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Avoidance and Depression: Evidence for Reinforcement as a Mediating Factor

A Dissertation  
Presented for  
the Doctor of Philosophy  
Degree  
The University of Tennessee, Knoxville

John Paul Carvalho  
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### **Abstract**

Behavioral Activation theory (Martell, Addis, & Jacobson, 2001) posits that a pattern of excessive use of avoidant coping strategies removes an individual from environmental sources of reward and reinforcement and subsequently leads to the development (or maintenance) of depressive symptoms. This investigation examined this theory by establishing measures of environmental reward as mediators between avoidance and depression, while further demonstrating that there is a strong connection between avoidance and depression independent of anxiety. Reward was measured by both self-report questionnaire (Reward Probability Inventory; Carvalho et al., under review) and daily activity diary ratings (Hopko, Bell, Armento, Hunt, & Lejuez, 2003), which were considered proxy measures for positive reinforcement. Avoidance was primarily assessed with the Cognitive-Behavioral Avoidance Scale (CBAS; Ottenbreit & Dobson, 2004), which distinguishes between cognitive and behavioral avoidance. When anxiety was controlled, reward significantly mediated the relationships between depression and cognitive, behavioral, and total avoidance. However, when structural equation modeling incorporating latent variables for avoidance and reward tested the same model, reward was not a mediator. In post-hoc mediation analyses, gender differences emerged whereby among females, diary-measured reward only mediated the relation between cognitive avoidance and depression when anxiety was controlled, while in males diary reward was a mediator with all three forms of avoidance. This investigation, while producing mixed results overall, provides initial support for the proposed mediating role of reinforcement in the relationship between avoidance and

depression and further highlights the relevance of avoidance and reinforcement in the conceptualization of depression.

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## **Introduction**

Behavioral theories explain the development and persistence of depressive symptoms as the result of decreases in environmental reward, associated reductions in positively reinforced healthy behavior, reinforcement of depressive or passive behaviors, and punishment of healthy alternative behaviors (Ferster, 1973; Lewinsohn, 1974; Lewinsohn, Sullivan, & Grosscup, 1980; Martell, Addis, & Jacobson, 2001; Rose & Staats, 1988). Cognitions and behaviors that serve an avoidant function are thought to be critical precursors to the reductions of reward and positive reinforcement that predispose people to depression (Ferster, 1973; Martell et al., 2001). The construct of avoidance can be defined as an individual's attempt to prevent, escape, or reduce contact with subjectively aversive or minimally rewarding internal or external stimuli. These aversive stimuli can come in different forms, including thoughts, behaviors, emotions, memories, and social interactions (Cloninger, 1987; Hayes, Wilson, Gifford, Follette, & Strosahl, 1996; Ottenbreit & Dobson, 2004). Avoidance can be either a covert (e.g., cognitive or experiential avoidance) or overt (e.g., behavioral avoidance) process that an individual employs in order to reduce the frequency or alter the subjective experience of unpleasant events or the situations that produce them. Avoidance can take either an active (e.g., overt escape behavior) or a passive (e.g., failure to act) form (Hayes et al., 1996; Ottenbreit & Dobson, 2004). In behavioral conceptualizations, behavior aimed at escaping or avoiding negative stimuli leads to a pattern of passivity and withdrawal that reduces the frequency and intensity of positively reinforced behavior, which in turn produces and/or increases depressive symptoms. In other words, according to these theories there is a relationship between avoidance and depression that is

largely explained by the mediating role of reduced positive reinforcement (Ferster, 1973; Lewinsohn, 1974; Martell et al., 2001).

Indeed, while avoidance is a necessary and adaptive human function in many situations (e.g. fight-or-flight response; Cannon, 1929; Gray, 1988), clinicians and researchers have long recognized the potential for over-reliance on avoidance behaviors to play a central role in eliciting and maintaining psychological impairment (e.g., Freud, 1924). Consistent with behavioral conceptualizations, excessive avoidance has been implicated in a variety of emotional and behavioral problems, particularly depressive and anxiety disorders (Barlow, 2002; Chawla & Ostafin, 2007; Ottenbreit & Dobson, 2004).

The majority of the research on avoidance has focused on its role in the etiology and maintenance of anxiety disorders (Barlow, 2002). While comparatively less attention has been given to how avoidance may relate to depression, there is support that this relationship exists and is important in the conceptualization and treatment of depression. Much of this evidence comes from literature on coping strategies and psychobiological temperament. These different disciplines have somewhat varied definitions and conceptualizations of avoidance, but they still describe the phenomenon of avoiding aversive stimuli as a contributing factor to depressive symptomatology. Furthermore, the psychotherapy literature and treatment outcome studies provide additional support for avoidance as an integral component of depression. The literature regarding the role of avoidance in depression will be reviewed below, followed by a more detailed explication of behavioral theorists' understanding of this relationship and the potential mediating role of reinforcement.

#### *Avoidance Coping and Depression*

Coping processes are the responses individuals make to psychological distress or stressful life situations in order to manage, reduce, or eliminate stress (Cronkite & Moos, 1995). Coping processes can have a focus that is based on either approaching or avoiding the problem and a method that is primarily either cognitive or behavioral, making up four basic types of coping strategies: cognitive approach, behavioral approach, cognitive avoidance, and behavioral avoidance (Moos & Schaefer, 1993). According to coping theory, approach coping involves confronting a problem and taking active steps to resolve it. Avoidance coping, on the other hand, consists of focusing attention away from the problem being experienced. More specifically, cognitive avoidance coping represents denying or minimizing a stressful situation while passively deciding that nothing can be done to change it. Behavioral avoidance coping occurs when a problem is avoided through participation in alternative activities, adoption of temporarily satisfying albeit maladaptive behaviors such as substance use, gambling, or binge eating, or through openly venting unpleasant emotions of anger and despair (e.g., yelling or shouting at others). Such alternative behaviors may seem rewarding and reduce tension momentarily, but also often have negative consequences such as the maintenance and exacerbation of psychological distress (Cronkite & Moos, 1995).

Individuals who endorse greater frequency and severity of depression symptoms in clinical (Kuyken & Brewin, 1994; Satija, Advani, & Nathawat, 1997; Spurrell & McFarlane, 1995; Turner, King, & Tremblay, 1992), nonclinical (Connor-Smith & Compas, 2002; Folkman & Lazarus, 1986; Gomez & McLaren, 2006; Mitchell & Hodson, 1983; Penland, Masten, Zelhart, Fournet, & Callahan, 2000), and medical (Alexander-Passe, 2006; Arnett, Higginson, Voss, Randolph, & Grandey, 2002; Fukunishi, 1996; Fukunishi, Hosaka, Negishi, & Moriya, 1997; Mytko et al., 1996; Spangenberg & Campbell, 1999) samples report that

they are more likely to employ escape and avoidance coping strategies in the presence of stress. Euthymic individuals with a previous history of depression rely more on cognitive and behavioral avoidance coping strategies than never depressed control groups (Ingram, Trenary, Odom, Berry, & Nelson, 2007).

Longitudinal investigations of this relationship have indicated that a tendency to employ avoidance coping strategies contributes to maintenance of depression symptoms and may precede the onset of depression. A composite stress-resistance factor comprised of infrequent use of avoidant coping, self-confidence, an easy-going disposition, and family support protected against the development of depression and psychosomatic symptoms at one-year follow-up in a community sample of about 500 randomly selected men and women (Holahan & Moos, 1986). One year (Krantz & Moos, 1988) and ten year (Cronkite, Moos, Twohey, Cohen, & Swindle, 1998) longitudinal investigations have shown that avoidance coping is one of several factors that increases the risk of non-remission or partial remission from unipolar depression.

In a 10-year longitudinal study, Holahan and colleagues investigated the role of life stressors in the relationship between avoidance coping and depression in a large sample of adults (Holahan, Moos, Holahan, Brennan, & Schutte, 2005). Those who rated higher in avoidance coping at baseline were more likely to experience chronic and acute stressors over the next four years, as well as greater depression symptom severity at 10-year follow-up. Further, the relationship between avoidance and the development of depression symptoms was mediated by the cumulative occurrence of life stressors over the first four years, even when controlling for baseline depression. These results indicate that avoidant coping may exacerbate problems and create further stress, which in turn increases risk for the onset of

depression symptoms. This finding is consistent with Ferster's (1973) behavioral model of avoidance, which maintains that avoidance behavior restricts access to environmental reward and potentially increases punishing experiences, which consequently serves as a catalyst for the development of depression. Accordingly, stressful life events may represent removal from reward and exposure to punishment (Lewinsohn et al., 1980). The passivity and failure to respond that Ferster associates with avoidance may help explain the observed increase in stressful life circumstances, as problems and stressors are thought to be exacerbated when appropriate steps are not taken to resolve them (Davila, 1993; Holahan et al., 2005; Nezu, Nezu, & Perri, 1989).

#### *Cognitive Versus Behavioral Avoidance*

Avoidance coping can be either a cognitive or behavioral process (Cronkite & Moos, 1995). Blalock and Joiner (2000) investigated this categorization of avoidant coping by performing confirmatory factor analysis on the Coping Responses Inventory (Moos, 1988). Cognitive avoidance coping and behavioral avoidance coping emerged as two distinct constructs. Further, cognitive avoidance coping interacted with life stress and gender to predict increases in depression and anxiety over a three week period. High cognitive avoidance in combination with negative life events led to increases in depression and anxiety in women, but not in men. This interaction was significant only with cognitive avoidance (i.e., not behavioral avoidance). Important to note, however, the authors did not test possible main effects between behavioral (or cognitive) avoidance and depression symptoms, as they were more directly concerned with the moderating effects of gender and coping style on the relationship between life stressors and depression.

These results suggest a need to examine cognitive and behavioral avoidance separately. They also point to possible gender differences in the function and psychological outcomes of coping style. In the Blalock and Joiner (2000) study, there were no group differences between males and females in the use of cognitive or behavioral avoidance or in the number of reported negative life events. Gender differences only emerged when these variables were examined as an interaction in predicting depression, indicating that women who respond to stress with cognitive avoidance coping are at higher risk for depression than men who rely on the same coping style (Blalock & Joiner, 2000). Further research is necessary to better understand this finding.

Rumination is an internal process that can be considered a form of avoidance. Depressive rumination, a pattern of repetitively thinking about causes and implications of depressive symptoms, is considered by behavioral theorists to be an escape or avoidance behavior that promotes passivity and prevents adaptive problem solving and access to social reinforcement (Martell et al., 2001). According to Behavioral Activation theory (BA; Martell et al., 2001), rumination is different in structure from other avoidance methods, such as social withdrawal, but serves the same function in that it removes an individual from healthy environmental reinforcement contingencies. The thoughts that characterize rumination are considered to be repetitive and unproductive. The more time that is spent engaging in ruminative thought, the less time an individual interacts socially or effectively takes steps to solve distressing problems. In other words, according to BA, rumination is a form of avoidance that removes an individual from healthy behavior and associated reinforcement and contributes to withdrawal, passivity, and related depression symptomatology (Martell et al., 2001; Moulds, Kandris, Starr, & Wong, 2007). Consistent with this theory, rumination,

especially of the negatively focused brooding variety, has been found to occur concurrently with depression and also appears to contribute to depression onset and maintenance (Nolen-Hoeksema, 2000; Nolen-Hoeksema, Morrow, & Fredrickson, 1993; Treynor, Gonzalez, & Nolen-Hoeksema, 2003). A related conceptualization of rumination postulates that this repetitive thought pattern serves to protect an individual from emotionally and physiologically distressing visual imagery (Moulds et al., 2007; Watkins & Moulds, 2007). According to this hypothesis, rumination is a cognitive form of avoidance that is also conceptually similar to experiential avoidance (Hayes et al., 2004), in that it helps an individual avoid aversive emotional experiences.

