. T., Hellstrom, K., Holme, I., Humble, M., Madsbu, H. P., & Wold, J. E. (2001). Randomised controlled general practice trial of sertraline, exposure therapy and combined treatment in generalised social phobia. *The British Journal of Psychiatry : The Journal of Mental Science, 179*, 23-30.

Bogels, S. M., Sijbers, G. F., & Voncken, M. (2006). Mindfulness and task concentration training for social phobia: A pilot study. *Journal of Cognitive Psychotherapy, 20*(1), 33-44.

Bogels, S. M., & van Melick, M. (2004). The relationship between child-report, parent self-report, and partner report of perceived parental rearing behaviors and anxiety in children and parents. *Personality and Individual Differences, 37*(8), 1583-1596. doi:http://dx.doi.org/10.1016/j.paid.2004.02.014

Bouton, M. E. (2002). Context, ambiguity, and unlearning: Sources of relapse after behavioral extinction. *Biological Psychiatry, 52*(10), 976-986.

Bower, J. E., Ganz, P. A., & Aziz, N. (2005). Altered cortisol response to psychologic stress in breast cancer survivors with persistent fatigue. *Psychosomatic Medicine, 67*(2), 277-280. doi:10.1097/01.psy.0000155666.55034.c6

Bower, J. E., Ganz, P. A., Dickerson, S. S., Petersen, L., Aziz, N., & Fahey, J. L. (2005). Diurnal cortisol rhythm and fatigue in breast cancer survivors. *Psychoneuroendocrinology, 30*(1), 92-100. doi:10.1016/j.psyneuen.2004.06.003

Boyce, W. T., & Ellis, B. J. (2005). Biological sensitivity to context: I. an evolutionary-developmental theory of the origins and functions of stress reactivity. *Development and Psychopathology, 17*(2), 271-301.

Braarud, H. C., & Stormark, K. M. (2006). Maternal soothing and infant stress responses: Soothing, crying and adrenocortical activity during inoculation. *Infant Behavior & Development, 29*(1), 70-79. doi:10.1016/j.infbeh.2005.08.008

Brand, S., Annen, H., Holsboer-Trachsler, E., & Blaser, A. (2011). Intensive two-day cognitive-behavioral intervention decreases cortisol secretion in soldiers suffering from specific phobia to wear protective mask. *Journal of Psychiatric Research, 45*(10), 1337-1345. doi:10.1016/j.jpsychires.2011.04.010; 10.1016/j.jpsychires.2011.04.010

Brewer, J. A., Sinha, R., Chen, J. A., Michalsen, R. N., Babuscio, T. A., Nich, C., . . . Rounsaville, B. J. (2009). Mindfulness training and stress reactivity in substance abuse: Results from a randomized, controlled stage I pilot study. *Substance Abuse : Official Publication of the Association for Medical Education and Research in Substance Abuse, 30*(4), 306-317. doi:10.1080/08897070903250241; 10.1080/08897070903250241

Broeren, S., Muris, P., Diamantopoulou, S., & Baker, J. R. (2013). The course of childhood anxiety symptoms: Developmental trajectories and child-related factors in normal children. *Journal of Abnormal Child Psychology, 41*(1), 81-95. doi:10.1007/s10802-012-9669-9 [doi]

Broeren, S., Newall, C., Dodd, H. F., Locker, R., & Hudson, J. L. (2014). Longitudinal investigation of the role of temperament and stressful life events in childhood anxiety. *Development and Psychopathology, 26*(2), 437-449. doi:10.1017/S0954579413000989 [doi]

Brown, K. W., & Ryan, R. M. (2003). The benefits of being present: Mindfulness and its role in psychological well-being. *Journal of Personality and Social Psychology, 84*(4), 822-848.

Brown, K. W., Ryan, R. M., & Creswell, J. D. (2007). Mindfulness: Theoretical foundations and evidence for its salutary effects. *Psychological Inquiry, 18*(4), 211-237.

Bruce, S. E., Yonkers, K. A., Otto, M. W., Eisen, J. L., Weisberg, R. B., Pagano, M., . . . Keller, M. B. (2005). Influence of psychiatric comorbidity on recovery and recurrence in generalized anxiety disorder, social phobia, and panic disorder: A 12-year prospective study. *The American Journal of Psychiatry, 162*(6), 1179-1187. doi:10.1176/appi.ajp.162.6.1179

Buckner, J. D., & Schmidt, N. B. (2009). A randomized pilot study of motivation enhancement therapy to increase utilization of cognitive-behavioral therapy for social anxiety. *Behaviour Research and Therapy, 47*(8), 710-715. doi:10.1016/j.brat.2009.04.009

Burg, J. M., Wolf, O. T., & Michalak, J. (2012). Mindfulness as self-regulated attention: Associations with heart rate variability. *Swiss Journal of Psychology, 71*(3), 135-139.

Buske-Kirschbaum, A., Geiben, A., Hollig, H., Morschhauser, E., & Hellhammer, D. (2002). Altered responsiveness of the hypothalamus-pituitary-adrenal axis and the sympathetic adrenomedullary system to stress in patients with atopic dermatitis. *The Journal of Clinical Endocrinology and Metabolism, 87*(9), 4245-4251.

Buss, K. A., Davidson, R. J., Kalin, N. H., & Goldsmith, H. H. (2004). Context-specific freezing and associated physiological reactivity as a dysregulated fear response. *Developmental Psychology, 40*(4), 583-594. doi:10.1037/0012-1649.40.4.583 [doi]

Butler, A. C., Chapman, J. E., Forman, E. M., & Beck, A. T. (2006). The empirical status of cognitive-behavioral therapy: A review of meta-analyses. *Clinical Psychology Review, 26*(1), 17-31. doi:10.1016/j.cpr.2005.07.003

Calkins, S. D., Fox, N. A., & Marshall, T. R. (1996). Behavioral and physiological antecedents of inhibited and uninhibited behavior. *Child Development, 67*(2), 523-540.

Camart, N., Andre, C., Trybou, V., & Bourdel, M. C. (2006). Évaluation des effets à court terme d'une thérapie cognitivo-comportermentale de groupe dans la phobie sociale: Résultats auprès de soixante patients. *L'Encephale: Revue de Psychiatrie Clinique, Biologique et Thérapeutique, 36* (6, Pt 1), 1011-1018.

Campbell, D. T., & Fiske, D. W. (1959). Convergent and discriminant validation by the multitrait-multimethod matrix. *Psychological Bulletin, 56*(2), 81-105.

Canetti L. & Bachar E. (1997). Parental bonding and mental health in adolescence. *Adolescence 32* (126), 381–394.

Canino, G., Shrout, P. E., Rubio-Stipec, M., Bird, H. R., Bravo, M., Ramirez, R., . . . Martinez-Taboas, A. (2004). The DSM-IV rates of child and adolescent disorders in puerto rico: Prevalence, correlates, service use, and the effects of impairment. *Archives of General Psychiatry, 61*(1), 85-93. doi:10.1001/archpsyc.61.1.85

Cardaciotto, L., Herbert, J. D., Forman, E. M., Moitra, E., & Farrow, V. (2008). The assessment of present-moment awareness and acceptance: The philadelphia mindfulness scale. *Assessment, 15*(2), 204-223. doi:10.1177/1073191107311467

Carey, T. A., & Mansell, W. (2009). Show us a behaviour without a cognition and we'll show you a rock rolling down a hill. *Cognitive Behaviour Therapist, 2*(3), 123-133.

Carlson, L. E., Speca, M., Faris, P., & Patel, K. D. (2007). One year pre-post intervention follow-up of psychological, immune, endocrine and blood pressure outcomes of mindfulness-based stress reduction (MBSR) in breast and prostate cancer outpatients. *Brain, Behavior, and Immunity, 21*(8), 1038-1049. doi:10.1016/j.bbi.2007.04.002

Cartwright-Hatton, S., McNicol, K., & Doubleday, E. (2006). Anxiety in a neglected population: Prevalence of anxiety disorders in pre-adolescent children. *Clinical Psychology Review, 26*(7), 817-833. doi:10.1016/j.cpr.2005.12.002

Chartier, M. J., Walker, J. R., & Stein, M. B. (2003). Considering comorbidity in social phobia. *Social Psychiatry and Psychiatric Epidemiology, 38*(12), 728-734. doi:10.1007/s00127-003-0720-6

Chartrand, H., Cox, B., ElGabalawy, R., & Clara, I. (2011). Social anxiety disorder subtypes and their mental health correlates in a nationally representative canadian sample. *Canadian Journal of Behavioural Science/Revue Canadienne Des Sciences Du Comportement, 43*(2), 89-98.

Chiesa, A., & Serretti, A. (2010). A systematic review of neurobiological and clinical features of mindfulness meditations. *Psychological Medicine, 40*(8), 1239-1252. doi:10.1017/S0033291709991747

Cho, Y., & Telch, M. J. (2005). Testing the cognitive content-specificity hypothesis of social anxiety and depression: An application of structural equation modeling. *Cognitive Therapy and Research, 29*(4), 399-416.

Chorpita, B. F., Albano, A. M., & Barlow, D. H. (1996). Cognitive processing in children: Relation to anxiety and family influences. *Journal of Clinical Child Psychology, 25*(2), 170-176. doi:http://dx.doi.org/10.1207/s15374424jccp2502_5

Chorpita, B. F., Taylor, A. A., Francis, S. E., Moffitt, C., & Austin, A. A. (2004). Efficacy of modular cognitive behavior therapy for childhood anxiety disorders. *Behavior Therapy, 35*(2), 263-287. doi:http://dx.doi.org/10.1016/S0005-7894%2804%2980039-X

Chorpita, B. F., Weisz, J. R., Daleiden, E. L., Schoenwald, S. K., Palinkas, L. A., Miranda, J., . . . Research Network on Youth Mental Health. (2013). Long-term outcomes for the child STEPs randomized effectiveness trial: A comparison of modular and standard treatment designs with usual care. *Journal of Consulting and Clinical Psychology, 81*(6), 999-1009. doi:10.1037/a0034200 [doi]

Chronis-Tuscano, A., Degnan, K. A., Pine, D. S., Perez-Edgar, K., Henderson, H. A., Diaz, Y., . . . Fox, N. A. (2009). Stable early maternal report of behavioral inhibition predicts lifetime social anxiety disorder in adolescence. *Journal of the American Academy of Child and Adolescent Psychiatry, 48*(9), 928-935. doi:10.1097/CHI.0b013e3181ae09df; 10.1097/CHI.0b013e3181ae09df

Clark, D. B., & Agras, W. S. (1991). The assessment and treatment of performance anxiety in musicians. *The American Journal of Psychiatry, 148*(5), 598-605.

Clark, D. M., Ehlers, A., McManus, F., Hackmann, A., Fennell, M., Campbell, H., . . . Louis, B. (2003). Cognitive therapy versus fluoxetine in generalized social phobia: A randomized placebo-controlled trial. *Journal of Consulting and Clinical Psychology, 71*(6), 1058-1067. doi:10.1037/0022-006X.71.6.1058

Clark, D. M., & McManus, F. (2002). Information processing in social phobia. *Biological Psychiatry, 51*(1), 92-100.