Two published studies have specifically looked at the relationships between rumination, avoidance, depression, and anxiety. These investigations aimed to support the avoidance function of rumination proposed by the two theories stated above by demonstrating relationships between rumination and cognitive, behavioral, and experiential avoidance. Using the Cognitive-Behavioral Avoidance Scale (CBAS; Ottenbreit & Dobson, 2004) to measure cognitive and behavioral avoidance and the Acceptance and Action Questionnaire (AAQ; Hayes et al., 2004) to assess experiential avoidance, Cribb, Moulds, and Carter (2006) demonstrated that cognitive, behavioral, and experiential avoidance were all significantly correlated with one another and with rumination and depression, even when controlling for anxiety. Moulds et al. (2007) observed similar results, although the relationship between cognitive avoidance and rumination did not remain significant after controlling for anxiety, even though the relationship between behavioral avoidance and rumination did remain significant when anxiety was taken into account. Both cognitive and

behavioral avoidance continued to be associated with depression symptom severity independent of anxiety. Experiential avoidance was not assessed in this study.

The authors explained the discrepancy in the rumination-cognitive avoidance relationship as a result of some items on the cognitive avoidance scale identifying a tendency to “not think” about aversive topics. Rumination, on the other hand, involves repetitively thinking about sources of distress. It is through excessive cognition that attention is averted from unpleasant emotions and environmental sources of distress (Eysenck & Calvo, 1992). In this way, rumination acts as a form of avoidance (Moulds et al., 2007). Therefore, the authors considered the results supportive of the avoidance function of rumination as hypothesized by BA (Martell et al., 2001) and Watkins and Moulds (2007). These two studies not only provide support for the behavioral conceptualization of rumination as an avoidance strategy, but also indicate that the relationship between depression and avoidance is not merely a function of comorbid anxiety symptoms. Further, the latter study underscores the importance of discriminating between cognitive and behavioral avoidance as two distinct constructs.

#### *Harm Avoidance and Depression*

Cloninger’s psychobiological model of temperament and character (Cloninger, 1987) identifies three genetic temperament dimensions that are independently heritable, become evident in early childhood, and are each related to a specific neurotransmitter. Harm avoidance (HA) is one such dimension that is characterized by a tendency to inhibit behavior in response to aversive stimuli in order to avoid punishment, novelty, and nonreward. Excessive HA hinders both novelty-seeking and reward-seeking behavior, so that rather than experiencing positive reinforcement contingencies, active behaviors are extinguished and a pattern of passive avoidance ensues. High HA is hypothesized to be associated with tension,

worry, pessimism, behavioral inhibition, social withdrawal, and fatigability. In healthy adults, HA appears to be a generally stable trait characteristic (Cloninger, 1987).

There has been strong and consistent support for a positive relationship between HA and depression. Using self-report personality instruments developed by Cloninger to identify temperament dimensions (Cloninger, Przybeck, Svrakic, & Wetzel, 1994; Cloninger, Przybeck, & Svrakic, 1991), cross-sectional, longitudinal, and treatment outcome designs have demonstrated that depressed individuals rate higher on HA than nondepressed controls and that there is a positive relationship between HA and depression severity in both clinical and nonclinical samples (Agosti & McGrath, 2002; Cheung & Todd-Oldehaver, 2006; Cloninger, Svrakic, & Przybeck, 2006; Farmer et al., 2003; Hansenne, Pitchot, Gonzalez Moreno, Machurot, & Ansseau, 1998; Hansenne et al., 1997; Hansenne et al., 1999; Josefsson, Larsson, Sydsjo, & Nylander, 2007; Jylha & Isometsa, 2006; Mulder, Joyce, Frampton, Luty, & Sullivan, 2006; Nelson & Cloninger, 1997; Ono et al., 2002; Richter, Eisemann, & Richter, 2000). Even though elevated HA is associated with anxiety disorders (Kennedy, Schwab, & Hyde, 2001; Starcevic, Uhlenhuth, Fallon, & Pathak, 1996), the relationship between HA and depression persists when controlling for anxiety symptoms (Tanaka, Sakamoto, Kijima, & Kitamura, 1998).

HA, while often considered a stable personality trait, appears to fluctuate with depression symptoms as a state-dependent factor. Treatment outcome studies examining the effects of antidepressant medications have noted that HA is diminished in treatment responders as depression symptoms are alleviated (Agosti & McGrath, 2002; Chien & Dunner, 1996; Corruble, Duret, Pelissolo, Falissard, & Guelfi, 2002; Hirano et al., 2002; Joffe, Bagby, Levitt, & Regan, 1993; Richter et al., 2000). Abrams et al. (2004), for example,

observed HA patterns in a treatment-outcome study comparing individuals with major depression, dysthymia, depressive personality disorder, and healthy controls. All depressed participants rated higher in HA than controls both before and after 12 weeks of antidepressant treatment. However, HA was reduced significantly in those depressed participants who responded to treatment. Further, consistent with additional findings (Joffe et al., 1993; Joyce, Mulder, & Cloninger, 1994; Mulder et al., 2006; Nelsen & Dunner, 1995; Nelson & Cloninger, 1995), higher HA at baseline was predictive of poorer treatment response, indicating that avoidant tendencies may negatively influence treatment outcome as well as contribute to the maintenance of depression symptoms.

Importantly, there also is evidence that HA is related to the onset of depression symptoms. In a large community sample, high baseline HA was strongly predictive of depression symptoms at one-year follow-up even when controlling for age, gender, and treatment variables, suggesting HA may represent an emotional vulnerability to the development of depression (Cloninger et al., 2006). Similarly, twin studies have offered support for HA as a genetic vulnerability to depression (Farmer et al., 2003; Ono et al., 2002). Elevated HA also persists in euthymic individuals who are in remission from depression, further suggesting the possibility that increased HA represents a depression vulnerability (Smith, Duffy, Stewart, Muir, & Blackwood, 2005).

Taken together, data from the coping and temperament literatures suggest that avoidance has both state and trait properties, is concurrently related to the presence and severity of depression diagnosis and symptoms, predicts poorer depression treatment outcome, may represent a vulnerability to the development of depression symptoms, and can be categorized as either a cognitive or behavioral coping strategy. Therefore, consistent with

Ferster's (1973) behavioral conceptualization, overreliance on avoidance may be integrally related to depression, contributing to onset, maintenance, and severity of depression symptoms.

*Evidence for the Avoidance-Depression Relationship from the Psychotherapy Literature*

The relevance of avoidance in psychopathology has been a consistent theme in contemporary psychotherapy literature. A number of prominent clinical theories and associated treatment interventions have described the influence that avoidant cognitive processes and behavior can have on emotional symptoms and the importance of addressing this avoidance through psychological treatment. Problem-solving therapy (Nezu et al., 1989) suggests that avoidance of depression-inducing problems as well as avoiding implementation of potential solutions to these problems can exacerbate issues and prolong and intensify depression. Research on problem-solving strategies supports this hypothesis (D'Zurilla, Chang, Nottingham, & Faccini, 1998; Nezu & Ronan, 1988). Wachtel (1993) considers avoidance of anxiety-related symptoms to be a primary underlying determinant of psychopathology and exposure to this anxiety a necessary component of successful psychotherapy. In their unified treatment approach to emotional disorders, Barlow and colleagues identified the prevention of emotional avoidance as a fundamental therapeutic component to treatment (Barlow, Allen, & Choate, 2004). Beutler (2000) described exposing clients to sources of behavioral and emotional avoidance as one of the eight optimal and enhancing guidelines to empirically informed psychological interventions.

In recent years, a number of therapeutic interventions have focused on the reduction of experiential avoidance as a primary treatment goal. Experiential avoidance refers to the avoidance of "private experiences," including thoughts, emotions, bodily sensations, and

behavioral predispositions (Hayes et al., 1996). Recent research has demonstrated a relationship between experiential avoidance and a broad range of psychopathology (Chawla & Ostafin, 2007), including depression (Reddy, Pickett, & Orcutt, 2006; Spira et al., 2007; Tull & Gratz, 2008). Interventions that consider experiential avoidance a principal feature of psychopathology and target it in treatment include Mindfulness-Based Cognitive Therapy (Segal, Williams, & Teasdale, 2001), Dialectical Behavior Therapy (Linehan, 1993), behavioral activation (Hopko & Lejuez, 2007; Martell et al., 2001), and others (Hayes & Harris, 2000; Roemer & Orsillo, 2002). While several of these treatments admittedly are in their early stages of development, there has been support for their efficacy in the treatment of depression (Cuijpers et al., 2007; Ekers et al., 2008; Williams, Russell, & Russell, 2008), anxiety (Hayes, Beevers, Feldman, Laurenceau, & Perlman, 2005), and borderline personality disorder (Lynch, Trost, Salsman, & Linehan, 2007).

One of the fastest emerging of these contemporary therapies is Acceptance and Commitment Therapy (ACT; Hayes, Strosahl, & Wilson, 1999). ACT is guided by the notion that experiential avoidance is a maladaptive process that elicits psychopathology, including depression. Experiential avoidance is a learned strategy that provides relief in the short-term but is counterproductive in that aversive experiences are not successfully escaped from and are later experienced as intrusive and debilitating. Further, employment of this avoidant approach prevents the successful development of skills necessary to properly adapt to changes in one's environment (Hayes et al., 1996). ACT aims to promote acceptance and mindfulness of emotional experiences through an active embracing of experience and open and nonjudgmental exposure to the private stimuli that were previously avoided (Hayes et al., 1999). Recent data suggest ACT shows promise in the treatment of a broad range of

disorders and maladaptive behaviors, including work-site stress (Bond & Bunce, 2000), smoking cessation (Gifford et al., 2004), psychosis (Bach & Hayes, 2002; Gaudiano & Herbert, 2006), epilepsy (Lundgren, Dahl, Melin, & Kies, 2006), chronic pain (McCracken, Vowles, & Eccleston, 2005), trichotillomania (Woods, Wetterneck, & Flessner, 2006), social anxiety (Dalrymple & Herbert, 2007), obsessive-compulsive disorder (Twohig, Hayes, & Masuda, 2006), and posttraumatic stress disorder (Orsillo & Batten, 2005).

ACT also has been implemented as a treatment for depression (Zettle, 2007). There have been few investigations of the outcomes of such treatments, but the evidence available indicates that this avoidance-focused intervention is effective as a depression treatment. Zettle and Hayes (Hayes, Luoma, Bond, Masuda, & Lillis, 2006; Zettle & Hayes, 1986) compared an early version of ACT (comprehensive distancing) to cognitive therapy (CT) and found that while participants in both conditions improved significantly on clinician-rated depression, the ACT group evidenced superior improvement immediately following treatment and at 2-month follow-up. Changes were mediated by a decrease in the believability of depressogenic thoughts (Hayes et al., 2006). When this design was replicated in a group format, ACT and CT were equally effective in treating depression (Zettle & Raines, 1989). In a recent randomized controlled trial comparing ACT and CT in the treatment of outpatients with depression and anxiety, both treatments were equally effective in alleviating depression symptoms. The effects of ACT on depression were mediated by experiential avoidance, acceptance, and acting with awareness; all mechanisms of change predicted by ACT theory. Based on these results and other data (Hollon, Thase, & Markowitz, 2002), both ACT and CT appear to be effective depression interventions, but differ in the way they elicit symptom improvement. ACT appears to foster change by

targeting avoidance (Forman, Herbert, Moitra, Yeomans, & Geller, 2007) while CT seems to operate through reductions in depressogenic beliefs and modifications to fundamental core schemas. These studies all support the role of avoidance in contributing to depression and the reduction of avoidance as a potential pathway for treatment.

Many psychological interventions have placed an emphasis on avoidance, but few have focused specifically on the causal influence of avoidance on depression. Ferster (1973) highlighted avoidant behavior as a determinant of depressive behavior and symptoms. In doing so, he stressed the role of the environment in prompting, shaping, and maintaining depressive behavior and the need to analyze this relationship between environment and behavior in order to understand and treat depression. While this theory was pursued and extended by other theorists (Lewinsohn, 1974; Lewinsohn et al., 1980; Staats & Heiby, 1985), purely behavioral conceptualizations and treatments of emotional disorders have largely been overshadowed by the subsequent cognitive (or cognitive-behavioral) therapy movement that began with Beck and colleagues (Beck, Rush, Shaw, & Emery, 1979). A landmark study by Jacobson et al. (1996) revitalized behavioral theory and reaffirmed the role of avoidance in the development and maintenance of depressive disorders. In this component analysis of cognitive-behavioral therapy (CBT), the behavioral activation (BA) component of CBT was compared to full CBT as well as a therapy condition that incorporated both BA and a partial version of CBT (the addressing of automatic thoughts) in the treatment of 151 outpatients meeting criteria for major depression. To the surprise of the investigators, who were admittedly biased in favor of CBT, BA was as effective as both cognitive therapy conditions. Further, these results were maintained at 2-year follow-up (Gortner, Gollan, Dobson, & Jacobson, 1998).

This study inspired the development of two behaviorally-focused treatments for depression: *behavioral activation* (BA; Martell et al., 2001) and the *brief behavioral activation treatment for depression* (BATD; Lejuez, Hopko, & Hopko, 2001; Lejuez, Hopko, LePage, Hopko, & McNeil, 2001). While these treatments differ somewhat in structure and technique, they share a theoretical foundation based on traditional behavioral principles (Hopko, Lejuez, Ruggiero, & Eifert, 2003). In accordance with Ferster's (1973) functional analysis of depression, behavioral activation treatments seek to modify an individual's environment through behavior change in order to increase access to positively reinforcing events and activities while limiting reinforcement of depressed behavior. Both BA and BATD incorporate an acceptance-change model that emphasizes action- as opposed to avoidance-based strategies as a means to cope with aversive stimuli (Hopko, Lejuez, Ruggiero et al., 2003).

BA's conceptualization of depression includes a specific emphasis on the role of avoidance that is central to the present investigation. Behavioral and cognitive avoidance of minimally rewarding or aversive environmental experiences are thought to be critical in producing and maintaining depressed behavior characterized by passivity, withdrawal, and inactivity. In avoiding the aversive internal events that accompany such stimuli, an individual's ability to adaptively problem solve and obtain positive reinforcement is ultimately hindered, extinguished, or prevented from developing. A central goal of treatment is to reduce escape and avoidance behavior and associated passivity through recognition of this avoidance pattern and increased participation in alternative healthy and rewarding behaviors. Importance is placed not only on behavioral avoidance, but also cognitive

avoidance strategies such as rumination, which are all hypothesized to interfere with one's ability to elicit reward from the environment (Martell et al., 2001).

The efficacy of behavioral activation interventions has generally been well supported (Cuijpers, van Straten, & Warmerdam, 2007; Ekers, Richards, & Gilbody, 2008; Hopko, Lejuez, LePage, Hopko, & McNeil, 2003). In a recent randomized trial comparing BA, cognitive therapy (CT), Paroxetine, and a medication placebo, BA outperformed all other conditions with moderately to severely depressed participants when observed drop-out rate, relapse and recurrence problems, and side effects for Paroxetine treatment were considered (Dimidjian et al., 2006). A similarly designed randomized trial examining the long-term efficacy of these treatment types showed that the treatment gains of BA were nearly as long-lasting as those of CT, and that both outperformed medication over two-year follow-up (Dobson et al., 2008). Two recent meta-analyses have indicated that behavioral interventions for depression are equally as effective as more comprehensive CBT protocols (Cuijpers et al., 2007; Ekers et al., 2008).

#### *Measures of Avoidance: Development of the Cognitive-Behavioral Avoidance Scale*

The emphasis of avoidance in BA's conceptualization of depression has highlighted the need for further research examining this relationship. To this point, there has been an inconsistency in how the construct of avoidance has been defined and measured. Avoidant coping processes are not conceptualized in the same way as the personality disposition of harm avoidance. Coping measures often target coping responses to a single event, rather than assessing these processes as a pervasive trait, as is more clinically useful (Ottenbreit & Dobson, 2004). Further, avoidance has often been measured through multiple scales or

through subscales from larger coping or personality measures that have been criticized with regard to psychometric properties (Blalock & Joiner, 2000).

The Acceptance and Action Questionnaire (AAQ; Hayes et al., 2004), a commonly utilized measure of experiential avoidance, demonstrates internal consistency ( $\alpha = .70$ ) that is considered on the cusp of what is acceptable for a clinically significant measure (i.e.,  $\alpha \geq .70$ ) and is 'fair' at best (Cicchetti, 1994; Cicchetti & Sparrow, 1990). This brings into question the extent to which the AAQ is accurately measuring the singular construct of experiential avoidance. The Behavioral Activation for Depression Scale (BADS; Kanter, Mulick, Busch, Berlin, & Martell, 2007) was created as a means to measure avoidance, activation, and behavioral functioning in relation to BA treatment. This measure includes an Avoidance/Rumination subscale that relates significantly to depression in both clinical and nonclinical samples (Kanter et al., 2007; Kanter, Rusch, Busch, & Sedivy, 2009). The authors acknowledge, however, that this scale was designed as a treatment outcome measure, rather than a measure of psychopathology. Further, this subscale is limited in focus, in that it primarily assesses cognitive forms of avoidance such as rumination, and does not directly account for behavioral avoidance (Kanter et al., 2007).

In response to this need for further research and a specific and integrated way to define and measure the construct of avoidance, the Cognitive-Behavioral Avoidance Scale (CBAS; Ottenbreit & Dobson, 2004) was developed as a way to investigate avoidance, specifically as it relates to depression. The CBAS considers avoidance a trait characteristic that is employed in response to external situations or internal thoughts, emotions, or experiences. Avoidance can be either a cognitive or behavioral process. Cognitive avoidance includes the use of active and passive cognitive processes such as distraction, denial,

minimization, passive acceptance, and ignoring when faced with a source of distress.

Behavioral avoidance can also be an active or passive approach to a problem, and includes participation in alternative/distracting activities, escape, or the failure to approach.

The CBAS definition of behavioral avoidance should be distinguished from that in the coping literature, which includes the use of emotional discharge (Cronkite & Moos, 1995). Emotional discharge subscales have been criticized as being confounded with measures of distress and anxiety (e.g., “I take it out on other people when I feel angry or depressed”), and hence are misleading in labeling emotion-focused coping as an avoidant and maladaptive strategy (Stanton, Danoff-Burg, Cameron, & Ellis, 1994; Stanton, Kirk, Cameron, & Danoff-Burg, 2000). Other investigations have demonstrated that emotional processing and expression are indeed healthy coping mechanisms and are inversely related to psychopathology (Stanton et al., 2000; Stanton, Kirk et al., 2000).

Due to observed relationships between restricted and reduced social interactions and depression (Clark, Beck, & Alford, 1999; Joiner, Lewinsohn, & Seeley, 2002), the CBAS differentiates between the avoidance of social and nonsocial events. Social avoidance is a means of escaping interactions with or thoughts and feelings about other people. Nonsocial avoidance comes in response to a situation that does not involve others. It was thought that this distinction would provide important information as to how avoidance strategies might relate to the connection between social factors and depression, and also could elucidate observed differences in how socially-oriented versus autonomous individuals react to various forms of stress and loss (Coyne & Whiffen, 1995; Ottenbreit & Dobson, 2004). All of the above dimensions are reflected in four subscales of the CBAS: Cognitive Social, Cognitive

Nonsocial, Behavioral Social, and Behavioral Nonsocial avoidance (Ottenbreit & Dobson, 2004).

Few studies have incorporated the CBAS to this point, but those that have used the measure have demonstrated avoidance and all of its subtypes to be associated with a depression diagnosis (Ottenbreit, 2007) and depression symptom severity (Cribb et al., 2006; Moulds et al., 2007; Ottenbreit & Dobson, 2004; Vandromme, Raes, Defranc, & Hermans, 2007). Further, the CBAS appears to be both a valid and reliable scale, with good psychometric properties in both clinical (Ottenbreit, 2007) and nonclinical samples (Ottenbreit & Dobson, 2004; Vandromme et al., 2007). Interestingly, and consistent with BA theory, the CBAS also has been positively associated with impairment in activity as measured by the BADS (Kanter et al., 2007; Kanter et al., 2009).

#### *The Relationship between Reinforcement and Depression*

Behavioral activation treatments are thought to treat depression through a combination of reducing avoidance and escape behavior and increasing contact with positive reinforcement for healthy behavior. Much of the literature on behavior theory has focused on the latter relationship between positive reinforcement and depression symptoms. Lewinsohn and colleagues highlighted a low rate of response-contingent positive reinforcement (RCPR) as the critical predictor of clinical depression (Lewinsohn, 1974; Lewinsohn & Graf, 1973; Lewinsohn & Libet, 1972). RCPR is defined as an increase in the frequency or duration of a behavior as a result of positive or pleasurable outcomes. Minimal environmental (and social) reinforcement was proposed to result in the extinction of “healthy” adaptive behaviors and consequently the dysphoric mood and passivity that often characterize depression. A low rate of RCPR is a product of: 1) a decreased number of events that are potentially reinforcing for

the individual, 2) decreased availability of these potential reinforcers in the environment, 3) inabilities to experience rewarding contingencies due to inadequate instrumental behaviors such as social skill, and 4) increased exposure to aversive stimuli (e.g., punishment) in the form of distressing, upsetting, or unpleasant events (Lewinsohn, 1974; Lewinsohn et al., 1980). The occurrence of such aversive events leads to avoidance behaviors that result in limited exposure to potentially rewarding activities and a lower rate of RCPR. Reduced RCPR is thought to be sufficient in producing the dysphoria and related symptoms observed in clinical depression (Lewinsohn, 1974; Lewinsohn et al., 1980; MacPhillamy & Lewinsohn, 1974).

Supporting behavioral theory, a number of studies demonstrated relationships between pleasant events and mood state, with individuals reporting fewer positive events, decreased environmental reward, and more limited abilities to obtain reinforcement endorsing increased depression severity (Bouman & Luteijn, 1986; Hopko, Armento, Cantu, Chambers, & Lejuez, 2003; Hopko & Mullane, 2008; Lewinsohn & Amenson, 1978; Lewinsohn & Graf, 1973; Lewinsohn & Libet, 1972; MacPhillamy & Lewinsohn, 1974). It also was shown that depressed individuals tend to engage in fewer rewarding interpersonal behaviors, suggesting that insufficient social interaction and decreased social reinforcement may predict negative affect (Joiner et al., 2002; Lewinsohn & Shaffer, 1971; Libet & Lewinsohn, 1973). Important to note, however, a few studies have not supported the link between RCPR and mood variability (Biglan & Craker, 1982; Hammen & Glass, 1975; Sweeney, Shaeffer, & Golin, 1982), possibly due to difficulty in accurately assessing the construct of RCPR (Carvalho et al., in press).

In a related but more integrated paradigmatic behaviorism theory of depression, depression arises when positive emotional stimuli in the environment are limited or negative emotional stimuli are excessive (Staats & Heiby, 1985). Divergent from traditional behavioral theories, however, cognitive and emotional factors are hypothesized to impact whether such environmental circumstances ultimately result in depression. While this theory is more complex than traditional behavioral theories, investigations of paradigmatic theories of depression support traditional views by similarly showing that the frequency and intensity of both positive and negative events are important predictors of depression symptom severity (Davis, 2001; Davis & Burns, 1999; Rose & Staats, 1988; Wilkinson, 1993).