Clauss, J. A., & Blackford, J. U. (2012). Behavioral inhibition and risk for developing social anxiety disorder: A meta-analytic study. *Journal of the American Academy of Child and Adolescent Psychiatry, 51*(10), 1066-1075.e1. doi:10.1016/j.jaac.2012.08.002; 10.1016/j.jaac.2012.08.002

Clow, A., Thorn, L., Evans, P., & Hucklebridge, F. (2004). The awakening cortisol response: Methodological issues and significance. *Stress (Amsterdam, Netherlands), 7*(1), 29-37. doi:10.1080/10253890410001667205

Cobham, V. E., Dadds, M. R., & Spence, S. H. (1999). Anxious children and their parents: What do they expect? *Journal of Clinical Child Psychology, 28*(2), 220-231. doi:10.1207/s15374424jccp2802_9 [doi]

Condren, R. M., O'Neill, A., Ryan, M. C., Barrett, P., & Thakore, J. H. (2002). HPA axis response to a psychological stressor in generalised social phobia. *Psychoneuroendocrinology, 27*(6), 693-703.

Coryell, W. (1997). Hypersensitivity to carbon dioxide as a disease-specific trait marker. *Biological Psychiatry, 41*(3), 259-263.

Coryell, W., Pine, D., Fyer, A., & Klein, D. (2006). Anxiety responses to CO2 inhalation in subjects at high-risk for panic disorder. *Journal of Affective Disorders, 92*(1), 63-70. doi:10.1016/j.jad.2005.12.045

Costello, E. J., Egger, H. L., & Angold, A. (2005). The developmental epidemiology of anxiety disorders: Phenomenology, prevalence, and comorbidity. *Child and Adolescent Psychiatric Clinics of North America, 14*(4), 631-48, vii. doi:10.1016/j.chc.2005.06.003

Costello, E. J., Mustillo, S., Erkanli, A., Keeler, G., & Angold, A. (2003). Prevalence and development of psychiatric disorders in childhood and adolescence. *Archives of General Psychiatry, 60*(8), 837-844. doi:10.1001/archpsyc.60.8.837

Couture-Lalande, M.-E., Lebel, S., & Bielajew, C. (2014). Analysis of the cortisol diurnal rhythmicity and cortisol reactivity in long-term breast cancer survivors. *Breast Cancer Management, 3*(6), 465-476.

Cox, B. J., Walker, J. R., Enns, M. W., & Karpinski, D. C. (2002). Self-criticism in generalized social phobia and response to cognitive-behavioral treatment. *Behavior Therapy, 33*(4), 479-491.

Cox, B. J., MacPherson, P. S., & Enns, M. W. (2005). Psychiatric correlates of childhood shyness in a nationally representative sample. *Behaviour Research and Therapy, 43*(8), 1019-1027. doi:S0005-7967(04)00179-2 [pii]

Cox, J. L., Connor, Y. M., Henderson, I., McGuire, R. J., & Kendell, R. E. (1983). Prospective study of the psychiatric disorders of childbirth by self report questionnaire. *Journal of Affective Disorders, 5*(1), 1-7.

Craske et al., (2014). Randomized controlled trial of cognitive behavioral therapy and acceptance and commitment therapy for social phobia: Outcomes and moderators. *Journal of Consulting and Clinical Psychology, 82*(6), 1034-1048. doi:10.1037/a0037212 [doi]

Dadds, M. R., Barrett, P. M., Rapee, R. M., & Ryan, S. (1996). Family process and child anxiety and aggression: An observational analysis. *Journal of Abnormal Child Psychology, 24*(6), 715-734.

Damer, D. E., Latimer, K. M., & Porter, S. H. (2010). "Build your social confidence": A social anxiety group for college students. *Journal for Specialists in Group Work, 35*(1), 7-22.

Davidson, J. R., Foa, E. B., Huppert, J. D., Keefe, F. J., Franklin, M. E., Compton, J. S., . . . Gadde, K. M. (2004). Fluoxetine, comprehensive cognitive behavioral therapy, and placebo in generalized social phobia. *Archives of General Psychiatry, 61*(10), 1005-1013. doi:10.1001/archpsyc.61.10.1005

Davidson, J. R., Hughes, D. L., George, L. K., & Blazer, D. G. (1993). The epidemiology of social phobia: Findings from the duke epidemiological catchment area study. *Psychological Medicine, 23*(3), 709-718.

Day, C., Kowalenko, S., Ellis, M., Dawe, S., Harnett, P., & Scott, S. (2011). The helping families programme: A new parenting intervention for children with severe and persistent conduct problems. *Child and Adolescent Mental Health, 16*(3), 167-171. doi:http://dx.doi.org/10.1111/j.1475-3588.2010.00588.x

de Boer, A. G., van Lanschot, J. J., Stalmeier, P. F., van Sandick, J. W., Hulscher, J. B., de Haes, J. C., & Sprangers, M. A. (2004). Is a single-item visual analogue scale as valid, reliable and responsive as multi-item scales in measuring quality of life? *Quality of Life Research : An International Journal of Quality of Life Aspects of Treatment, Care and Rehabilitation, 13*(2), 311-320.

de Haan, M., Gunnar, M. R., Tout, K., Hart, J., & Stansbury, K. (1998). Familiar and novel contexts yield different associations between cortisol and behavior among 2-year-old children. *Developmental Psychobiology, 33*(1), 93-101.

de Wilde, A., & Rapee, R. M. (2008). Do controlling maternal behaviours increase state anxiety in children's responses to a social threat? A pilot study. *Journal of Behavior Therapy and Experimental Psychiatry, 39*(4), 526-537. doi:10.1016/j.jbtep.2007.10.011 [doi]

Degnan, K. A., Almas, A. N., & Fox, N. A. (2010). Temperament and the environment in the etiology of childhood anxiety. *Journal of Child Psychology and Psychiatry, and Allied Disciplines, 51*(4), 497-517. doi:10.1111/j.1469-7610.2010.02228.x; 10.1111/j.1469-7610.2010.02228.x

Degnan, K. A., Henderson, H. A., Fox, N. A., & Rubin, K. H. (2008). Predicting social wariness in middle childhood: The moderating roles of child care history, maternal personality and maternal behavior. *Social Development (Oxford, England), 17*(3), 471-487. doi:10.1111/j.1467-9507.2007.00437.x [doi]

Dumas, J. E., LaFreniere, P. J., & Serketich, W. J. (1995). "Balance of power": A transactional analysis of control in mother-child dyads involving socially competent, aggressive, and anxious children. *Journal of Abnormal Psychology, 104*(1), 104-113.

Edelmann, R. J., & Baker, S. R. (2002). Self-reported and actual physiological responses in social phobia. *The British Journal of Clinical Psychology / the British Psychological Society, 41*(Pt 1), 1-14.

Edwards, S. L., Rapee, R. M., & Kennedy, S. (2010). Prediction of anxiety symptoms in preschool-aged children: Examination of maternal and paternal perspectives. *Journal of Child Psychology and Psychiatry, and Allied Disciplines, 51*(3), 313-321. doi:10.1111/j.1469-7610.2009.02160.x; 10.1111/j.1469-7610.2009.02160.x

Ellis, B. J., Essex, M. J., & Boyce, W. T. (2005). Biological sensitivity to context: II. empirical explorations of an evolutionary-developmental theory. *Development and Psychopathology, 17*(2), 303-328.

Elzinga, B. M., Spinhoven, P., Berretty, E., de Jong, P., & Roelofs, K. (2010). The role of childhood abuse in HPA-axis reactivity in social anxiety disorder: A pilot study. *Biological Psychology, 83*(1), 1-6. doi:10.1016/j.biopsycho.2009.09.006; 10.1016/j.biopsycho.2009.09.006

Engert, V., Buss, C., Khalili-Mahani, N., Wadiwalla, M., Dedovic, K., & Pruessner, J. C. (2010). Investigating the association between early life parental care and stress responsivity in adulthood. *Developmental Neuropsychology, 35*(5), 570-581. doi:10.1080/87565641.2010.494752 [doi]

Engert, V., Efanov, S. I., Dedovic, K., Duchesne, A., Dagher, A., & Pruessner, J. C. (2010). Perceived early-life maternal care and the cortisol response to repeated psychosocial stress. *Journal of Psychiatry & Neuroscience : JPN, 35*(6), 370-377. doi:10.1503/jpn.100022 [doi]

Enns, M. W., Cox, B. J., & Clara, I. (2002). Parental bonding and adult psychopathology: Results from the US national comorbidity survey. *Psychological Medicine, 32*(6), 997-1008.

Erisman, S. M., & Roemer, L. (2012). A preliminary investigation of the process of mindfulness. *Mindfulness, 3*(1), 30-43.

Erwin, B. A., Heimberg, R. G., Juster, H., & Mindlin, M. (2002). Comorbid anxiety and mood disorders among persons with social anxiety disorder. *Behaviour Research and Therapy, 40*(1), 19-35.

Eskildsen, A., Hougaard, E., & Rosenberg, N. K. (2010). Pre-treatment patient variables as predictors of drop-out and treatment outcome in cognitive behavioural therapy for social phobia: A systematic review. *Nordic Journal of Psychiatry, 64*(2), 94-105. doi:10.3109/08039480903426929

Essau, C. A., Sasagawa, S., Chen, J., & Sakano, Y. (2012). Taijin kyofusho and social phobia symptoms in young adults in england and in japan. *Journal of Cross-Cultural Psychology, 43*(2), 219-232. doi:http://dx.doi.org/10.1177/0022022110386372

Essex, M. J., Klein, M. H., Slattery, M. J., Goldsmith, H. H., & Kalin, N. H. (2010). Early risk factors and developmental pathways to chronic high inhibition and social anxiety disorder in adolescence. *The American Journal of Psychiatry, 167*(1), 40-46. doi:10.1176/appi.ajp.2009.07010051 [doi]

Facchinetti, F., Tarabusi, M., & Volpe, A. (2004). Cognitive-behavioral treatment decreases cardiovascular and neuroendocrine reaction to stress in women waiting for assisted reproduction. *Psychoneuroendocrinology, 29*(2), 162-173.

Falk Dahl, C. A., & Dahl, A. A. (2010). Lifestyle and social network in individuals with high level of social phobia/anxiety symptoms: A community-based study. *Social Psychiatry and Psychiatric Epidemiology, 45*(3), 309-317. doi:10.1007/s00127-009-0069-6

Fedoroff, I. C., & Taylor, S. (2001). Psychological and pharmacological treatments of social phobia: A meta-analysis. *Journal of Clinical Psychopharmacology, 21*(3), 311-324.

Feldman, G., Hayes, A., Kumar, S., Greeson, J., & Laurenceau, J. (2007). Mindfulness and emotion regulation: The development and initial validation of the cognitive and affective mindfulness scale-revised (CMS-R). *Journal of Psychopathology and Behavioral Assessment, 29*(3), 177-190.

Fendrich M., Warner V., & Weissman M. M. (1990). Family risk factors, parental depression, and psychopathology in offspring. *Developmental Psychology, 26* (1), 40–50. doi:10.1037/0012-1649.26.1.40

Feske, U., & Chambless, D. L. (1995). Cognitive behavioral versus exposure only treatment for social phobia: A meta-analysis. *Behavior Therapy, 26*(4), 695-720.

Fiocco, A. J., Joober, R. & Lupien, S. J. (2007). Education modulates cortisol reactivity to the Trier Social Stress Test in middle-aged adults. *Psychoneuroendocrinology, 32*(8-10), 1158-1163.

Fjorback, L. O., Arendt, M., Ornbol, E., Fink, P., & Walach, H. (2011). Mindfulness-based stress reduction and mindfulness-based cognitive therapy: A systematic review of randomized controlled trials. *Acta Psychiatrica Scandinavica, 124*(2), 102-119. doi:10.1111/j.1600-0447.2011.01704.x; 10.1111/j.1600-0447.2011.01704.x

Fox, N. A., Henderson, H. A., Marshall, P. J., Nichols, K. E., & Ghera, M. M. (2005). Behavioral inhibition: Linking biology and behavior within a developmental framework. *Annual Review of Psychology, 56*, 235-262. doi:10.1146/annurev.psych.55.090902.141532

Friedman, B. H. (2007). An autonomic flexibility-neurovisceral integration model of anxiety and cardiac vagal tone. *Biological Psychology, 74*(2), 185-199. doi:10.1016/j.biopsycho.2005.08.009

Furlan, P. M., DeMartinis, N., Schweizer, E., Rickels, K., & Lucki, I. (2001). Abnormal salivary cortisol levels in social phobic patients in response to acute psychological but not physical stress. *Biological Psychiatry, 50*(4), 254-259.

Furmark, T. (2002). Social phobia: Overview of community surveys. *Acta Psychiatrica Scandinavica, 105*(2), 84-93.

Gaab, J., Sonderegger, L., Scherrer, S., & Ehlert, U. (2006). Psychoneuroendocrine effects of cognitive-behavioral stress management in a naturalistic setting--a randomized controlled trial. *Psychoneuroendocrinology, 31*(4), 428-438. doi:10.1016/j.psyneuen.2005.10.005

Galantino, M. L., Baime, M., Maguire, M., Szapary, P. O., & Farrar, J. T. (2005). Short communication: Association of psychological and physiological measures of stress in health-care professionals during an 8-week mindfulness program: mindfulness in practice. *Stress and Health, 21*, 255-261

Galovski, T. E., Blanchard, E. B., Malta, L. S., & Freidenberg, B. M. (2003). The psychophsiology of aggressive drivers: Comparison to non-aggressive drivers and pre- to post-treatment change following a cognitive-behavioural treatment. *Behaviour Research and Therapy, 41*(9), 1055-1067.

Ganiban, J. M., Ulbricht, J., Saudino, K. J., Reiss, D., & Neiderhiser, J. M. (2011). Understanding child-based effects on parenting: Temperament as a moderator of genetic and environmental contributions to parenting. *Developmental Psychology, 47*(3), 676-692. doi:10.1037/a0021812 [doi]

Garakani, A., Martinez, J. M., Aaronson, C. J., Voustianiouk, A., Kaufmann, H., & Gorman, J. M. (2009). Effect of medication and psychotherapy on heart rate variability in panic disorder. *Depression and Anxiety, 26*(3), 251-258. doi:10.1002/da.20533; 10.1002/da.20533

Gerlach, A. L., Wilhelm, F. H., & Roth, W. T. (2003). Embarrassment and social phobia: The role of parasympathetic activation. *Journal of Anxiety Disorders, 17*(2), 197-210.

Gerlsma, C., Snijders, T. A. B., van Duijn, Marijtje A. J, & Emmelkamp, P. M. G. (1997). Parenting and psychopathology: Differences in family members' perceptions of parental rearing styles. *Personality and Individual Differences, 23*(2), 271-282. doi:http://dx.doi.org/10.1016/S0191-8869%2897%2900033-0

Gerra, G., Zaimovic, A., Mascetti, G. G., Gardini, S., Zambelli, U., Timpano, M., . . . Brambilla, F. (2001). Neuroendocrine responses to experimentally-induced psychological stress in healthy humans. *Psychoneuroendocrinology, 26*(1), 91-107.

Giles, G., & Price, I. R. (2008). Adolescent computer use: Approach, avoidance, and parental control. *Australian Journal of Psychology, 60*(2), 63-71. doi:http://dx.doi.org/10.1080/00049530701829896

Ginsburg, G. S., Grover, R. L., & Ialongo, N. (2004). Parenting behaviors among anxious and non-anxious mothers: Relation with concurrent and long-term child outcomes. *Child & Family Behavior Therapy, 26*(4), 23-41. doi:http://dx.doi.org/10.1300/J019v26n04_02

Ginsburg, G. S., Grover, R. L., Cord, J. J., & Ialongo, N. (2006). Observational measures of parenting in anxious and nonanxious mothers: Does type of task matter? *Journal of Clinical Child and Adolescent Psychology : The Official Journal for the Society of Clinical Child and Adolescent Psychology, American Psychological Association, Division 53, 35*(2), 323-328. doi:10.1207/s15374424jccp3502_16 [doi]

Gladstone, G. L., & Parker, G. B. (2005). Chapter: The role of parenting in the development of psychopathology: An overview of research using the parental bonding instrument. In J. L. [. Hudson, & R. M. [. Rapee (Eds.), *Psychopathology and the family* (pp. 21-33). New York, NY, US: Elsevier Science; US. doi:http://dx.doi.org/10.1016/B978-008044449-9/50003-4

Gladstone, G. L., Parker, G. B., Mitchell, P. B., Wilhelm, K. A., & Malhi, G. S. (2005). Relationship between self-reported childhood behavioral inhibition and lifetime anxiety disorders in a clinical sample. *Depression and Anxiety, 22*(3), 103-113. doi:10.1002/da.20082

Glasgow, R. E., & Arkowitz, H. (1975). The behavioral assessment of male and female social competence in dyadic heterosexual interactions. *Behavior Therapy, 6*(4), 488-498.

Gluck, M. E., Geliebter, A., & Lorence, M. (2004). Cortisol stress response is positively correlated with central obesity in obese women with binge eating disorder (BED) before and after cognitive-behavioral treatment. *Annals of the New York Academy of Sciences, 1032*, 202-207. doi:10.1196/annals.1314.021

Goldin, P., Ziv, M., Jazaieri, H., & Gross, J. J. (2012). Randomized controlled trial of mindfulness-based stress reduction versus aerobic exercise: Effects on the self-referential brain network in social anxiety disorder. *Frontiers in Human Neuroscience, 6*, 295. doi:10.3389/fnhum.2012.00295; 10.3389/fnhum.2012.00295

Goldin, P., Ziv, M., Jazaieri, H., Hahn, K., & Gross, J. J. (2013). MBSR vs aerobic exercise in social anxiety: fMRI of emotion regulation of negative self-beliefs. *Social Cognitive and Affective Neuroscience, 8*(1), 65-72. doi:10.1093/scan/nss054; 10.1093/scan/nss054

Goldin, P. R., & Gross, J. J. (2010). Effects of mindfulness-based stress reduction (MBSR) on emotion regulation in social anxiety disorder. *Emotion (Washington, D.C.), 10*(1), 83-91. doi:10.1037/a0018441; 10.1037/a0018441

Gonzalez, A., Jenkins, J. M., Steiner, M., & Fleming, A. S. (2009). The relation between early life adversity, cortisol awakening response and diurnal salivary cortisol levels in postpartum women. *Psychoneuroendocrinology, 34*(1), 76-86. doi:10.1016/j.psyneuen.2008.08.012

Gould, R. A., Buckminster, S., Pollack, M. H., Otto, M. W., & Yap, L. (1997). Cognitive-behavioral and pharmacological treatment for social phobia: A meta-analysis. *Clinical Psychology: Science and Practice, 4*(4), 291-306.

Granath, J., Ingvarsson, S., von Thiele, U., & Lundberg, U. (2006). Stress management: A randomized study of cognitive behavioural therapy and yoga. *Cognitive Behaviour Therapy, 35*(1), 3-10. doi:10.1080/16506070500401292

Gregory, A. M., Caspi, A., Moffitt, T. E., Koenen, K., Eley, T. C., & Poulton, R. (2007). Juvenile mental health histories of adults with anxiety disorders. *The American Journal of Psychiatry, 164*(2), 301-308. doi:10.1176/appi.ajp.164.2.301

Griffin, M. G., Resick, P. A., & Galovski, T. E. (2012). Does physiologic response to loud tones change following cognitive-behavioral treatment for posttraumatic stress disorder? *Journal of Traumatic Stress, 25*(1), 25-32. doi:10.1002/jts.21667; 10.1002/jts.21667

Grossman, P., Wilhelm, F. H., Kawachi, I., & Sparrow, D. (2001). Gender differences in psychophysiological responses to speech stress among older social phobics:: Congruence and incongruence between self-evaluative and cardiovascular reactions. *Psychosomatic Medicine, 63*(5), 765-777.

Gunnar, M. R., Kryzer, E., Van Ryzin, M. J., & Phillips, D. A. (2011). The import of the cortisol rise in child care differs as a function of behavioral inhibition. *Developmental Psychology, 47*(3), 792-803. doi:10.1037/a0021902; 10.1037/a0021902

Gunnar, M. R., Sebanc, A. M., Tout, K., Donzella, B., & van Dulmen, M. M. (2003). Peer rejection, temperament, and cortisol activity in preschoolers. *Developmental Psychobiology, 43*(4), 346-358.

Gunnar, M. R., Tout, K., de Haan, M., Pierce, S., & Stansbury, K. (1997). Temperament, social competence, and adrenocortical activity in preschoolers. *Developmental Psychobiology, 31*(1), 65-85.

Hale, W. W.,3rd, Engels, R., & Meeus, W. (2006). Adolescent's perceptions of parenting behaviours and its relationship to adolescent generalized anxiety disorder symptoms. *Journal of Adolescence, 29*(3), 407-417. doi:S0140-1971(05)00090-4 [pii]

Halford, K., & Foddy, M. (1982). Cognitive and social skills correlates of social anxiety. *The British Journal of Clinical Psychology / the British Psychological Society, 21 (Pt 1)*(Pt 1), 17-28.

Hammerfald, K., Eberle, C., Grau, M., Kinsperger, A., Zimmermann, A., Ehlert, U., & Gaab, J. (2006). Persistent effects of cognitive-behavioral stress management on cortisol responses to acute stress in healthy

subjects--a randomized controlled trial. *Psychoneuroendocrinology, 31*(3), 333-339. doi:10.1016/j.psyneuen.2005.08.007

Hastings, P. D., Ruttle, P. L., Serbin, L. A., Mills, R. S., Stack, D. M., & Schwartzman, A. E. (2011). Adrenocortical responses to strangers in preschoolers: Relations with parenting, temperament, and psychopathology. *Developmental Psychobiology, 53*(7), 694-710. doi:10.1002/dev.20545 [doi]

Haug, T. T., Blomhoff, S., Hellstrom, K., Holme, I., Humble, M., Madsbu, H. P., & Wold, J. E. (2003). Exposure therapy and sertraline in social phobia: I-year follow-up of a randomised controlled trial. *The British Journal of Psychiatry : The Journal of Mental Science, 182*, 312-318.

Hayes, S. C. (2008). Climbing our hills: A beginning conversation on the comparison of acceptance and commitment therapy and traditional cognitive behavioral therapy. *Clinical Psychology: Science and Practice, 15*(4), 286-295.

Hayes, S. C., & Wilson, K. G. (2003). Mindfulness: Method and process. *Clinical Psychology: Science and Practice, 10*(2), 161-165.

Heeren, A., Lange, W-G., Philoppot, P., & Wong, Q. J. J. (2014). Biased cognitions and social anxiety: building a global framework for integrating cognitive, behavioral, and neural processes. *Frontiers in Human Neuroscience, 8*, 538, doi: 10.3389/fnhum.2014.00538.

Heimberg, R. G. (2002). Cognitive-behavioral therapy for social anxiety disorder: Current status and future directions. *Biological Psychiatry, 51*(1), 101-108.

Heimberg, R. G., & Becker, R. E. (2002). *Cognitive– behavioral group therapy for social phobia: Basic mechanisms and clinical strategies*. New York, NY: The Guildford Press.