At this juncture, it is important to note the conceptual relationship between reward and reinforcement. Although positive reinforcers often are experienced as rewarding or pleasurable to an individual, it also is true that environmental events may function as positive reinforcers yet be somewhat aversive in their form or presentation. For example, when harsh verbal criticism of a depressed individual's socially withdrawn behavior has the effect of increasing the frequency and duration of social isolation. The behavioral studies described in this section, consistent with the Ferster (1973) and Lewinsohn (1974) conceptualizations, consider positive reinforcement as increased behavior that is generally a product of rewarding or pleasurable experiences and/or the absence of aversive, unpleasant, or negative stimuli. This is the formulation upon which the current investigation is based.

Many of the above studies have used self-report questionnaires such as the Pleasant Events Schedule (PES; MacPhillamy & Lewinsohn, 1971) to measure the frequency and intensity of positive events that an individual experiences as an approximate, yet valid, method of quantifying RCPR. However, the PES is limited in that it is quite extensive (i.e.,

320 items) and prompts for specific events that may be pleasant but not necessarily associated with increased RCPR. Other similarly focused measures (Armento & Hopko, 2007; Kanter et al., 2007) have been more concise, but fail to assess for RCPR as defined by Lewinsohn (1974). The Environmental Reward Observation Scale (EROS; Armento & Hopko, 2007), for example, appears to be a valid measure of environmental reward, but does not comprehensively address Lewinsohn's behavioral model. Accordingly, the Reward Probability Index (RPI; Carvalho et al., in press) was developed to address the need for a more viable measure of RCPR. The RPI is a brief and psychometrically sound self-report measure that includes items that target each of the four dimensions of RCPR. The scale measures environmental reward through a two factor structure (Reward Probability and Environmental Suppressors) as a means of approximating the presence and magnitude of RCPR.

A more ecologically valid method of measuring environmental reward (as a proxy measure of reinforcement) is through the use of daily activity diaries (Hopko, Armento et al., 2003). Studies incorporating daily diaries have found daily ratings of behaviors and depression symptoms to correlate strongly with self-report and clinician-rated measures of depression (Freeman, DeRubeis, & Rickels, 1996; Robbins & Tanck, 1984; Stamenkovic et al., 2001). Similar daily diary designs have demonstrated adequate internal consistency and good convergent and discriminant validity in research on anxiety (Fydrich, Dowdall, & Chambless, 1992; Nelson & Clum, 2002), social phobia (Beidel, 1996), pain (Feldman, Downey, & Schaffer-Neitz, 1999; Grant, Long, & Willms, 2002; van den Brink, Bandell, & Huijter, 2001), alcohol abuse (Watson, 1999), sexual behaviors (Okami, 2002), gambling

(Atlas & Peterson, 1990), insomnia (Haythornthwaite, Hegel, & Kerns, 1991), and sickle cell disease (Ely, Dampier, Gilday, O'Neal, & Brodecki, 2002).

Hopko and colleagues (Hopko, Armento et al., 2003) examined reward in mildly depressed and nondepressed college students through the use of daily diaries that allowed participants to indicate what behaviors they engaged in over a 1-week period and how rewarding or pleasurable they found each of those activities. The depressed group was less active and obtained less pleasure from their behaviors than their nondepressed counterparts, supporting an inverse relationship between RCPR and depression. Additionally, when the sample was examined as a whole, daily affect was correlated with both reward value of behaviors and overall activity level in the predicted directions. A similar investigation incorporating daily diaries found that the qualitative aspects of behavior differentially relate to depression symptoms. Mildly depressed participants engaged in less social, physical, and educational behaviors and more employment-related behaviors compared to nondepressed controls (Hopko & Mullane, 2008).

Treatment outcome research has been another source of evidence for the influence of environmental reinforcement on depression. In addition to the more modern behavioral activation interventions discussed above, early behavioral treatments for depression demonstrated attenuation in symptoms through strategies designed to increase availability of positive reinforcement, including monitoring of pleasant events and associated mood, activity scheduling, social skills development, and behavioral psychoeducation (Barrera, 1979; Brown & Lewinsohn, 1984; Lewinsohn & Atwood, 1969; Lewinsohn & Graf, 1973; Lewinsohn & Shaffer, 1971; Lewinsohn & Shaw, 1969; Lewinsohn et al., 1980; Sanchez, Lewinsohn, & Larson, 1980; Zeiss, Lewinsohn, & Munoz, 1979). More recently, there has

been evidence that in behavioral activation, depression severity is reduced as self-reported environmental reward increases, indicating that elevated reward may represent a mechanism of improvement (Gawrysiak, Nicholas, & Hopko, 2009).

The BADS (Kanter et al., 2007) is a self-report measure designed to track improvements in behavior and reductions in avoidance over the course of BA treatment. In two preliminary validation studies, the BADS and each of its behavior-related subscales were associated with depression symptom severity in clinical and nonclinical samples (Kanter et al., 2007; Kanter et al., 2009). Further, the Avoidance subscale of the BADS related positively to depression and correlated with the activity- and impairment-related subscales of the measure, providing some support for the proposed relationship between avoidance, behavior, and depression (Kanter et al., 2007; Kanter et al., 2009). Importantly, while avoidance was separately related to both depression and activity, these variables were not tested together in the same model.

### *Study Purpose and Hypotheses*

With abundant support for the relationship between avoidance and depression, there is a need to further explore possible pathways of this relationship. According to behavioral theories of depression, avoidance patterns remove an individual from contact with reinforcing encounters with the environment, which in turn leads to the development of depression symptoms (Ferster, 1973; Martell et al., 2001). To date, no investigation has directly examined this proposed pathway between avoidance and depression. This study aimed to provide support for positive reinforcement as a mediating factor that at least partially accounts for the link between avoidance and depression.

For the purposes of this study, and consistent with the Ferster (1973) and Lewinsohn (1974) formulations, positive reinforcement was conceptualized as increased behavior that generally is a function of rewarding or pleasant responses and a freedom from aversive stimuli, a process that has antidepressant effects (Abreu & Santos, 2008; Skinner, 1953, 1989). It is important to note that to accurately and validly measure positive reinforcement per se, one would need to observe increased behavior over time as a function of specific environmental consequences. This might be possible in an experimental setting, but is beyond the scope of the measures used in this investigation. For this reason, RCPR was approximated through the use of validated self-report instruments and daily behavior diaries that assessed magnitude of environmental reward as an estimated probability of RCPR. Multi-modal assessment incorporating direct (diaries) and indirect (RPI, EROS) measures of reward was utilized in order to reduce measurement error and strengthen the validity of the findings (Cone, 1978).

Avoidance was measured with the CBAS (Ottenbreit & Dobson, 2004), which allows cognitive and behavioral avoidance to be examined as separate constructs as well as through an aggregate total avoidance score. Additionally, despite some minor concerns about psychometric properties described above, two supplementary self-report measures of avoidance (AAQ-measured experiential avoidance and BADS-measured avoidance/rumination) were included in the analyses.

Further, all analyses examining the relationship between avoidance and depression were conducted while controlling for anxiety symptoms as measured by the Beck Anxiety Inventory (BAI; Beck & Steer, 1993). This was necessary due to the commonly documented comorbidity between depression and anxiety symptoms (Lepine, Wittchen, & Essau, 1993;

Mazer & Cloninger, 1990) as well as the well-established association between avoidance and anxiety (Barlow, 2002). The BAI was used due to its strong discriminate validity in distinguishing anxiety symptoms from depressive symptoms (Beck & Steer, 1993). Controlling for BAI-measured anxiety ensured that any observed relationships with depression occurred independent of the effects of co-occurring anxiety.

The primary aim of this investigation was to provide a more detailed understanding of the proposed relationship between avoidance, reinforcement, and depression by testing the following hypotheses:

Hypothesis 1a: Each measure of avoidance (Total CBAS, CBAS Cognitive Avoidance, CBAS Behavioral Avoidance, AAQ experiential avoidance, BADS Avoidance/Rumination) would show significant positive relationships with depression symptom severity as measured by the Beck Depression Inventory – II (BDI-II; Beck, Steer, & Brown, 1996).

Hypothesis 1b: The relationship between each avoidance dimension and depression symptom severity would remain significant when anxiety symptoms (BAI) were partialled out of both the avoidance and depression variables.

Hypothesis 2: Each form of avoidance would show significant negative relationships with environmental reward, as measured by (a) self-report questionnaires (RPI, EROS) and (b) daily diary ratings.

Hypothesis 3: Reward, as measured by (a) self-report questionnaires (RPI, EROS) and (b) daily diaries, would be significantly inversely related to depression symptom severity.

Hypothesis 4a: Reward, as measured by (a) the RPI and (b) daily diaries, would mediate the relationships between total avoidance (CBAS) and depression, cognitive avoidance (CBAS) and depression, and behavioral avoidance (CBAS) and depression.

Hypothesis 4b: These relationships would remain significant after anxiety symptoms (BAI) were controlled.

Hypothesis 5a: Structural equation modeling (SEM) would demonstrate that reward, as measured by a latent variable derived from the RPI, EROS, and Daily Diaries, would mediate the relationship between depression and avoidance, as measured by a latent variable comprised of the CBAS Total, AAQ, and BADS Avoidance/Rumination scale.

Hypothesis 5b: This relationship would remain significant after controlling for anxiety symptoms (BAI).

## Method

### *Participants*

The final sample included 158 male and female undergraduate psychology students recruited from the University of Tennessee. Three participants (two female, one male) completed visit 1 but did not return for visit 2, and were not included in any of the analyses. One female participant did not complete the diaries correctly, and her data was not included in the analyses. Participants were recruited through the University of Tennessee Human Participation in Research (HPR) website. Under this system, psychology students can search online for ongoing research projects to fulfill their research participation credit requirement. They choose projects based on the project's title, description, and available times to participate. This project was entitled "Depression and Rewarding Activity" on HPR. The description of the study read: "Participants will be asked to complete some questionnaires, then monitor their daily activities for one week using a daily diary. They will then meet briefly with an experimenter for a second visit to complete additional questionnaires. Individuals having problems with depression are especially encouraged, though the study is open to everyone." The study title and description were intended to draw depressed participants into the study, in order to increase the variance of depression symptomatology in the sample. Any students who were at least 18-years-old that chose this project were allowed to participate in order to earn credit. There were no exclusion criteria aside from age.

The sample consisted of 61 males (38.6%) and 97 females (61.4%), with a mean age of 19.1 years ( $SD = 2.0$  years). Ethnic distribution was as follows: 123 Caucasians (77.8%),

18 African Americans (11.4%), 7 Asian Americans/Pacific Islanders (4.4%), 2 Latinos (1.3%), and 8 participants who identified as “Other” (5.1%) (see Table 1<sup>1</sup>).

### *Measures*

The Cognitive-Behavioral Avoidance Scale (CBAS; Ottenbreit & Dobson, 2004) is a self-report measure intended to assess multiple dimensions of trait-level avoidance as it relates to depression. The scale includes 31 items rated on a 1-5 Likert scale, and is comprised of four subscales of avoidance: Behavioral Social, Cognitive Social, Behavioral Nonsocial, and Cognitive Nonsocial avoidance. Subscales demonstrate adequate to strong coefficient alphas ( $\alpha = 0.86, 0.78, 0.75, 0.80$ , respectively) and test-retest reliability ( $r = 0.86, 0.58, 0.88, 0.94$ , respectively). A total avoidance score can also be calculated, which has excellent internal consistency ( $\alpha = .91$ ) and test-retest reliability (0.92). The CBAS also correlates moderately with other measures of avoidance as well as depression and anxiety scales (Kanter et al., 2007; Kanter et al., 2009; Ottenbreit & Dobson, 2004). Sample items include, “I try not to think about problems in my personal relationships” (Cognitive Social) and “I quit activities that challenge me too much” (Behavioral Nonsocial). Internal consistency for the total avoidance score in the current sample was excellent (T1  $\alpha = .94$ , T2  $\alpha = .96$ ).