Heimberg, R. G., Liebowitz, M. R., Hope, D. A., Schneier, F. R., Holt, C. S., . . . Klein, D. F. (1998). Cognitive behavioral group therapy vs phenelzine therapy for social phobia: 12-week outcome. *Archives of General Psychiatry, 55*(12), 1133-1141.

Hettema, J. M., Neale, M. C., & Kendler, K. S. (2001). A review and meta-analysis of the genetic epidemiology of anxiety disorders. *The American Journal of Psychiatry, 158*(10), 1568-1578.

Hettema, J. M., Prescott, C. A., Myers, J. M., Neale, M. C., & Kendler, K. S. (2005). The structure of genetic and environmental risk factors for anxiety disorders in men and women. *Archives of General Psychiatry, 62*(2), 182-189. doi:10.1001/archpsyc.62.2.182

Hirsch, C. R., & Clark, D. M. (2004). Information-processing bias in social phobia. *Clinical Psychology Review*. 24, 799–825. doi: 10.1016/j.cpr.2004.07.005.

Hirshfeld, D. R., Biederman, J., Brody, L., Faraone, S. V., & Rosenbaum, J. F. (1997). Expressed emotion toward children with behavioral inhibition: Associations with maternal anxiety disorder. *Journal of the American Academy of Child and Adolescent Psychiatry, 36*(7), 910-917. doi:10.1097/00004583-199707000-00012

Hofmann, S. G., & Asmundson, G. J. (2008). Acceptance and mindfulness-based therapy: New wave or old hat? *Clinical Psycholology Review, 28*(1), 1-16.

Hofmann, S. G., Moscovitch, D. A., & Kim, H. J. (2006). Autonomic correlates of social anxiety and embarrassment in shy and non-shy individuals. *International Journal of Psychophysiology : Official Journal of the International Organization of Psychophysiology, 61*(2), 134-142. doi:10.1016/j.ijpsycho.2005.09.003

Hofmann, S. G., Sawyer, A. T., Witt, A. A., & Oh, D. (2010). The effect of mindfulness-based therapy on anxiety and depression: A meta-analytic review. *Journal of Consulting and Clinical Psychology, 78*(2), 169-183. doi:10.1037/a0018555

Hofmann, S. G., & Smits, J. A. (2008). Cognitive-behavioral therapy for adult anxiety disorders: A meta-analysis of randomized placebo-controlled trials. *The Journal of Clinical Psychiatry, 69*(4), 621-632.

Hofmann, S. G., & Bogels, S. M. (2006). Recent advances in the treatment of social phobia: Introduction to the special issue. *Journal of Cognitive Psychotherapy, 20*(1), 3-5.

Hudson, J. L., Comer, J. S., & Kendall, P. C. (2008). Parental responses to positive and negative emotions in anxious and nonanxious children. *Journal of Clinical Child and Adolescent Psychology, 37*(2), 303-313. doi:10.1080/15374410801955839 [doi]

Hudson, J. L., & Dodd, H. F. (2012). Informing early intervention: Preschool predictors of anxiety disorders in middle childhood. *PloS One, 7*(8), e42359. doi:10.1371/journal.pone.0042359 [doi]

Hudson, J. L., Dodd, H. F., & Bovopoulos, N. (2011). Temperament, family environment and anxiety in preschool children. *Journal of Abnormal Child Psychology, 39*(7), 939-951. doi:10.1007/s10802-011-9502-x; 10.1007/s10802-011-9502-x

Hudson, J. L., Dodd, H. F., Lyneham, H. J., & Bovopoulous, N. (2011). Temperament and family environment in the development of anxiety disorder: Two-year follow-up. *Journal of the American Academy of Child and Adolescent Psychiatry, 50*(12), 1255-64.e1. doi:10.1016/j.jaac.2011.09.009; 10.1016/j.jaac.2011.09.009

Hudson, J. L., & Rapee, R. M. (2001). Parent-child interactions and anxiety disorders: An observational study. *Behaviour Research and Therapy, 39*(12), 1411-1427.

Hudson, J. L., & Rapee, R. M. (2002). Parent-child interactions in clinically anxious children and their siblings. *Journal of Clinical Child and Adolescent Psychology : The Official Journal for the Society of Clinical Child and Adolescent Psychology, American Psychological Association, Division 53, 31*(4), 548-555. doi:10.1207/S15374424JCCP3104_13 [doi]

Ingram, R. E., & Luxton, D. D. (2005). Vulnerability-stress models. In : Hankin, B. L., & Abela, J. R. (Eds), *Development of Psychopathology: A Vulnerability-Stress Perspective.* California: Sage Publications, Inc.

Jafarian-Tehrani, M., & Sternberg, E. M. (1999). Animal models of neuroimmune interactions in inflammatory diseases. *Journal of Neuroimmunology, 100*(1-2), 13-20.

Jazaieri, H., Goldin, P. R., Werner, K., Ziv, M., & Gross, J. J. (2012). A randomized trial of MBSR versus aerobic exercise for social anxiety disorder. *Journal of Clinical Psychology, 68*(7), 715-731. doi:10.1002/jclp.21863; 10.1002/jclp.21863

Johnson, J. G., Cohen, P., Kasen, S., & Brook, J. S. (2008). Parental concordance and offspring risk for anxiety, conduct, depressive, and substance use disorders. *Psychopathology, 41*(2), 124-128. doi:10.1159/000112028

Kabat-Zinn J. (1990). *Full catastrophe living: using the wisdom of the body and the mind to fase stress, pain and illness*. New York, US: Dell.

Kabat-Zinn, J. (2003). Mindfulness-based interventions in context: Past, present, and future. *Clinical Psychology: Science and Practice, 10*(2), 144-156.

Kabat-Zinn, J., & Santorelli, S. (1993). *Mindfulness-based stress reduction professional training resource manual*.

Kagan, J., Reznick, J. S., & Snidman, N. (1987). The physiology and psychology of behavioral inhibition in children. *Child Development, 58*(6), 1459-1473.

Kagan, J., Reznick, J. S., & Snidman, N. (1988a). Biological bases of childhood shyness. *Science (New York, N.Y.), 240*(4849), 167-171.

Kagan, J., Reznick, J. S., & Snidman, N. (1988b). Temperamental influences on reactions to unfamiliarity and challenge. *Advances in Experimental Medicine and Biology, 245*, 319-339.

Kagan, J., Reznick, J. S., Snidman, N., Gibbons, J., & Johnson, M. O. (1988). Childhood derivatives of inhibition and lack of inhibition to the unfamiliar. *Child Development, 59*(6), 1580-1589.

Kagan, J., & Snidman, N. (1991). Temperamental factors in human development. *The American Psychologist, 46*(8), 856-862.

Kagan, J., & Snidman, N. (1999). Early childhood predictors of adult anxiety disorders. *Biological Psychiatry, 46*(11), 1536-1541. doi:S0006-3223(99)00137-7 [pii]

Kandel, E., Schwartz, J., & Jessell, T. (2000). *Principles of neural science, 4th ed.* McGraw-Hill, New York.

Kaviani, H., Javaheri, F., & Hatami, N. (2011). Mindfulness-based cognitive therapy (MBCT) reduces depression and anxiety induced by real stressful setting in non-clinical population. *International Journal of Psychology & Psychological Therapy, 11*(2), 285-296.

Keller, M. B. (2003). The lifelong course of social anxiety disorder: A clinical perspective. *Acta Psychiatrica Scandinavica.Supplementum, (417)*(417), 85-94.

Kendell, R. E., McGuire, R. J., Connor, Y., & Cox, J. L. (1981). Mood changes in the first three weeks after childbirth. *Journal of Affective Disorders, 3*(4), 317-326.

Kertes, D. A., Donzella, B., Talge, N. M., Garvin, M. C., Van Ryzin, M. J., & Gunnar, M. R. (2009). Inhibited temperament and parent emotional availability differentially predict young children's cortisol responses to novel social and nonsocial events. *Developmental Psychobiology, 51*(7), 521-532. doi:10.1002/dev.20390 [doi]

Kessler, R. C. (2003). The impairments caused by social phobia in the general population: Implications for intervention. *Acta Psychiatrica Scandinavica.Supplementum, (417)*(417), 19-27.

Kessler, R. C., Berglund, P., Demler, O., Jin, R., Merikangas, K. R., & Walters, E. E. (2005). Lifetime prevalence and age-of-onset distributions of DSM-IV disorders in the national comorbidity survey replication. *Archives of General Psychiatry, 62*(6), 593-602. doi:10.1001/archpsyc.62.6.593

Kim, W., Lim, S. K., Chung, E. J., & Woo, J. M. (2009). The effect of cognitive behavior therapy-based psychotherapy applied in a forest environment on physiological changes and remission of major depressive disorder. *Psychiatry Investigation, 6*(4), 245-254. doi:10.4306/pi.2009.6.4.245; 10.4306/pi.2009.6.4.245

Kimbrel, N. A., Cobb, A. R., Mitchell, J. T., Hundt, N. E., & Nelson-Gray, R. O. (2008). Sensitivity to punishment and low maternal care account for the link between bulimic and social anxiety symptomology. *Eating Behaviors, 9*(2), 210-217. doi:10.1016/j.eatbeh.2007.09.005 [doi]

Kimbrel, N. A., Mitchell, J. T., Hundt, N. E., Robertson, C. D., & Nelson-Gray, R. O. (2012). BIS and BAS interact with perceived parental affectionless control to predict personality disorder symptomatology. *Journal of Personality Disorders, 26*(2), 203-212. doi:10.1521/pedi.2012.26.2.203 [doi]

Kirschbaum, C., Kudielka, B. M., Gaab, J., Schommer, N. C., & Hellhammer, D. H. (1999). Impact of gender, menstrual cycle phase, and oral contraceptives on the activity of the hypothalamus-pituitary-adrenal axis. *Psychosomatic Medecine, 61*(2), 154-162.

Kirschbaum, C., & Hellhammer, D. H. (1994). Salivary cortisol in psychoneuroendocrine research: Recent developments and applications. *Psychoneuroendocrinology, 19*(4), 313-333.

Kirschbaum, C., Pirke, K. M., & Hellhammer, D. H. (1993). The 'trier social stress test'--a tool for investigating psychobiological stress responses in a laboratory setting. *Neuropsychobiology, 28*(1-2), 76-81. doi:119004 [pii]

Kirschbaum, C., Prussner, J. C., Stone, A. A., Federenko, I., Gaab, J., Lintz, D., . . . Hellhammer, D. H. (1995). Persistent high cortisol responses to repeated psychological stress in a subpopulation of healthy men. *Psychosomatic Medicine, 57*(5), 468-474.

Klatt, M. D., Buckworth, J., & Malarkey, W. B. (2009). Effects of low-dose mindfulness-based stress reduction (MBSR-ld) on working adults. *Health Education & Behavior : The Official Publication of the Society for Public Health Education, 36*(3), 601-614. doi:10.1177/1090198108317627

Kocovski, N. L., Fleming, J. E., Hawley, L. L., Ho, M. H., & Antony, M. M. (2015). Mindfulness and acceptance-based group therapy and traditional cognitive behavioral group therapy for social anxiety disorder: Mechanisms of change. *Behaviour Research and Therapy, 70*, 11-22.

Kocovski, N. L., Fleming, J. E., Hawley, L. L., Huta, V., & Antony, M. M. (2013). Mindfulness and acceptance-based group therapy versus traditional cognitive behavioral group therapy for social anxiety disorder: A randomized controlled trial. *Behaviour Research and Therapy, 51*(12), 889-898. doi:10.1016/j.brat.2013.10.007 [doi]

Kocovski, N. L., Fleming, J. E., & Rector, N. A. (2009). Mindfulness and acceptance-based group therapy for social anxiety disorder: An open trial. *Cognitive and Behavioral Practice, 16*(3), 276-289.

Koszycki, D., Benger, M., Shlik, J., & Bradwejn, J. (2007). Randomized trial of a meditation-based stress reduction program and cognitive behavior therapy in generalized social anxiety disorder. *Behaviour Research and Therapy, 45*(10), 2518-2526. doi:10.1016/j.brat.2007.04.011

Koszycki, D., Bilodeau, C., Zwanzger, P., Schneider, B. H., Flament, M. F., & Bradwejn, J. (2013). Parental bonds in children at high and low familial risk for panic disorder. *Child Psychiatry and Human Development, 44*(2), 278-289. doi:10.1007/s10578-012-0324-z [doi]

Kringlen, E., Torgersen, S., & Cramer, V. (2001). A norwegian psychiatric epidemiological study. *The American Journal of Psychiatry, 158*(7), 1091-1098.

Kudielka, B. M., Gierens, A., Hellhammer, D. H., Wust, S., & Schlotz, W. (2012). Salivary cortisol in ambulatory assessment--some dos, some don'ts, and some open questions. *Psychosomatic Medicine, 74*(4), 418-431.

Kuehner, C., Huffziger, S., & Liebsch, K. (2009). Rumination, distraction and mindful self-focus: effects on mood, dysfunctional attitudes and cortisol stress response. *Psychological Medicine, 39*, 219-228.

Lahat, A., Hong, M., & Fox, N. A. (2011). Behavioural inhibition: Is it a risk factor for anxiety? *International Review of Psychiatry (Abingdon, England), 23*(3), 248-257. doi:10.3109/09540261.2011.590468; 10.3109/09540261.2011.590468

Last, C. G., Perrin, S., Hersen, M., & Kazdin, A. E. (1996). A prospective study of childhood anxiety disorders. *Journal of the American Academy of Child and Adolescent Psychiatry, 35*(11), 1502-1510. doi:10.1097/00004583-199611000-00019

Last, C. G., & Strauss, C. C. (1990). School refusal in anxiety-disordered children and adolescents. *Journal of the American Academy of Child and Adolescent Psychiatry, 29*(1), 31-35. doi:10.1097/00004583-199001000-00006

Lau, M. A., Bishop, S. R., Segal, Z. V., Buis, T., Anderson, N. D., Carlson, L., . . . Devins, G. (2006). The toronto mindfulness scale: Development and validation. *Journal of Clinical Psychology, 62*(12), 1445-1467. doi:10.1002/jclp.20326

Leahy, R. L., & Holland, S. J. (2000). *Treatment plans and interventions for depression and anxiety disorders.* Guilford Press, New York.

Lepine, J. P., & Lellouch, J. (1995). Classification and epidemiology of social phobia. *European Archives of Psychiatry and Clinical Neuroscience, 244*, 290--296. doi:- 10.1007/BF02190406

Levin, A. P., Saoud, J. B., Strauman, T., & Gorman, J. M. (1993). Responses of "generalized" and "discrete" social phobics during public speaking. *Journal of Anxiety Disorders, 7*(3), 207-221.

Lewinsohn, P. M., & Rosenbaum, M. (1987). Recall of parental behavior by acute depressives, remitted depressives, and nondepressives. *Journal of Personality and Social Psychology, 52*(3), 611-619.

Lewis-Morrarty, E., Degnan, K. A., Chronis-Tuscano, A., Rubin, K. H., Cheah, C. S., Pine, D. S., . . . Fox, N. A. (2012). Maternal over-control moderates the association between early childhood behavioral inhibition and adolescent social anxiety symptoms. *Journal of Abnormal Child Psychology, 40*(8), 1363-1373. doi:10.1007/s10802-012-9663-2 [doi]

Libby, D. J., Worhunsky, P. D., Pilver, C. E., & Brewer, J. A. (2012). Meditation-induced changes in high-frequency heart rate variability predict smoking outcomes. *Frontiers in Human Neuroscience, 6*, 54. doi:10.3389/fnhum.2012.00054; 10.3389/fnhum.2012.00054

Licht, C. M. M., de Geus, Eco J. C, van Dyck, R., & Penninx, B. W. J. H. (2009). Association between anxiety disorders and heart rate variability in the netherlands study of depression and anxiety (NESDA). *Psychosomatic Medicine, 71*(5), 508-518.

Lieb, R., Isensee, B., Hofler, M., Pfister, H., & Wittchen, H. U. (2002). Parental major depression and the risk of depression and other mental disorders in offspring: A prospective-longitudinal community study. *Archives of General Psychiatry, 59*(4), 365-374.

Lieb, R., Wittchen, H. U., Hofler, M., Fuetsch, M., Stein, M. B., & Merikangas, K. R. (2000). Parental psychopathology, parenting styles, and the risk of social phobia in offspring: A prospective-longitudinal community study. *Archives of General Psychiatry, 57*(9), 859-866.

Liebowitz, M. R., Heimberg, R. G., Schneier, F. R., Hope, D. A., . . . Klein, D. F. (1999). Cognitive-behavioral group therapy versus phenelzine in social phobia: Long-term outcome. *Depression and Anxiety, 10*(3), 89-98.

Lightman, S. L. (2008). The neuroendocrinology of stress: A never ending story. *Journal of Neuroendocrinology, 20*(6), 880-884. doi:10.1111/j.1365-2826.2008.01711.x [doi]

Lingjaerde, O., & Foreland, A. R. (1998). Direct assessment of improvement in winter depression with a visual analogue scale: High reliability and validity. *Psychiatry Research, 81*(3), 387-392.

Lipsitz, J. D., Markowitz, J. C., Cherry, S., & Fyer, A. J. (1999). Open trial of interpersonal psychotherapy for the treatment of social phobia. *The American Journal of Psychiatry, 156*(11), 1814-1816.

Luecken, L. J. (2000). Parental caring and loss during childhood and adult cortisol responses to stress. *Psychology & Health, 15*(6), 841-851. doi:http://dx.doi.org/10.1080/08870440008405586

Magee, W. J., Eaton, W. W., Wittchen, H. U., McGonagle, K. A., & Kessler, R. C. (1996). Agoraphobia, simple phobia, and social phobia in the national comorbidity survey. *Archives of General Psychiatry, 53*(2), 159-168.

Manzaneque, J. M., Vera, F. M., Ramos, N. S., Godoy, Y. A., Rodriguez, F. M., Blanca, M. J., . . . Enguix, A. (2011). Psychobiological modulation in anxious and depressed patients after a mindfulness meditation programme: A pilot study. *Stress and Health: Journal of the International Society for the Investigation of Stress, 27*(3), 216-222.

Marcus, M. T., Fine, M., Moeller, F. G., Khan, M. M., Pitts, K., Swank, P. R., & Liehr, P. (2003). Change in stress levels following mindfulness-based stress reduction in a therapeutic community. *Addictive Disorders & their Treatment, 2*(3), 63-68.

Martel, F. L., Hayward, C., Lyons, D. M., Sanborn, K., Varady, S., & Schatzberg, A. F. (1999). Salivary cortisol levels in socially phobic adolescent girls. *Depression and Anxiety, 10*(1), 25-27.

Martinez, J. M., Garakani, A., Kaufmann, H., Aaronson, C. J., & Gorman, J. M. (2010). Heart rate and blood pressure changes during autonomic nervous system challenge in panic disorder patients. *Psychosomatic Medicine, 72*(5), 442-449. doi:10.1097/PSY.0b013e3181d972c2; 10.1097/PSY.0b013e3181d972c2

Mason, D. (1991). Genetic variation in the stress response: Susceptibility to experimental allergic encephalomyelitis and implications for human inflammatory disease. *Immunology Today, 12*(2), 57-60. doi:10.1016/0167-5699(91)90158-P

Mauss, I. B., Wilhelm, F. H., & Gross, J.J. (2003). Autonomic recovery and habituation in social anxiety. *Psychophysiology, 40*(4), 648-653.

Mauss, I. B, Wilhelm, F. H., & Gross, J. J. (2004). Is there less to social anxiety than meets the eye? Emotion experience, expression, and bodily responding. *Cognition and Emotion, 18*(5), 631-662. doi:10.1080/02699930341000112

McClure, E. B., Brennan, P. A., Hammen, C., & Le Brocque, R. M. (2001). Parental anxiety disorders, child anxiety disorders, and the perceived parent-child relationship in an australian high-risk sample. *Journal of Abnormal Child Psychology, 29*(1), 1-10.

McCoy, S. J., Beal, J. M., Payton, M. E., Stewart, A. L., DeMers, A. M., & Watson, G. H. (2005). Correlations of visual analog scales with edinburgh postnatal depression scale. *Journal of Affective Disorders, 86*(2-3), 295-297. doi:10.1016/j.jad.2005.01.001

McEvoy, P. M. (2007). Effectiveness of cognitive behavioural group therapy for social phobia in a community clinic: A benchmarking study. *Behaviour Research and Therapy, 45*(12), 3030-3040. doi:10.1016/j.brat.2007.08.002

McLeod, B. D., Wood, J. J., & Weisz, J. R. (2007). Examining the association between parenting and childhood anxiety: A meta-analysis. *Clinical Psychology Review, 27*(2), 155-172. doi:10.1016/j.cpr.2006.09.002

Meites, T. M., Ingram, R. E., & Siegle, G. J. (2012). Unique and shared aspects of affective symptomatology: The role of parental bonding in depression and anxiety symptom profiles. *Cognitive Therapy and Research, 36*(3), 173-181. doi:http://dx.doi.org/10.1007/s10608-011-9426-3

Melbourne Academic Mindfulness Interest Group (2006). Mindfulness-based psychotherapies: a review of conceptual foundations, empirical evidence and practical considerations. *Australian and New Zealand Journal of Psychiatry,* 40, 285–294.

Merikangas, K. R., Avenevoli, S., Dierker, L., & Grillon, C. (1999). Vulnerability factors among children at risk for anxiety disorders. *Biological Psychiatry, 46*(11), 1523-1535.

Merikangas, K. R., He, J. P., Burstein, M., Swanson, S. A., Avenevoli, S., Cui, L., . . . Swendsen, J. (2010). Lifetime prevalence of mental disorders in U.S. adolescents: Results from the national comorbidity survey replication--adolescent supplement (NCS-A). *Journal of the American Academy of Child and Adolescent Psychiatry, 49*(10), 980-989. doi:10.1016/j.jaac.2010.05.017; 10.1016/j.jaac.2010.05.017

Mezzacappa, E., Tremblay, R. E., Kindlon, D., Saul, J. P., Arseneault, L., Seguin, J., . . . Earls, F. (1997). Anxiety, antisocial behavior, and heart rate regulation in adolescent males. *Journal of Child Psychology and Psychiatry, and Allied Disciplines, 38*(4), 457-469.

Miller, J. J., Fletcher, K., & Kabat-Zinn, J. (1995). Three-year follow-up and clinical implications of a mindfulness meditation-based stress reduction intervention in the treatment of anxiety disorders. *General Hospital Psychiatry, 17*(3), 192-200.