Due to the current investigation’s focus on cognitive and behavioral avoidance and lack of emphasis on social factors, it was decided to collapse the four CBAS subscales into two subscales: Cognitive Avoidance (Cognitive Social + Cognitive Nonsocial) and Behavioral Avoidance (Behavioral Social + Behavioral Nonsocial). Because the authors of the CBAS (Ottenbreit & Dobson, 2004) did not establish psychometric properties for these

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<sup>1</sup> All tables and figures are located in the Appendix.

combined subscales, internal consistency and one-week test-retest reliability were calculated from this study's sample. The Cognitive Avoidance subscale demonstrated excellent internal consistency at Times 1 ( $\alpha = .90$ ) and 2 ( $\alpha = .93$ ), as well as strong test-retest reliability ( $r = .87$ ). Similarly excellent internal consistency (T1  $\alpha = .93$ , T2  $\alpha = .91$ ) and test-retest reliability ( $r = .91$ ) were established with the Behavioral Avoidance subscale. These two subscales were also strongly correlated ( $r = .70$ ,  $p < .001$ ). More detailed correlation statistics are presented in Table 2.

The Reward Probability Index (RPI; Carvalho et al., in press) is a 20-item self-report measure designed to measure the magnitude of environmental reward as an approximation of response-contingent positive reinforcement. The scale assesses RCPR's four dimensions via two factors: Reward Probability (potentially reinforcing events and instrumental behaviors in obtaining reinforcement) and Environmental Suppressors (availability of reinforcement in the environment and presence of punishing/aversive experiences). Sample items include, "I have many interests that bring me pleasure" (Reward Probability) and "There are a lot of activities I might enjoy, but they just don't seem to happen" (Environmental Suppressors). Participants rate each item on a 4-point Likert scale (1 = *strongly disagree* to 4 = *strongly agree*) for the time period of the "past several months," with higher scores indicating higher levels of reward. Psychometric properties of the RPI were established through three studies. The measure demonstrated strong internal consistency ( $\alpha = .88$  to  $.92$ ) and two-week test-retest reliability ( $r = .69$ ). Convergent validity was established through strong correlations with measures of activity, avoidance, reward, and depression ( $r = .65$  to  $.81$ ). Discriminant validity was supported via smaller correlations with measures of social support and somatic anxiety ( $r = -.29$  to  $-.40$ ). Further, the RPI accounted for variance in daily diary-reported

environmental reward over and above both a preexisting reward measure (EROS) and self-reported depression (BDI-II). In the present study, internal consistency was strong (total score T1  $\alpha = .89$ , T2  $\alpha = .91$ ).

The Environmental Reward Observation Scale (EROS; Armento & Hopko, 2007) is a 10-item measure that assesses environmental reward on a 4-point Likert scale. The scale is intended to identify the magnitude of reinforcing events, the availability of reinforcement in the environment, and the ability of an individual to elicit that reinforcement. Sample items include “A lot of activities in my life are pleasurable,” “It is easy for me to find enjoyment in my life,” and “The activities I engage in usually have positive consequences.” The EROS has strong internal consistency ( $\alpha = .85$  to  $.90$ ) and excellent one week test-retest reliability ( $r = .85$ ). The EROS also correlated strongly with other commonly administered and psychometrically sound self-report measures of depression and anxiety, as well as the Pleasant Events Schedule ( $r = -.43$  to  $-.71$ ; Armento & Hopko, 2007). Internal consistency was strong in this study (T1  $\alpha = .89$ , T2  $\alpha = .90$ ).

The Beck Depression Inventory-II (BDI-II; Beck et al., 1996) is a measure of depression symptom severity which consists of 21 items, each of which is rated on a 4-point Likert scale (0-3 point anchors), with items summed to form a total score. Sample items include assessment of the frequency and intensity of “sadness,” “guilt,” and “concentration difficulty” over the previous two weeks. The instrument has excellent internal consistency ( $\alpha = .92$ ) as well as strong convergent validity with other measures of depression (Beck et al., 1996; Nezu, Ronan, Meadows, & McClure, 2000). Internal consistency in this sample was excellent (T1  $\alpha = .91$ , T2  $\alpha = .93$ ).

The Beck Anxiety Inventory (BAI; Beck & Steer, 1993) is a 21-item questionnaire designed specifically to distinguish cognitive and somatic symptoms of anxiety from those of depression. Participants rate how much they have been bothered by anxiety symptoms over the past week. Symptoms addressed include feeling nervous, unable to relax, and shaky. Good psychometric properties have been demonstrated for the measure among community, medical, and psychiatric outpatient samples (Beck & Steer, 1993; Morin et al., 1999; Osman, Kopper, Barrios, Osman, & Wade, 1997; Wetherell & Areán, 1997). Internal consistency in this study was excellent (T1  $\alpha = .90$ , T2  $\alpha = .91$ ).

The Behavioral Activation for Depression Scale (BADs; Kanter et al., 2007) is a 25-item scale that assesses behaviors presumed to be targeted during behavioral activation treatment interventions (BA; Martell et al., 2001). The measure includes four subscales: Activation, Avoidance/Rumination, Work/School Impairment, and Social Impairment. In this investigation, only the Avoidance/Rumination subscale was used. Sample items include “I did things to avoid feeling sadness or other painful emotions” and “Most of what I did was to escape from or avoid something unpleasant.” This subscale has good internal consistency ( $\alpha = .86$ ) and test-retest reliability ( $r = .76$ ), and correlates with depression (BDI-II,  $r = .63$ ), rumination, and other measures of avoidance (AAQ,  $r = .51$ , CBAS;  $r = .29$  to  $.57$ ). There has been support for the predictive validity of the Avoidance/Rumination subscale, as individuals with higher scores on this scale were less likely to return for a follow-up assessment (Kanter et al., 2007). Internal consistency of the total score and subscales are adequate ( $\alpha = .76$  to  $.87$ ), and good 1-week test-retest reliability has been established ( $r = .74$ ). The BADs total score correlates strongly with the BDI ( $r = -.67$  to  $-.70$ ) and has good discriminant validity as evidenced by a significant albeit weak relationship with the BAI ( $r =$

-19). In the present study, internal consistency was strong with the total score (T1  $\alpha = .92$ , T2  $\alpha = .92$ ) as well as the Avoidance/Rumination subscale (T1  $\alpha = .88$ , T2  $\alpha = .91$ ).

The Acceptance and Action Questionnaire (AAQ; Hayes et al., 2004) is a 9-item self-report scale that measures experiential avoidance as defined by Acceptance and Commitment Therapy (Hayes et al., 2004). Sample items include, “I rarely worry about getting my anxieties, worries, and feelings under control” and “If I could magically remove all the painful experiences I’ve had in my life, I would do so.” Participants rate items on a 1 (*never true*) to 7 (*always true*) Likert scale. The AAQ is related to measures of psychopathology as well as other measures of avoidant coping. The scale has demonstrated what the authors consider adequate internal consistency ( $\alpha = .70$ ), although this value approaches what is often viewed as an unacceptably low level (i.e.,  $\alpha < .70$ ; Cicchetti, 1994; Cicchetti & Sparrow, 1990). Similar reliability values were observed in the present investigation (T1  $\alpha = .70$ , T2  $\alpha = .74$ ).

Seven daily diary activity-monitoring forms (Hopko, Armento et al., 2003) were used to monitor behaviors and associated reward values over a 7-day period. Diaries are divided into half-hour segments beginning at 8:00 am and ending at 2:00 am, for a total of 18 hours per day. Participants indicate what behaviors they engaged in for the majority of each half-hour period, and the associated amount of reward or pleasure they received from that activity (rated from 1 to 4, with 1 being the lowest and 4 being the highest). Participants were given the following instructions with their diaries:

I’d like you to keep this record for one week, making an effort to behave in as “normal” a manner as possible. What I’d like you to do is to record your behaviors during these half-hour intervals – you don’t have to put everything you did in each half hour, only how MOST of your time during that half hour was spent. Remember to record only your behaviors, that is, what you do and how you spend your time. It is

not necessary to write down specific thoughts or feelings that you might be having. Also, don't worry about having to write down everything as it happens – that might be much too overwhelming. Instead, try to keep track of your behaviors every 3-4 hours, remembering how you spent your time. When you write down your behaviors, rate each of them using this scale, from 1 (least rewarding or pleasurable) to 4 (most rewarding or pleasurable). Of course you also may rate behaviors as having a reward value of “2” or “3.” You have one form for each day of the week till we next meet. Try to be as accurate and as thorough as you can.

### *Procedure*

Participants met with investigators for two administration sessions. The first lasted approximately 30 minutes and consisted of providing informed consent followed by completion of a demographic questionnaire and the self-report questionnaires described above. Following completion of the questionnaires, participants were given seven daily diary activity-monitoring forms (Hopko, Armento et al., 2003) with instructions. Participants were scheduled for a return visit one week from their initial session. At this second visit, they returned their seven completed diary forms and also completed all self-report questionnaires a second time. Mean elapsed time between visit 1 and visit 2 was 7.71 days ( $SD = 2.44$  days).

Daily diaries were quantified by totaling the number of hours spent in each level of reward activity (1 (lowest) through 4 (highest)). To assess reward value of behaviors as a continuous variable, each participant received a total daily diary reward score that was based on the following formula: Total Daily Diary Reward = Time in Level 1 behaviors (\*1) + Time in Level 2 behaviors (\*2) + Time in Level 3 behaviors (\*3) + Time in Level 4 behaviors (\*4) / Total number of recorded hours. The equation is in the form of a ratio in order to account for possible differences between participants in the total number of recorded hours.

It was decided that a second diary-measured reward variable that factored out time spent in sleep-related behavior was necessary. This was based on the concern that time spent sleeping did not fit the criteria for potentially reinforcing behavior that the diaries were meant to assess (i.e., response-contingent positive reinforcement). In other words, sleep behavior was conceptualized as a negatively reinforced behavior in that depressed individuals might increase sleep behavior to avoid aversive emotions. As such, inclusion of sleep behaviors (and their reward value) might artificially increase overall reward for individuals with increased depression. Accordingly, Adjusted Daily Diary Reward was calculated using the above formula, with the exception that all sleep-related behaviors were removed from the hours totals. It was theorized that this variable would provide a more valid measure of daily diary-reported activities and associated reward values.

Final CBAS, AAQ, RPI, EROS, BADS, BDI-II, and BAI scores were calculated by averaging the totals (and subscale totals) from the first and second administrations of the measures. This procedure was done to obtain a more complete and accurate picture of participant psychological and behavioral functioning during the one-week period, as opposed to using only time 1 or time 2 scores.

### **Data Analysis**

The Statistical Package for Social Sciences (SPSS) was used to compute descriptive statistics, correlations, internal consistencies, ANOVAs, chi-squares, and simple mediation analyses. Structural equation modeling was carried out with AMOS Graphics (Arbuckle, 1999).

Hypotheses 1a, 2, and 3 were tested with a series of bivariate correlations. Partial correlations were computed to test Hypothesis 1b, examining the relationships between all measures of avoidance and BDI-II depression symptom severity after removing the influence of BAI-measured anxiety symptom severity from the avoidance and depression variables.

Mediation analyses (e.g., tests of indirect effects) were conducted using a bootstrapping method (Preacher & Hayes, 2008). Bootstrapping is a nonparametric sampling procedure that generates an empirical approximation of the sampling distribution of the indirect effect (i.e., the effect of an independent variable on the dependent variable through a mediator variable). The procedure considers the sample size ( $n$ ) a miniature representation of the population. This sample is repeatedly re-sampled  $k$  times, each time using replacement to create a new sample of size  $n$  where the direct and indirect effects of the model are estimated. After being repeated  $k$  times (where  $k$  is usually at least 5,000 re-samples),  $k$  estimates of the indirect effect are produced, allowing for the creation of confidence intervals that are used to approximate the effect of the mediator variable in the population sampled. If zero does not fall between the lower bound and upper bound of the  $ci\%$  confidence interval, there is a  $ci\%$  chance that the indirect effect is meaningful (i.e., not zero). This is the conceptual equivalent of a mediation effect being significant at the  $100 - ci\%$  significance level (e.g., .05 where  $ci\% = 95$ ) (Hayes, 2009; Preacher & Hayes, 2008).

Bootstrapping is preferable to the traditionally used causal steps approach advocated by Baron and Kenny (Baron & Kenny, 1986) for several reasons (Hayes, 2009; MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002). First, unlike the causal steps approach (when incorporating the Sobel test (Sobel, 1982) to test for significance of indirect effects), the bootstrapping technique does not assume that the sampling distribution of the indirect effect is normal. This is a flawed assumption outside of very large sample sizes, as most samples are not normally distributed (Hayes, 2009; MacKinnon et al., 2002). Second, in contrast to the causal steps approach, the bootstrapping technique does not require the direct effects between the IV, DV, and mediator to be significant in order for mediation to occur (Hayes, 2009). Finally, related to this distinction, the causal steps approach is very low in power compared to other mediation methods (MacKinnon et al., 2002), meaning it is less likely than other methods to detect the indirect effect through the mediator. Accordingly, the Type II error rate (i.e., false negative) is too high with this test (MacKinnon et al., 2002). The bootstrapping method described above has a more accurate Type II error rate and greater statistical power than the causal steps method, and is more appropriate when examining small to moderate sample sizes (Preacher & Hayes, 2004, 2008; Shrout & Bolger, 2002).

For the present investigation, bootstrapping techniques were performed in line with recommendations by Preacher & Hayes (2008), with  $k = 5,000$  re-samples and bias-corrected and accelerated (BCa) confidence intervals (CI) used to evaluate indirect effects. BCa confidence intervals include corrections for median bias and skew (Efron & Tibshirani, 1993). Both 95% and 99% confidence intervals were examined for each mediation analysis, which was the equivalent of testing for significance at both the .05 and the .01 levels.

## Results

### *Descriptive Statistics*

Descriptive statistics are provided in Table 1. One-way ANOVAs indicated no significant differences between males and females in age [ $F(1, 157) = .07, p = .80, \eta^2 = .00$ ], CBAS Total Avoidance [ $F(1, 157) = 1.00, p = .32, \eta^2 = .01$ ], CBAS Cognitive Avoidance [ $F(1, 157) = .42, p = .52, \eta^2 = .00$ ], CBAS Behavioral Avoidance [ $F(1, 157) = 1.51, p = .22, \eta^2 = .01$ ], BADS Avoidance/Rumination [ $F(1, 157) = 3.28, p = .07, \eta^2 = .02$ ], RPI Total [ $F(1, 157) = 2.29, p = .13, \eta^2 = .01$ ], RPI Reward Probability [ $F(1, 157) = 1.11, p = .29, \eta^2 = .01$ ], RPI Environmental Suppressors [ $F(1, 157) = 2.79, p = .10, \eta^2 = .02$ ], Total Daily Diary Reward [ $F(1, 157) = 1.63, p = .20, \eta^2 = .01$ ], Adjusted Daily Diary Reward (Sleep Removed) [ $F(1, 157) = 1.24, p = .27, \eta^2 = .01$ ], EROS [ $F(1, 157) = 1.80, p = .18, \eta^2 = .01$ ], or days elapsed between visit 1 and visit 2 [ $F(1, 157) = .08, p = .78, \eta^2 = .00$ ]. Males and females did differ in depression symptom severity [BDI-II;  $F(1, 157) = 6.31, p = .01, \eta^2 = .04$ ], somatic anxiety [BAI:  $F(1, 157) = 5.54, p = .02, \eta^2 = .03$ ], and experiential avoidance [AAQ:  $F(1, 157) = 5.70, p = .02, \eta^2 = .04$ ], with females rating higher on each of these measures. Due to these gender differences, all remaining analyses were conducted for the total sample, as well as for males and females separately. A Chi-square analysis yielded no significant gender differences in terms of ethnic background ( $\chi^2(4) = 8.04, p = .09$ ).

### *Bivariate Correlations*

Bivariate correlations among self-report measures and daily diary totals are presented in Table 2. As predicted by Hypothesis 1, depression symptom severity (BDI-II) was significantly associated with CBAS-measured Cognitive ( $r = .68, p < .001$ ), Behavioral ( $r = .71, p < .001$ ), and Total Avoidance ( $r = .75, p < .001$ ), as well as experiential avoidance

(AAQ:  $r = .75, p < .001$ ) and BADS Avoidance/Rumination ( $r = .74, p < .001$ ), indicating a strong positive relationship between avoidance and depression. Interestingly, while each of these indices of avoidance correlated significantly with BAI-measured anxiety, a series of Pearson's tests of dependent  $r$ 's demonstrated that the magnitude of the correlation was significantly smaller in each case when compared to the BDI-II results.

Supporting Hypothesis 2, Total, Cognitive, and Behavioral Avoidance as measured by the CBAS, as well as AAQ experiential avoidance, all correlated inversely with all six measures of environmental reward (RPI Total, RPI Reward Probability, RPI Environmental Suppressors, Total Daily Diary Reward, Adjusted Daily Diary Reward, and EROS, all  $p < .001$ ). BADS Avoidance/Rumination was inversely related to the RPI Total, both RPI subscales, and the EROS ( $p < .001$ ), as well as Total Daily Diary Reward ( $r = -.16, p < .05$ ). The BADS did not correlate significantly with Adjusted Daily Diary Reward, although this relationship did approach significance ( $r = -.15, p = .05$ ). These relationships indicate that, as predicted, high avoidance is associated with decreased environmental reward.

Consistent with Hypothesis 3 along with predominant behavioral conceptualizations of depression, depression severity (BDI-II) was inversely related to environmental reward, as measured by RPI Total ( $r = -.79, p < .001$ ), RPI Reward Probability ( $r = -.65, p < .001$ ), RPI Environmental Suppressors ( $r = -.78, p < .001$ ), Total Daily Diary Reward ( $r = -.30, p < .001$ ), Adjusted Daily Diary Reward ( $r = -.32, p < .001$ ), and the EROS ( $r = -.79, p < .001$ ).

Correlations separated by gender are presented in Tables 3 (males) and 4 (females). A series of Pearson's tests of independent  $r$ 's was conducted to test for significant differences in correlation values between males and females. Males and females differed on only one correlation value. Compared to females, male RPI Environmental Suppressors ratings

correlated more strongly with Total Daily Diary Reward ( $Z = 1.98, p < .05$ ). Similarly, the difference between genders in the relationship between RPI Environmental Suppressors and Adjusted Daily Diary Reward approached significance ( $Z = 1.80, p = .07$ ). Additionally, among males the correlations between BADS Avoidance/Rumination and both diary variables were significant, while these relationships were not significant with females (although the differences between correlation values across gender for these variables were not significant).

### *Partial Correlations*

In order to examine the relationship between avoidance and depression independent of the effect of anxiety, a series of partial correlations between depression and each measure of avoidance while controlling for anxiety was conducted (Table 5). Even when controlling for somatic anxiety (BAI), depression severity maintained significant positive relationships with CBAS Total Avoidance ( $r = .68, p < .001$ ), CBAS Cognitive Avoidance ( $r = .62, p < .001$ ), CBAS Behavioral Avoidance ( $r = .61, p < .001$ ), AAQ experiential avoidance ( $r = .61, p < .001$ ), and BADS Avoidance/Rumination ( $r = .59, p < .001$ ). These significant relationships were maintained with males and with females, as detailed in Table 5. A series of Pearson's tests of independent  $r$ 's determined that there were no significant differences between any of the male and female correlation values.

### *Mediation*

A series of mediation analyses were conducted using the bootstrapping technique described above. Mediation was considered to have occurred if the 95% BCa confidence intervals generated by the bootstrapping method did not contain zero. Depression severity (BDI-II) was the dependent variable in each analysis. The first set of analyses tested total

avoidance, cognitive avoidance, and behavioral avoidance as measured by the CBAS separately as independent variables with the RPI total score as the mediating variable. In each case, the RPI mediated the relationship between avoidance and depression, as predicted. These analyses were repeated with somatic anxiety (BAI) as a covariate, in order to control for the effect of anxiety in this relationship. Even when controlling for anxiety, RPI reward mediated the links between depression and each of the three forms of avoidance. These results are presented in Table 6.

A second set of mediation analyses was performed with Adjusted Daily Diary Reward as the mediating variable (see Table 7). The IVs and DV were the same as in the above designs. Diary-measured reward mediated the relationship between cognitive avoidance and depression and behavioral avoidance and depression. Surprisingly, mediation did not occur when total avoidance was entered as the predictor variable. Examination of direct effects indicated that the only direct relationship that was not significant was that between reward and depression ( $\beta = -1.897$ ,  $p = .129$ ). However, when these analyses were repeated while controlling for anxiety, diary-measured reward did mediate the relationship between total avoidance and depression, as well as the relationships between cognitive and behavioral avoidance and depression. Therefore, when examining the pure relationship between avoidance and depression while controlling for the effects of comorbid anxiety symptoms, reward, as measured by both the RPI and daily diaries, was a mediating factor.

Subsequent mediation analyses were completed separating males from females, to examine possible gender differences. For males, the RPI was a significant mediator with total, cognitive, and behavioral avoidance as predictor variables. These results were maintained when controlling for anxiety (see Table 8). Similar results were observed with

Adjusted Daily Diary Reward as the mediator (see Table 9). Diary-measured reward was a significant mediator for each form of avoidance, even when anxiety was controlled.

Therefore, in males, reward (both RPI- and diary-measured) significantly mediates the relationship between avoidance and depression, just as predicted.

When examining females separately, the RPI mediated the links between each of the three avoidance measures and depression. These results held when anxiety was controlled (see Table 10). However, different results were seen when diary scores were used as the reward variable (see Table 11). In these analyses, reward did not meet criteria for mediation with total, cognitive, or behavioral avoidance as IVs. In each case, the direct effect between reward and depression was the only direct relationship that did not reach significance (total avoidance:  $\beta = -.760$ ,  $p = .652$ ; cognitive avoidance:  $\beta = -2.087$ ,  $p = .271$ ; behavioral avoidance:  $\beta = -1.440$ ,  $p = .427$ ). When anxiety was entered as a covariant, diary-measured reward only mediated the relationship between cognitive avoidance and depression – the relationships between behavioral avoidance and total avoidance and depression were not mediated by diary-measured reward when anxiety was controlled. Again, the only direct effects that were not significant were between reward and depression (total avoidance:  $\beta = -1.576$ ,  $p = .230$ ; behavioral avoidance:  $\beta = 2.277$ ,  $p = .119$ ). Therefore, contradictory to results observed in males, with females only RPI-measured reward consistently mediated the relationship between avoidance and depression. When anxiety symptoms were taken into account, daily diary-measured reward only fit criteria as a mediator when cognitive avoidance was the predictor variable.

*Structural Equation Modeling (SEM)*

SEM was used in order to allow for analyses that incorporated latent variables, which are comprehensive measures of a particular construct that are derived from three or more observed variables (Kline, 1998). It was thought that latent variables would provide for more valid and accurate measures of the constructs of avoidance and reward by combining multiple observed variables and reducing measurement error. Following recommendations by Hu and Bentler (Hu & Bentler, 1999) for sample sizes less than 250 participants, the comparative fit index (CFI) and standardized root mean residuals (SRMR) were used to evaluate how well models fit with the data. In order to provide the maximum balance between type I and type II errors, CFI should be  $> .95$  and SRMR should be  $< .08$  (Hu & Bentler, 1999).