Monk, C., Kovelenko, P., Ellman, L. M., Sloan, R. P., Bagiella, E., Gorman, J. M., & Pine, D. S. (2001). Enhanced stress reactivity in paediatric anxiety disorders: Implications for future cardiovascular health. *The International Journal of Neuropsychopharmacology , 4*(2), 199-206. doi:doi:10.1017/S146114570100236X

Moore, P. S., Whaley, S. E., & Sigman, M. (2004). Interactions between mothers and children: Impacts of maternal and child anxiety. *Journal of Abnormal Psychology, 113*(3), 471-476. doi:10.1037/0021-843X.113.3.471 [doi]

Moscovitch, D. A., Hofmann, S. G., Suvak, M. K., & In-Albon, T. (2005). Mediation of changes in anxiety and depression during treatment of social phobia. *Journal of Consulting and Clinical Psychology, 73*(5), 945-952. doi:10.1037/0022-006X.73.5.945

Moscovitch, D. A. (2009). What is the core fear in social phobia? A new model to facilitate individualized case conceptualization and treatment. *Cognitive and Behavioral Practice, 16*(2), 123-134.

Muris, P., Meesters, C., Merckelbach, H., & Hulsenbeck, P. (2000). Worry in children is related to perceived parental rearing and attachment. *Behaviour Research and Therapy, 38*(5), 487-497. doi:S0005-7967(99)00072-8 [pii]

Muris, P., van Brakel, A. M., Arntz, A., & Schouten, E. (2011). Behavioral inhibition as a risk factor for the development of childhood anxiety disorders: A longitudinal study. *Journal of Child and Family Studies, 20*(2), 157-170. doi:10.1007/s10826-010-9365-8

Nachmias, M., Gunnar, M., Mangelsdorf, S., Parritz, R. H., & Buss, K. (1996). Behavioral inhibition and stress reactivity: The moderating role of attachment security. *Child Development, 67*(2), 508-522.

Narita, K., Fujihara, K., Takei, Y., Suda, M., Aoyama, Y., Uehara, T., . . . Mikuni, M. (2012). Associations among parenting experiences during childhood and adolescence, hypothalamus-pituitary-adrenal axis hypoactivity, and hippocampal gray matter volume reduction in young adults. *Human Brain Mapping, 33*(9), 2211-2223. doi:10.1002/hbm.21354 [doi]

Nater U . M. et al., (2005). Human salivary alpha-amylase reactivity in a psychosocial stress paradigm. *International Journal of Psychophysiology, 55*, 333-342.

Nater U. M., & Rohleder, N. (2009). Salivary alpha-amylase as a non-invasive biomarker for the sympathetic nervous system: Current state of research. *Psychoneuroendocrinology, 34*, 486 - 496.

Niles, A. N., Burklund, L. J., Arch, J. J., Lieberman, M. D., Saxbe, D., & Craske, M. G. (2014). Cognitive mediators of treatment for social anxiety disorder: comparing acceptance and commitment therapy and cognitive-behavioral therapy. *Behavior Therapy, 45*(5), 664-677.

Nutt, D., Garcia de Miguel, B., & Davies, S. J. C. (2008). Phenomenology of anxiety disorders., 365-393.

Ohayon, M. M., & Schatzberg, A. F. (2010). Social phobia and depression: Prevalence and comorbidity. *Journal of Psychosomatic Research, 68*(3), 235-243. doi:10.1016/j.jpsychores.2009.07.018

Ost, L. G. (1987). Applied relaxation: Description of a coping technique and review of controlled studies. *Behaviour Research and Therapy, 25*(5), 397-409.

Otto, M. W., Pollack, M. H., Gould, R. A., Worthington, J. J.,3rd, McArdle, E. T., & Rosenbaum, J. F. (2000). A comparison of the efficacy of clonazepam and cognitive-behavioral group therapy for the treatment of social phobia. *Journal of Anxiety Disorders, 14*(4), 345-358.

Pace, T. W., Negi, L. T., Adame, D. D., Cole, S. P., Sivilli, T. I., Brown, T. D., . . . Raison, C. L. (2009). Effect of compassion meditation on neuroendocrine, innate immune and behavioral responses to psychosocial

stress. *Psychoneuroendocrinology, 34*(1), 87-98. doi:10.1016/j.psyneuen.2008.08.011; 10.1016/j.psyneuen.2008.08.011

Pace, T. W., Negi, L. T., Sivilli, T. I., Issa, M. J., Cole, S. P., Adame, D. D., & Raison, C. L. (2010). Innate immune, neuroendocrine and behavioral responses to psychosocial stress do not predict subsequent compassion meditation practice time. *Psychoneuroendocrinology, 35*(2), 310-315. doi:10.1016/j.psyneuen.2009.06.008

Pagani, M., Lombardi, F., Guzzetti, S., Rimoldi, O., Furlan, R., Pizzinelli, P., . . . Piccaluga, E. (1986). Power spectral analysis of heart rate and arterial pressure variabilities as a marker of sympatho-vagal interaction in man and conscious dog. *Circulation Research, 59*(2), 178-193.

Parker, G. (1979). Reported parental characteristics of agoraphobics and social phobics. *The British Journal of Psychiatry : The Journal of Mental Science, 135*, 555-560.

Parker, G. (1990). The parental bonding instrument. A decade of research. *Social Psychiatry and Psychiatric Epidemiology, 25*(6), 281-282.

Phillips, K. M., Antoni, M. H., Lechner, S. C., Blomberg, B. B., . . . Carver, C. S. (2008). Stress management intervention reduces serum cortisol and increases relaxation during treatment for nonmetastatic breast cancer. *Psychosomatic Medicine, 70*(9), 1044-1049. doi:10.1097/PSY.0b013e318186fb27; 10.1097/PSY.0b013e318186fb27

Piet, J., Hougaard, E., Hecksher, M. S., & Rosenberg, N. K. (2010). A randomized pilot study of mindfulness-based cognitive therapy and group cognitive-behavioral therapy for young adults with social phobia. *Scandinavian Journal of Psychology,* doi:10.1111/j.1467-9450.2009.00801.x

Pine, D. S., Cohen, P., Gurley, D., Brook, J., & Ma, Y. (1998). The risk for early-adulthood anxiety and depressive disorders in adolescents with anxiety and depressive disorders. *Archives of General Psychiatry, 55*(1), 56-64.

Pluess, M., & Belsky, J. (2009). Differential susceptibility to rearing experience: The case of childcare. *Journal of Child Psychology and Psychiatry, and Allied Disciplines, 50*(4), 396-404. doi:10.1111/j.1469-7610.2008.01992.x; 10.1111/j.1469-7610.2008.01992.x

Ponniah, K., & Hollon, S. D. (2008). Empirically supported psychological interventions for social phobia in adults: A qualitative review of randomized controlled trials. *Psychological Medicine, 38*(1), 3-14. doi:10.1017/S0033291707000918

Porges, S. W., Doussard-Roosevelt, J. A., & Maiti, A. J. (1994). Vagal tone and the physiological regulation of emotion. In : Fox, N. A. (Ed.), *The Development of Emotion Regulation*. Chicago: University of Chicago Press.

Proulx, K. (2003). Integrating mindfulness-based stress reduction. *Holistic Nursing Practice, 17*(4), 201-208.

Pruessner, J. C., Hellhammer, D. H., & Kirschbaum, C. (1999). Burnout, perceived stress, and cortisol responses to awakening. *Psychosomatic Medicine, 61*(2), 197-204.

Pruessner, M., Vracotas, N., Joober, R., Pruessner, J. C., & Malla, A. K. (2013). Blunted cortisol awakening response in men with first episode psychosis: Relationship to parental bonding. *Psychoneuroendocrinology, 38*(2), 229-240. doi:10.1016/j.psyneuen.2012.06.002 [doi]

Rabe, S., Dorfel, D., Zollner, T., Maercker, A., & Karl, A. (2006). Cardiovascular correlates of motor vehicle accident related posttraumatic stress disorder and its successful treatment. *Applied Psychophysiology and Biofeedback, 31*(4), 315-330. doi:10.1007/s10484-006-9027-1

Rapee, R. M. (2014). Preschool environment and temperament as predictors of social and nonsocial anxiety disorders in middle adolescence. *Journal of the American Academy of Child and Adolescent Psychiatry, 53*(3), 320-328. doi:10.1016/j.jaac.2013.11.014; 10.1016/j.jaac.2013.11.014

Rapee, R. M., Gaston, J. E., & Abbott, M. J. (2009). Testing the efficacy of theoretically derived improvements in the treatment of social phobia. *Journal of Consulting and Clinical Psychology, 77*(2), 317-327. doi:10.1037/a0014800

Rapee, R. M., & Lim, L. (1992). Discrepancy between self- and observer ratings of performance in social phobics. *Journal of Abnormal Psychology, 101*(4), 728-731.

Rapee, R. M., Schniering, C. A., & Hudson, J. L. (2009). Anxiety disorders during childhood and adolescence: Origins and treatment. *Annual Review of Clinical Psychology, 5*, 311-341. doi:10.1146/annurev.clinpsy.032408.153628 [doi]

Revill, S. I., Robinson, J. O., Rosen, M., & Hogg, M. I. (1976). The reliability of a linear analogue for evaluating pain. *Anaesthesia, 31*(9), 1191-1198.

Reznick, J. S., Hegeman, I. M., Kaufman, E. R., Woods, S. W., & Jacobs, M. (1992). Retrospective and concurrent self-report of behavioral inhibition and their relation to adult mental health. *Development and Psychopathology, 4*(2), 301-321. doi:http://dx.doi.org/10.1017/S095457940000016X

Reznick, J. S., Kagan, J., Snidman, N., Gersten, M., Baak, K., & Rosenberg, A. (1986). Inhibited and uninhibited children: A follow-up study. *Child Development, 57*(3), 660-680. doi:http://dx.doi.org/10.2307/1130344

Robert McComb, J. J., Tacon, A., Randolph, P., & Caldera, Y. (2004). A pilot study to examine the effects of a mindfulness-based stress-reduction and relaxation program on levels of stress hormones, physical functioning, and submaximal exercise responses. *Journal of Alternative and Complementary Medicine (New York, N.Y.), 10*(5), 819-827. doi:10.1089/acm.2004.10.819

Roberts, A. D., Charler, M. L., Papadopoulos, A., Wessely, S., Chalder, T., & Cleare, A. J. (2010). Does hypocortisolism predict a poor response to cognitive behavioural therapy in chronic fatigue syndrome? *Psychological Medicine, 40*(3), 515-522. doi:10.1017/S0033291709990390; 10.1017/S0033291709990390

Roberts, A. D., Papadopoulos, A. S., Wessely, S., Chalder, T., & Cleare, A. J. (2009). Salivary cortisol output before and after cognitive behavioural therapy for chronic fatigue syndrome. *Journal of Affective Disorders, 115*(1-2), 280-286. doi:10.1016/j.jad.2008.09.013; 10.1016/j.jad.2008.09.013

Rodebaugh, T. L., & Heimberg, R. G. (2005). Combined treatment for social anxiety disorder. *Journal of Cognitive Psychotherapy, 19*(4), 331-345.

Rodebaugh, T. L., Holaway, R. M., & Heimberg, R. G. (2004). The treatment of social anxiety disorder. *Clinical Psychology Review, 24*(7), 883-908. doi:10.1016/j.cpr.2004.07.007

Roelofs, K., van Peer, J., Berretty, E., Jong, P., Spinhoven, P., & Elzinga, B. M. (2009). Hypothalamus-pituitary-adrenal axis hyperresponsiveness is associated with increased social avoidance behavior in social phobia. *Biological Psychiatry, 65*(4), 336-343. doi:10.1016/j.biopsych.2008.08.022; 10.1016/j.biopsych.2008.08.022

Roemer, L., & Orsillo, S. M. (2003). Mindfulness: A promising intervention strategy in need of further study. *Clinical Psychology: Science and Practice, 10*(2), 172-178.