The proposed model examined the potential mediating role of the latent variable Reward in the relationship between the latent variable Avoidance and the observed depression severity (BDI-II) variable. Each latent variable was derived from combining three observed variables, which is the minimum number of observed variables required to create a latent variable (Byrne, 2001). The latent variable of Avoidance was comprised of Total CBAS, Total AAQ, and BADS Avoidance/Rumination. The Reward latent variable was comprised of RPI Total, Adjusted Daily Diary Reward, and EROS Total. Bootstrapping ( $k = 5,000$  samples) was used to develop a 95% Bias-corrected (BC) confidence interval to test the indirect effects of Avoidance on depression, through Reward.

This model, pictured in Figure 1, represented a good fit to the data,  $\chi^2 (12) = 31.38$ ;  $CFI = .98$ ;  $SRMR = .038$ . Bootstrapping produced a 95% BC CI of  $-.109$  to  $.173$ , indicating mediation did not occur. Examination of direct effects indicated that the relationship between reward and depression was not significant in this model ( $\beta = -.164$ ,  $p = .251$ ), while the direct

effects between Avoidance and Reward and Avoidance and depression were significant at the .001 level.

This model was repeated with anxiety entered as a covariate to control for the shared variance of anxiety with avoidance and depression (see Figure 2). This model was also a good fit to the data,  $\chi^2 (16) = 46.63$ ;  $CFI = .97$ ;  $SRMR = .044$ . Based on the 95% BC CI (-.065 - .197), Reward did not fit as a mediator in the relationship between Avoidance and depression, even when anxiety was accounted for. Again, direct effects between Reward and depression were not significant ( $\beta = -.191$ ,  $p = .123$ ), while those between Avoidance and Reward and Avoidance and depression were significant at the .001 level.

Additional analyses using the same models were completed to examine possible gender differences. When the first model (Avoidance  $\rightarrow$  Reward  $\rightarrow$  depression) was run using only males, there was a good fit to the data,  $\chi^2 (12) = 11.15$ ;  $CFI = 1.00$ ;  $SRMR = .032$  (see Figure 3). Once again, 95% BC CI (-.093 - .205) indicated that Reward did not mediate the relation between Avoidance and depression. As with the total sample, the only direct effect that was not significant at the .001 level was that between Reward and depression ( $\beta = -.177$ ,  $p = .230$ ). This analysis was repeated with anxiety entered as a covariate, as seen in Figure 4. Again, there was a good fit,  $\chi^2 (16) = 15.77$ ;  $CFI = 1.00$ ;  $SRMR = .035$ . Results of 95% BC CI indicated that, even when anxiety was controlled, Reward did not mediate the relationship between Avoidance and depression. The direct effect between Reward and depression was once again not significant ( $\beta = -.214$ ,  $p = .146$ ). The effects of avoidance on depression and reward were significant, although the Avoidance to depression effect was only significant at the .05 level ( $\beta = .249$ ,  $p = .012$ ).

The above analyses were repeated with females only. The first model fit the data well,  $\chi^2(12) = 38.84$ ;  $CFI = .96$ ;  $SRMR = .051$  (see Figure 5). Bootstrapped 95% BC CI of  $-.311$  to  $.246$  indicated that Reward did not act as a mediator between Avoidance and depression. Similar to previous analyses, the direct effect between Reward and depression was the only direct effect that was not significant ( $\beta = -.212$ ,  $p = .330$ ). When this analysis was repeated with anxiety entered as a covariate, the model was an adequate fit to the data,  $\chi^2(16) = 50.21$ ;  $CFI = .95$ ;  $SRMR = .057$  (see Figure 6). Again, 95% BC CI ( $-.226 - .221$ ) showed that Reward did not act as a mediator even when anxiety was included in the model. The direct effect between Reward and depression was not significant ( $\beta = -.185$ ,  $p = .307$ ).

## Discussion

According to behavioral conceptualizations of depression, depressive symptoms arise when positive reinforcement (RCPR) for healthy behaviors decreases (Lewinsohn, 1974; Lewinsohn et al., 1980; Martell et al., 2001). Some theorists have proposed that such a reduction in reinforcement may result from patterns of excessive avoidance (Ferster, 1973; Martell et al., 2001). It has been hypothesized that a tendency for an individual to limit his or her contact with external or internal sources of distress through the use of avoidant behavioral and cognitive coping strategies can remove that individual from rewarding reinforcement contingencies, thus increasing the likelihood that depressive symptoms may develop and persist (Ferster, 1973; Martell et al., 2001; Watkins & Moulds, 2007). This is a central tenet of Behavioral Activation theory (Martell et al., 2001). While there is an abundance of evidence that links depression to increased avoidance and diminished RCPR, to date, no study has directly investigated this proposed mediating role of reinforcement. The primary aim of the current investigation was to provide initial evidence for the mediating role of positive reinforcement in the relationship between avoidance and depression. Using daily activity diaries and self-report measurements of environmental reward as proxy measures of positive reinforcement, results, while somewhat mixed, supported the hypothesis that increased trait-level cognitive and behavioral avoidance increase risk for depression through decreases in reinforcement.

Avoidance was measured with the CBAS (Ottenbreit & Dobson, 2004), a well-validated self-report instrument designed to assess cognitive avoidance and behavioral avoidance as they relate to depression, as well as the AAQ, a measure designed to assess experiential avoidance (Hayes et al., 2004), and the BADS Avoidance/Rumination subscale

(Kanter et al., 2007). The CBAS was considered to be a more appropriate measure of avoidance compared to the other measures used in this investigation due to stronger psychometric properties and a core theoretical backing that fit closely with the conceptualizations underlying this investigation's hypotheses. The CBAS's subscales allowed for the differentiation between cognitive and behavioral avoidance, which was deemed important in testing the mediating role of reinforcing behavior (Blalock & Joiner, 2000; Ottenbreit & Dobson, 2004). Accordingly, it was the primary avoidance measure used to test this study's hypotheses.

### *Evaluation of Hypotheses*

As predicted, both cognitive and behavioral CBAS avoidance, as well as the aggregate measure of the two (total avoidance), were positively related to depression severity as measured by the BDI-II. Avoidance also was inversely associated with reward as measured by self-report instruments (RPI and EROS) and daily activity diaries. The AAQ and BADS Avoidance/Rumination subscale demonstrated similar findings. All avoidance measures also correlated significantly with somatic anxiety severity (BAI), although with consistently smaller magnitudes than observed with the BDI, suggesting that avoidance may have been more strongly related to depression than to anxiety. This finding strengthens the argument that avoidance and depression are uniquely related. Consistent with behavioral theories, measures of reward were also significantly (inversely) related to avoidance and depression.

Given well-documented relationships between avoidance and anxiety (Barlow, 2002) and common comorbidity between depression and anxiety symptoms (Lepine et al., 1993; Mazer & Cloninger, 1990), it was important to establish that the relationships observed

between avoidance and depression remained significant when controlling for anxiety symptoms. Indeed, analyses revealed that even when controlling for somatic anxiety, all forms of avoidance maintained significant relationships with depression. Therefore, the observed relationships were not a function of covariance with anxiety symptoms, and do indeed indicate a positive relationship between avoidance and depression.

Mediation analyses were conducted using two methods: traditional mediation with observed variables and SEM using a combination of latent and observed variables. For each mediation analysis, depression severity was the outcome variable. The two methods produced divergent results. Traditional mediation analyses, conducted using bootstrapping methodology (Preacher & Hayes, 2008), largely demonstrated that reward mediates the relationship between avoidance and depression. When the RPI was entered as the reward variable, reward was a significant mediator with each form of avoidance, whether or not anxiety was accounted for, in the total sample as well as with males and females examined as separate groups.

Results were slightly different with environmental reward as assessed via daily diaries. In initial analyses with the total sample, diary-measured reward mediated the relationships between cognitive avoidance and depression and behavioral avoidance and depression, but not total avoidance and depression. However, when anxiety was controlled, diary-measured reward mediated the relationships between depression and all three forms of avoidance. Subsequent analyses separating males from females indicated gender differences. Specifically, diary-measured reward was a significant mediator with every combination of avoidance in the male sample. With females, however, diary-measured reward failed to mediate the relation between any of the three avoidance variables and depression. Even when

anxiety was controlled, diary-measured reward did not mediate the relationships between depression and total avoidance or behavioral avoidance, although there was significant mediation with cognitive avoidance.

SEM that incorporated latent variables for avoidance and reward produced different results. The latent variable of Avoidance was comprised of three distinct avoidance self-report measures: Total CBAS, the AAQ, and BADS Rumination/Avoidance. The Reward latent variable was made up of RPI Total, Adjusted Daily Diary Reward, and the EROS. Latent variables were used to provide a more comprehensive assessment of the relevant constructs. When these latent variables were used in the proposed mediation models, Reward did not act as a significant mediator. This finding was observed even when controlling for somatic anxiety.

While mediation results were mixed overall, there was strong evidence to support the mediating role of reward, and accordingly reinforcement, in the avoidance-depression relationship. All analyses that used the RPI total score as the sole reward variable demonstrated that this variable was a significant mediator. The RPI was arguably the strongest proxy measure of reinforcement used in this study, as it was specifically designed to measure the four hypothesized components of RCPR (i.e., the number of potential reinforcers, availability of reinforcers, the ability to obtain reinforcement, and exposure to aversive events) (Lewinsohn, 1974; Lewinsohn et al., 1980). While the daily diaries and the EROS are valid measures of reward, they are not as comprehensive as the RPI, and likely do not approximate RCPR to the same extent.

That being said, in the total sample diary-measured reward also largely mediated the avoidance-depression relationship. Importantly, when anxiety was taken into account, diary-

measured reward mediated the relationship between depression and all three forms of avoidance (cognitive, behavioral, and total). The analyses that controlled for the effects of anxiety were the more important tests in this investigation, as they more accurately tested the hypothesized relationship between avoidance and depression, accounting for commonly observed comorbidity between anxiety and depression (Lepine et al., 1993). In sum, the results from the traditional mediation analyses indicate that, independent of anxiety, a greater tendency to employ cognitive and behavioral avoidance strategies is associated with a decrease in environmental reward, which in turn appears to increase depressive symptomatology. Although positive reinforcement was not directly assessed, the reward measures used represent a suitable approximation for the purposes of this investigation, in order to provide initial support for reinforcement's hypothesized position in this avoidance-depression association.

It appears that both cognitive avoidance strategies (e.g., distracting oneself with alternative thoughts or trying not to think about sources of stress) and behavioral avoidance strategies (e.g., removing oneself from social engagements or easily giving up on challenging activities) diminish the frequency and intensity of RCPR. Avoidance strategies are often implemented as ways to deal with sources of stress or generally aversive internal or external stimuli. The CBAS measures these tendencies as they occur at the trait-level, meaning people high in CBAS-measured avoidance tend to use these techniques to cope quite frequently. Current data suggest that the use of such avoidant coping mechanisms can interfere with each of the four components of RCPR (the number of events that are potentially reinforcing for the individual, the availability of these potential reinforcers in the environment, ability to

experience rewarding contingencies based on instrumental behaviors such as social skill, and exposure to aversive stimuli in the form of upsetting, distressing, or unpleasant events).