Rosen, J. B., & Schulkin, J. (1998). From normal fear to pathological anxiety. *Psychological Review, 105*(2), 325-350.

Rosenbaum, J. F., Biederman, J., Hirshfeld, D. R., Bolduc, E. A., Faraone, S. V., Kagan, J., . . . Reznick, J. S. (1991). Further evidence of an association between behavioral inhibition and anxiety disorders: Results from a family study of children from a non-clinical sample. *Journal of Psychiatric Research, 25*(1-2), 49-65.

Rosser, S., Issakidis, C., & Peters, L. (2003). Perfectionism and social phobia: Relationship between the constructs and impact on cognitive behavior therapy. *Cognitive Therapy and Research, 27*(2), 143-151.

Rubin, K. H., Burgess, K. B., & Hastings, P. D. (2002). Stability and social-behavioral consequences of toddlers' inhibited temperament and parenting behaviors. *Child Development, 73*(2), 483-495.

Rubin, K. H., Hastings, P. D., Stewart, S. L., Henderson, H. A., & Chen, X. (1997). The consistency and concomitants of inhibition: Some of the children, all of the time. *Child Development, 68*(3), 467-483.

Rubin, K. H., Nelson, L. J., Hastings, P., & Asendorpf, J. (1999). The transaction between parents' perceptions of their children's shyness and their parenting styles. *International Journal of Behavioral Development, 23*(4), 937-958. doi:http://dx.doi.org/10.1080/016502599383612

Ruscio, A. M., Brown, T. A., Chiu, W. T., Sareen, J., Stein, M. B., & Kessler, R. C. (2008). Social fears and social phobia in the USA: Results from the national comorbidity survey replication. *Psychological Medicine, 38*(1), 15-28. doi:10.1017/S0033291707001699

Russ, S. J., Herbert, J., Cooper, P., Gunnar, M. R., Goodyer, I., Croudace, T., & Murray, L. (2012). Cortisol levels in response to starting school in children at increased risk for social phobia. *Psychoneuroendocrinology, 37*(4), 462-474. doi:10.1016/j.psyneuen.2011.07.014; 10.1016/j.psyneuen.2011.07.014

Scarpa, A., Raine, A., Venables, P. H., & Mednick, S. A. (1997). Heart rate and skin conductance in behaviorally inhibited mauritian children. *Journal of Abnormal Psychology, 106*(2), 182-190.

Schatzberg, A. F., Samson, J. A., Rothschild, A. J., Bond, T. C., & Regier, D. A. (1998). McLean hospital depression research facility: Early-onset phobic disorders and adult-onset major depression. *The British Journal of Psychiatry.Supplement, (34)*(34), 29-34.

Schiefelbein, V. L., & Susman, E. J. (2006). Cortisol levels and longitudinal cortisol change as predictors of anxiety in adolescents. *The Journal of Early Adolescence, 26*(4), 397-413. doi:http://dx.doi.org/10.1177/0272431606291943

Schmidt, L. A., Fox, N. A., Rubin, K. H., Sternberg, E. M., Gold, P. W., Smith, C. C., & Schulkin, J. (1997). Behavioral and neuroendocrine responses in shy children. *Developmental Psychobiology, 30*(2), 127-140.

Schneier, F. R., Heckelman, L. R., Garfinkel, R., Campeas, R., Fallon, B. A., Gitow, A., . . . Liebowitz, M. R. (1994). Functional impairment in social phobia. *The Journal of Clinical Psychiatry*, *55*(8), 322-331.

Schneier, F. R., Johnson, J., Hornig, C. D., Liebowitz, M. R., & Weissman, M. M. (1992). Social phobia. comorbidity and morbidity in an epidemiologic sample. *Archives of General Psychiatry*, *49*(4), 282-288.

Schommer, N. C., Hellhammer, D. H., & Kirschbaum, C. (2003). Dissociation between reactivity of the hypothalamus-pituitary-adrenal axis and the sympathetic-adrenal-medullary system to repeated psychosocial stress. *Psychosomatic Medicine*, *65*(3), 450-460.

Schwartz, C. E., Snidman, N., & Kagan, J. (1999). Adolescent social anxiety as an outcome of inhibited temperament in childhood. *Journal of the American Academy of Child and Adolescent Psychiatry*, *38*(8), 1008-1015. doi:10.1097/00004583-199908000-00017

Scrimshaw, S. V., & Maher, C. (2001). Responsiveness of visual analogue and McGill pain scale measures. *Journal of Manipulative and Physiological Therapeutics*, *24*(8), 501-504. doi:10.1067/mmt.2001.118208

Segal, Z. V., Williams, J. M., & Teasdale, J. D. (2002). *Mindfulness-based cognitive therapy for depression – a new approach to preventing relapse*. US: Guilford Press.

Shamir-Essakow, G., Ungerer, J. A., & Rapee, R. M. (2005). Attachment, behavioral inhibition, and anxiety in preschool children. *Journal of Abnormal Child Psychology*, *33*(2), 131-143.

Shields, M. (2004). Social anxiety disorder--beyond shyness. *Health Reports / Statistics Canada, Canadian Centre for Health Information, 15 Suppl*, 45-61.

Shortt, A. L., Barrett, P. M., Dadds, M. R., & Fox, T. L. (2001). The influence of family and experimental context on cognition in anxious children. *Journal of Abnormal Child Psychology*, *29*(6), 585-596.

Sideridis, G. D., & Kafetsios, K. (Mar 2008). Perceived parental bonding, fear of failure and stress during class presentations. *International Journal of Behavioral Development*, *32*(2), 119-130. doi:http://dx.doi.org/10.1177/0165025407087210

Siegmund, A., Koster, L., Meves, A. M., Plag, J., Stoy, M., & Strohle, A. (2011). Stress hormones during flooding therapy and their relationship to therapy outcome in patients with panic disorder and agoraphobia. *Journal of Psychiatric Research, 45*(3), 339-346. doi:10.1016/j.jpsychires.2010.07.002

Silove, D., Parker, G., Hadzi-Pavlovic, D., Manicavasagar, V., & Blaszczynski, A. (1991). Parental representations of patients with panic disorder and generalised anxiety disorder. *The British Journal of Psychiatry : The Journal of Mental Science, 159*, 835-841.

Silverman W. K., & Albano A. M. (1996). *The anxiety disorders interview schedule for DSM-IV-child version.* Physiological Corporation, San Antonio.

Siqueland, L., Kendall, P. C., & Steinberg, L. (1996). Anxiety in children: Perceived family environments and observed family interaction. *Journal of Clinical Child Psychology, 25*(2), 225-237. doi:http://dx.doi.org/10.1207/s15374424jccp2502_12

Smider, N. A., Essex, M. J., Kalin, N. H., Buss, K. A., Klein, M. H., Davidson, R. J., & Goldsmith, H. H. (2002). Salivary cortisol as a predictor of socioemotional adjustment during kindergarten: A prospective study. *Child Development, 73*(1), 75-92.

Smoller, J. W., Block, S. R., & Young, M. M. (2009). Genetics of anxiety disorders: The complex road from DSM to DNA. *Depression and Anxiety, 26*(11), 965-975. doi:10.1002/da.20623; 10.1002/da.20623

Spada, M. M., Caselli, G., Manfredi, C., Rebecchi, D., Rovetto, F., Ruggiero, G. M., . . . Sassaroli, S. (2012). Parental overprotection and metacognitions as predictors of worry and anxiety. *Behavioural and Cognitive Psychotherapy, 40*(3), 287-296. doi:10.1017/S135246581100021X [doi]

Stangier, U., Heidenreich, T., Peitz, M., Lauterbach, W., & Clark, D. M. (2003). Cognitive therapy for social phobia: Individual versus group treatment. *Behaviour Research and Therapy, 41*(9), 991-1007.

Stansbury, K., & Gunnar, M. R. (1994). Adrenocortical activity and emotion regulation. In : Fox, N. A. (Ed.), *The Development of Emotion Regulation*. Chicago: University of Chicago Press.

Stein, M. B., & Asmundson, G. J. (1994). Autonomic function in panic disorder: Cardiorespiratory and plasma catecholamine responsivity to multiple challenges of the autonomic nervous system. *Biological Psychiatry, 36*(8), 548-558.

Stein, M. B., & Deutsch, R. (2003). In search of social phobia subtypes: Similarity of feared social situations. *Depression and Anxiety, 17*(2), 94-97. doi:10.1002/da.10093

Stein, M. B., & Kean, Y. M. (2000). Disability and quality of life in social phobia: Epidemiologic findings. *The American Journal of Psychiatry, 157*(10), 1606-1613.

Stein, M. B., McQuaid, J. R., Laffaye, C., & McCahill, M. E. (1999). Social phobia in the primary care medical setting. *The Journal of Family Practice, 48*(7), 514-519.

Stein, M. B., & Stein, D. J. (2008). Social anxiety disorder. *Lancet, 371*(9618), 1115-1125. doi:10.1016/S0140-6736(08)60488-2

Stein D., Williamson D. E., Birmaher B., Brent D. A., Kaufman J., Dahl R. E., Perel J. M., & Ryan N. D. (2000). Parent–child bonding and family functioning in depressed children and children at high risk and low risk for future depression. *Journal of the American Academy of Child & Adolescent Psychiatry, 39* (11), 1387–1395. doi:10.1097/00004583-200011000-00013

Steiner, M., & Streiner, D. L. (2005). Validation of a revised visual analog scale for premenstrual mood symptoms: Results from prospective and retrospective trials. *Canadian Journal of Psychiatry.Revue Canadienne De Psychiatrie, 50*(6), 327-332.

Sternberg, E. M., Hill, J. M., Chrousos, G. P., Kamilaris, T., Listwak, S. J., Gold, P. W., & Wilder, R. L. (1989). Inflammatory mediator-induced hypothalamic-pituitary-adrenal axis activation is defective in streptococcal cell wall arthritis-susceptible lewis rats. *Proceedings of the National Academy of Sciences of the United States of America, 86*(7), 2374-2378.

Stevenson-Hinde, J., & Glover, A. (1996). Shy girls and boys: A new look. *Journal of Child Psychology and Psychiatry, and Allied Disciplines, 37*(2), 181-187.

Stevenson-Hinde, J., & Marshall, P. J. (1999). Behavioral inhibition, heart period, and respiratory sinus arrhythmia: An attachment perspective. *Child Development, 70*(4), 805-816.

Stopa, L., & Clark, D. M. (1993). Cognitive processes in social phobia. *Behaviour Research and Therapy, 31*(3), 255-267.

Sung, J., Woo, J. M., Kim, W., Lim, S. K., & Chung, E. J. (2012). The effect of cognitive behavior therapy-based "forest therapy" program on blood pressure, salivary cortisol level, and quality of life in elderly hypertensive patients. *Clinical and Experimental Hypertension (New York, N.Y.: 1993), 34*(1), 1-7. doi:10.3109/10641963.2011.618195; 10.3109/10641963.2011.618195

Swinson, R. P. (2005). Social anxiety disorder. *Canadian Journal of Psychiatry.Revue Canadienne De Psychiatrie, 50*(6), 305-307.

Tabachnick, B. G., & Fidell, L. S. (2007). *Experimental Design Using ANOVA.* US: Duxbury.

Talge, N. M., Donzella, B., & Gunnar, M. R. (2008). Fearful temperament and stress reactivity among preschool-aged children. *Infant and Child Development, 17*(4), 427-445. doi:10.1002/icd.585

Tani, F., Ponti, L., & Smorti, M. (2014). Shyness and psychological adjustment during adolescence: The moderating role of parenting style. *The Open Psychology Journal, 7 Jun,* Art 33-44; 12. doi:http://dx.doi.org/10.2174/1874350101407010033

Tarullo, A. R., Mliner, S., & Gunnar, M. R. (2011). Inhibition and exuberance in preschool classrooms: Associations with peer social experiences and changes in cortisol across the preschool year. *Developmental Psychology, 47*(5), 1374-1388. doi:10.1037/a0024093; 10.1037/a0024093

Taylor, C. B., Conrad, A., Wilhelm, F. H., Strachowski, D., Khaylis, A., Neri, E., . . . Spiegel, D. (2009). Does improving mood in depressed patients alter factors that may affect cardiovascular disease risk? *Journal of*

Psychiatric Research, 43(16), 1246-1252. doi:10.1016/j.jpsychires.2009.05.006; 10.1016/j.jpsychires.2009.05.006

Taylor, S. (1996). Meta-analysis of cognitive-behavioral treatments for social phobia. *Journal of Behavior Therapy and Experimental Psychiatry, 27*(1), 1-9.

Thase, M. E., Simons, A. D., & Reynolds, C. F.,3rd. (1993). Psychobiological correlates of poor response to cognitive behavior therapy: Potential indications for antidepressant pharmacotherapy. *Psychopharmacology Bulletin, 29*(2), 293-301.

Toneatto, T., & Nguyen, L. (2007). Does mindfulness meditation improve anxiety and mood symptoms? A review of the controlled research. *Canadian Journal of Psychiatry.Revue Canadienne De Psychiatrie, 52*(4), 260-266.

Tsaousis, I., Mascha, K., & Giovazolias, T. (2012). Can parental bonding be assessed in children? factor structure and factorial invariance of the parental bonding instrument (PBI) between adults and children. *Child Psychiatry and Human Development, 43*(2), 238-253. doi:10.1007/s10578-011-0260-3 [doi]

Tsigos, C., & Chrousos, G. P. (2002). Hypothalamic-pituitary-adrenal axis, neuroendocrine factors and stress. *Journal of Psychosomatic Research, 53*(4), 865-871. doi:S0022399902004294 [pii]

Turgeon, L., O'Connor, K. P., Marchand, A., & Freeston, M. H. (2002). Recollections of parent-child relationships in patients with obsessive-compulsive disorder and panic disorder with agoraphobia. *Acta Psychiatrica Scandinavica, 105*(4), 310-316. doi:1188 [pii]

Turner, S. M., Beidel, D. C., & Jacob, R. G. (1994). Social phobia: A comparison of behavior therapy and atenolol. *Journal of Consulting and Clinical Psychology, 62*(2), 350-358.

Turner, S. M., Beidel, D. C., Wolff, P. L., Spaulding, S., & Jacob, R. G. (1996). Clinical features affecting treatment outcome in social phobia. *Behaviour Research and Therapy, 34*(10), 795-804.

Uhde, T. W., Tancer, M. E., Gelernter, C. S., & Vittone, B. J. (1994). Normal urinary free cortisol and postdexamethasone cortisol in social phobia: Comparison to normal volunteers. *Journal of Affective Disorders, 30*(3), 155-161.

van Brunt, D. L. (2000). Modular cognitive-behavioral therapy: Dismantling validated treatment programs into self-standing treatment plan objectives. *Cognitive and Behavioral Practice, 7*(2), 156-165.

van der Bruggen, C. O., Stams, G. J., & Bogels, S. M. (2008). Research review: The relation between child and parent anxiety and parental control: A meta-analytic review. *Journal of Child Psychology and Psychiatry, and Allied Disciplines, 49*(12), 1257-1269. doi:10.1111/j.1469-7610.2008.01898.x [doi]

van Veen, J. F., van Vliet, I. M., Derijk, R. H., van Pelt, J., Mertens, B., & Zitman, F. G. (2008). Elevated alpha-amylase but not cortisol in generalized social anxiety disorder. *Psychoneuroendocrinology, 33*(10), 1313-1321. doi:10.1016/j.psyneuen.2008.07.004; 10.1016/j.psyneuen.2008.07.004

van Velzen, C. J., Emmelkamp, P. M., & Scholing, A. (1997). The impact of personality disorders on behavioral treatment outcome for social phobia. *Behaviour Research and Therapy, 35*(10), 889-900.

Vassilopoulos, S. (2005). Social anxiety and the effects of engaging in mental imagery. *Cognitive Therapy and Research, 29*(3), 261-277.

Vega, W. A., Kolody, B., Aguilar-Gaxiola, S., Alderete, E., Catalano, R., & Caraveo-Anduaga, J. (1998). Lifetime prevalence of DSM-III-R psychiatric disorders among urban and rural mexican americans in california. *Archives of General Psychiatry, 55*(9), 771-778.

Vicente, B., Kohn, R., Rioseco, P., Saldivia, S., Levav, I., & Torres, S. (2006). Lifetime and 12-month prevalence of DSM-III-R disorders in the chile psychiatric prevalence study. *The American Journal of Psychiatry, 163*(8), 1362-1370. doi:10.1176/appi.ajp.163.8.1362

Vocks, S., Legenbauer, T., Wachter, A., Wucherer, M., & Kosfelder, J. (2007). What happens in the course of body exposure? emotional, cognitive, and physiological reactions to mirror confrontation in eating disorders. *Journal of Psychosomatic Research, 62*(2), 231-239. doi:10.1016/j.jpsychores.2006.08.007

Vriends, N., Becker, E. S., Meyer, A., Michael, T., & Margraf, J. (2007). Subtypes of social phobia: Are they of any use? *Journal of Anxiety Disorders, 21*(1), 59-75. doi:10.1016/j.janxdis.2006.05.002

Weinstein, N., Brown, K. W., & Ryan, R. M. (2009). A multi-method examination of the effects of mindfulness on stress attribution, coping, and emotional well-being. *Journal of Research in Personality, 43*(3), 374-385.

Weissman, M. M., Wickramaratne, P., Nomura, Y., Warner, V., Pilowsky, D., & Verdeli, H. (2006). Offspring of depressed parents: 20 years later. *The American Journal of Psychiatry, 163*(6), 1001-1008. doi:10.1176/appi.ajp.163.6.1001

Weisz, J. R., Chorpita, B. F., Palinkas, L. A., Schoenwald, S. K., Miranda, J.,. . . Gibbons, R. D. (2012). Testing standard and modular designs for psychotherapy treating depression, anxiety, and conduct problems in youth: A randomized effectiveness trial. *Archives of General Psychiatry, 69*(3), 274-282. doi:http://dx.doi.org/10.1001/archgenpsychiatry.2011.147

Wewers, M. E., & Lowe, N. K. (1990). A critical review of visual analogue scales in the measurement of clinical phenomena. *Research in Nursing & Health, 13*(4), 227-236.

Whaley, S. E., Pinto, A., & Sigman, M. (1999). Characterizing interactions between anxious mothers and their children. *Journal of Consulting and Clinical Psychology, 67*(6), 826-836.

Williams, L. R., Degnan, K. A., Perez-Edgar, K. E., Henderson, H. A., Rubin, K. H.,. . . Fox, N. A. (2009). Impact of behavioral inhibition and parenting style on internalizing and externalizing problems from early childhood through adolescence. *Journal of Abnormal Child Psychology, 37*(8), 1063-1075. doi:10.1007/s10802-009-9331-3 [doi]

Williams, V. S., Morlock, R. J., & Feltner, D. (2010). Psychometric evaluation of a visual analog scale for the assessment of anxiety. *Health and Quality of Life Outcomes, 8*, 57-7525-8-57. doi:10.1186/1477-7525-8-57; 10.1186/1477-7525-8-57

Witek-Janusek, L., Albuquerque, K., Chroniak, K. R., Chroniak, C., Durazo-Arvizu, R., & Mathews, H. L. (2008). Effect of mindfulness based stress reduction on immune function, quality of life and coping in women newly diagnosed with early stage breast cancer. *Brain, Behavior, and Immunity, 22*(6), 969-981. doi:10.1016/j.bbi.2008.01.012

Wittchen, H. U., Essau, C. A., von Zerssen, D., Krieg, J. C., & Zaudig, M. (1992). Lifetime and six-month prevalence of mental disorders in the munich follow-up study. *European Archives of Psychiatry and Clinical Neuroscience, 241*(4), 247-258.

Wittchen, H. U., & Fehm, L. (2003). Epidemiology and natural course of social fears and social phobia. *Acta Psychiatrica Scandinavica, 108*(Supplement 417), 4-18.

Wittchen, H. U., Fuetsch, M., Sonntag, H., Muller, N., & Liebowitz, M. (2000). Disability and quality of life in pure and comorbid social phobia. findings from a controlled study. *European Psychiatry : The Journal of the Association of European Psychiatrists, 15*(1), 46-58.

Wittchen, H. U., Kessler, R. C., Pfister, H., & Lieb, M. (2000). Why do people with anxiety disorders become depressed? A prospective-longitudinal community study. *Acta Psychiatrica Scandinavica.Supplementum, (406)*(406), 14-23.

Wittchen, H. U., Nelson, C. B., & Lachner, G. (1998). Prevalence of mental disorders and psychosocial impairments in adolescents and young adults. *Psychological Medicine, 28*(1), 109-126.

Wolpe, J. (1990). The practice of behavior therapy (4th ed.). *The Practice of Behavior Therapy (4th Ed.).Xvi, 421 Pp*, Elmsford, NY, US: Pergamon Press; US

Wood, J. J., McLeod, B. D., Sigman, M., Hwang, W. C., & Chu, B. C. (2003). Parenting and childhood anxiety: Theory, empirical findings, and future directions. *Journal of Child Psychology and Psychiatry, and Allied Disciplines, 44*(1), 134-151.

Woodman, C. L., Noyes, R.,Jr, Black, D. W., Schlosser, S., & Yagla, S. J. (1999). A 5-year follow-up study of generalized anxiety disorder and panic disorder. *The Journal of Nervous and Mental Disease, 187*(1), 3-9.

Xu, Y., Schneier, F., Heimberg, R. G., Princisvalle, K., Liebowitz, M. R., Wang, S., & Blanco, C. (2012). Gender differences in social anxiety disorder: Results from the national epidemiologic sample on alcohol and related conditions. *Journal of Anxiety Disorders, 26*(1), 12-19. doi:10.1016/j.janxdis.2011.08.006 [doi]

Yonkers, K. A., Bruce, S. E., Dyck, I. R., & Keller, M. B. (2003). Chronicity, relapse, and illness--course of panic disorder, social phobia, and generalized anxiety disorder: Findings in men and women from 8 years of follow-up. *Depression and Anxiety, 17*(3), 173-179. doi:10.1002/da.10106

Yoon, K. L., & Joormann, J. (2012). Stress reactivity in social anxiety disorder with and without comorbid depression. *Journal of Abnormal Psychology, 121*(1), 250-255. doi:10.1037/a0025079; 10.1037/a0025079

Zgierska, A., Rabago, D., Zuelsdorff, M., Coe, C. Miller, M., Fleming, M. (2008). Mindfulness meditation for alcohol relapse prevention: A feasibility pilot study. *Journal of Addiction Medicine, 2*(3), 165-173.

Zimmermann, L. K., & Stansbury, K. (2004). The influence of emotion regulation, level of shyness, and habituation on the neuroendocrine response of three-year-old children. *Psychoneuroendocrinology, 29*(8), 973-982. doi:10.1016/j.psyneuen.2003.09.003 [doi]