First, it is likely that chronic avoidance can minimize the potential of events to have a reinforcing function. For example, if an individual is actively avoiding others, they are less likely to gain a sense of reward from social encounters that do occur. Similarly, if a person is actively preoccupied with distracting thoughts, it will be more difficult for them to attend to and derive pleasure from activities that may have been reinforcing at one time. Thus, the magnitude of reward, even when it is experienced, is reduced. Second, when avoidant tendencies limit the frequency of healthy interactions with the environment, the number of reinforcers that are available to an individual decreases. For instance, a man who spends most of his time watching television and rarely leaves his home limits the scope of his environment and the possible sources of reward with which he will come into contact. Third, over-reliance on avoidance affects an individual's ability or skill in obtaining reinforcement. For example, by regularly avoiding problems rather than confronting and resolving them, individuals limit their capacity to develop and enhance problem-solving skills. Similarly, by limiting social interactions, the development and maintenance of social skills are hindered. Finally, as neglected problems remain unresolved and multiply, so too do the degree of aversive stimuli (i.e., stressful or unpleasant life events) and associated stress that one encounters (Davila, 1993; Holahan et al., 2005; Nezu et al., 1989). The culmination of these decreases in RCPR is the development of negative affect, anhedonia, lack of energy, and other symptoms that characterize depression. In the present findings, the RPI's observed role as mediator between avoidance and depression strongly supports these conceptual links between avoidance and RCPR.

Surprisingly given the simple mediation results, the SEM mediation analyses did not produce significant findings. These results are difficult to interpret, given the strong relationships demonstrated in the traditional mediation analyses using observed variables. Examination of direct effects indicated that the relationship between Reward and depression was the weakest link in the models. This was the only direct effect that was not significant in these analyses. Therefore, the lack of findings can likely be attributed to this latent variable.

One possible explanation is that the Reward variable did not adequately represent the intended reward construct. Reward as measured by daily diaries might differ conceptually from reward as measured by the self-report questionnaires. Indeed, although the correlation between Adjusted Diary Reward and RPI Total was significant, it was not large ( $r = .41$ ). Further, the correlation between Adjusted Diary Reward and depression, while significant, was similarly modest ( $r = -.32$ ), especially compared to the correlation between RPI and depression ( $r = -.79$ ). The diaries, while an ecologically valid method of assessing the degree of pleasure obtained from various activities, do not directly target the four components of RCPR as the RPI does. Accordingly, it is conceivable that the diaries and the RPI may be measuring qualitatively different aspects of the reward construct, or two distinct (yet related) constructs. Therefore, considering these measures together in one latent variable may not have been conceptually appropriate, and may have weakened the mediation model (Kline, 1998).

Another plausible explanation for the lack of SEM findings may be related to having a sample size ( $n = 158$ ) that was potentially limited to yield significant results. Indeed, SEM is designed for large sample sizes (greater than 200 cases), although smaller samples are often utilized (Kline, 1998). Of course, another possibility is that these analyses correctly

demonstrated that neither reward nor reinforcement mediate the link between avoidance and depression. It is possible that in the real world, the relationship between avoidance and depression is not affected in any meaningful way by reinforcement. This relationship may be a direct linear connection or work through mediating factors that were not examined in this investigation. Indeed, in the two SEM analyses, only a small proportion of depression variance was accounted for by reward, compared to substantial relationships between avoidance and depression. Another possibility may be that the data is better explained when avoidance is considered the mediating variable between reward and depression, due to the bidirectional nature of these relationships<sup>2</sup>. However, while these are plausible conclusions, they do not seem the most likely explanations given the consistent results obtained in the simple mediation analyses with RPI and Diary Reward examined separately as mediators.

### *Gender Differences*

Notable gender differences emerged in this investigation. As expected, females rated significantly higher in both depressive and anxiety symptom severity, which is consistent with the clinical literature (Kessler et al., 1994, 2003, 2005) . However, somewhat unexpectedly, results from the mediation analyses suggest gender may be an important variable to consider in the avoidance-reinforcement-depression relationship. While the RPI was a significant mediator with males and females, analyses examining diary-measured reward as a mediator evidenced differences as a function of gender. It seems that in males, a greater tendency to employ both cognitive and behavioral avoidance strategies leads to increased symptoms of depression through a decrease in rewarding activity. This relationship

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<sup>2</sup> To test this possibility, an additional SEM model was tested that considered Avoidance a mediator between Reward and depression, while controlling for anxiety. This analysis yielded no difference in findings from the previous SEM analyses. Avoidance was not a mediator, and there was not a significant direct effect between Reward and depression.

is not as clear in females, where only cognitive avoidance was related to increased depression through diary-rated reward when anxiety was taken into account. These findings are especially interesting given that there were no significant group differences between males and females in the use of cognitive, behavioral, or aggregate avoidance strategies as measured by the CBAS or in reward levels as measured by the RPI, daily diaries, or EROS. Males and females did differ, however, in experiential avoidance as measured by the AAQ, with females rating higher.

While previous research has shown some evidence that females, especially those with elevated depression, are more likely than males to employ avoidance coping strategies (Hansenne et al., 1999; Hayes et al., 2004; Jylha & Isometsa, 2006; Moulds et al., 2007), overall, tests of gender differences in the use of avoidance have been inconclusive (Ben-Zur & Zeidner, 1996; Blalock & Joiner, 2000; Holahan & Moos, 1986; Ingram et al., 2007; Ottenbreit & Dobson, 2004). Similarly, no notable gender differences have been observed in RCPR or pleasurable events as they relate to depression (Carvalho et al., in press; Lewinsohn & Amenson, 1978; Lewinsohn & Graf, 1973).

Two previous studies that examined the relation between avoidance, stressful life events, and depression also observed gender differences. Stressful life events can be considered conceptually similar to reward and reinforcement, as greater frequency and magnitude of stressors are hypothesized to be a primary component of reduced RCPR (Lewinsohn et al., 1980). In a 10-year longitudinal investigation with a design similar to the present study, Holahan et al. (2005) examined the mediating effect of stressful life events in the relationship between avoidance and the development of depression. The authors found that stressors were a significant mediating variable for both men and women, although stress

fully explained the relationship between avoidance and depression for men, but only provided a partial explanation in females (i.e., direct effect between avoidance and depression was significant among females). These results were somewhat similar to those observed in the present study, where diary-measured reward was a stronger and more consistent mediator for men than for women. Also, the relationship between Adjusted Daily Diary Reward and depression seemed to be somewhat stronger among men ( $r = -.40$ ) compared to women ( $r = -.28$ ), although this difference was not significant.

Blalock and Joiner (2000) found that an interaction between avoidance, life stress, and gender predicted development of depression symptoms. Among women, a greater frequency of stressors interacted with cognitive avoidance to predict depression. There was no such relationship with men or with behavioral avoidance. These gender differences are the inverse of those found in the present investigation. However, the finding that only cognitive avoidance interacted with stressors to predict depression was similar to the finding in the present investigation that, for women, diary-measured reward only mediated the link between cognitive avoidance and depression (when anxiety was controlled).

Taken together with previous research, the present findings may indicate that avoidant tendencies in men are more likely to lead to reductions in external sources of reward and associated decreases in depression when compared to highly avoidant women. There is evidence that men are more physically active than women (Azevedo et al., 2007) and, more importantly, for men (and not women) physical activity is tied to self-esteem and self-worth (Hayes, Crocker, & Kowalski, 1999). Therefore, activity may be a factor that men deem more meaningful than women, and reductions in activity in men (and associated decreases in reward) may be more influential in predicting depression. The daily diaries, which quantified

the cumulative degree of pleasure derived from activities over the course of a week, may have been accounting for this phenomenon more so than the RPI, which also takes into account internal sources of reward probability (e.g., number of potentially reinforcing factors, instrumental ability in obtaining reward). Of course, another way to interpret these results is as a function of gender role as opposed to gender, per se. In other words, a quality of not deriving much pleasure from physical activity (or activity having little affect on one's mood), regardless of gender, may explain the data. Such a quality may be more likely in women, and accordingly, was represented through a gender discrepancy in these findings.

Gender discrepancies also suggest that, for women, cognitive avoidance strategies may play a more critical role in limiting pleasurable activity and predisposing to depression than behavioral avoidance. Females are, in fact, more likely to engage in rumination (a process that is conceptually related to cognitive avoidance), and in females rumination is more strongly related to depression than in men (Moulds et al., 2007). Perhaps the females that were more likely to ruminate were the most at risk for reductions in RCPR and associated depressive symptomatology. This would be consistent with BA's conceptualization of rumination (Martell et al., 2001). Further, since activity is less influential on self-esteem and self-worth in women (Hayes et al., 1999), avoidance strategies that are behavioral in nature may be less tied to reward values and associated affective changes. Alternatively, the gender differences might be related to variables not assessed in this investigation that either strengthened the relationship between diary-measured reward and depression in men or weakened it in women. Future research is needed to elucidate the role of gender in this process.

#### *Limitations and Future Directions*

There are several important limitations to consider in this study. First, it must be emphasized that reward and reinforcement are not synonymous. This investigation was based on behavioral theories that consider positive reinforcement to take place when pleasurable or rewarding outcomes following a behavior increase the likelihood of the future occurrence of that behavior (Lewinsohn, 1974). Therefore, in the present investigation reward was assessed as an approximate strategy to quantify reinforcement. Reinforcement was not directly assessed, and therefore conclusions about reinforcement's role in the avoidance-depression relationship, per se, cannot be drawn with complete confidence. However, as an initial investigation of these hypotheses, reward was considered an appropriate proxy measure. Future investigations would benefit from laboratory-based reinforcement paradigms that would allow for a more valid and direct assessment of reinforcement.

Second, because all data was cross-sectional, it is not possible to establish a temporal or causal connection between variables. It was hypothesized that in a causal fashion, avoidance leads to reduction in reward, which in turn increases depression. However, given the nature of the design, causation cannot be confirmed. The strong relationships between the three constructs could just as likely indicate that depression precedes increased avoidance and reduced reward. It is most likely, however, that these relationships are bidirectional in nature. Behavioral theories do in fact postulate that, even though this chain of events begins with avoidant behavior and associated decreases in reinforcement, depressed mood leads to further passivity, avoidance, and decreases in reward, creating a perpetuating cycle of negative symptoms and behaviors (Ferster, 1973; Lewinsohn, 1974). Future investigations would benefit from longitudinal designs that determine if individuals who tend to utilize

avoidant coping strategies experience less positive reinforcement over time, which consequently promotes the onset or maintenance of depressive symptoms.

Third, the strong magnitudes of the correlations observed between avoidance, reward, and depression, while likely indicating that these constructs are all highly related, may also be the result of a certain degree of multicollinearity or overlap between the different measures. Because these variables are so interrelated, it is conceptually difficult to parcel one construct from another in a single measure. For example, the items on the reward measures may be tapping into depression symptomatology, even though these are considered separate constructs. Therefore, the magnitudes of the correlations need to be interpreted carefully. There is little doubt, however, that despite possible issues in measurement, these three constructs are significantly related.

Finally, due to the sample used in this investigation, questions remain about external validity and generalizability of the findings. The sample was entirely comprised of undergraduate students who were predominantly Caucasians. Additionally, even though the mean BDI-II score ( $M = 13.59$ ) was consistent with a rating of mild depression (Beck & Steer, 1987), this was a nonclinical sample that included no formal assessment of depression diagnosis. Future investigations should test for these mediation effects in community and clinical samples in order to raise confidence about the external validity of findings. It would be expected that similar results would be observed in a depressed population, given the relatively high mean level of depression symptoms in the current sample.

### *Conclusion*

In sum, these findings provide important support for BA treatment and its underlying conceptualization of depression. BA considers avoidance behaviors implemental in creating a

depression-inducing environment (Martell et al., 2001). Over-reliance on avoidant coping creates an environment where healthy behaviors are not adequately reinforced and accordingly reduce in frequency or disappear altogether while being replaced with passive nonrewarding activity. This reduction in reinforcement brings about and maintains depressed mood and associated depressive symptoms (Ferster, 1973; Lewinsohn, 1974). BA helps depressed individuals to become more aware of this process, recognizing their avoidant tendencies and how they can become a hindrance. BA patients learn to become more active and to engage in goal-oriented behaviors that increase the frequency and intensity of reward that they experience. Reward has a reinforcing effect that increases the occurrence of healthy behaviors – elevating mood, increasing energy, and improving depression overall (Martell et al., 2001). As detailed earlier, there has been a great deal of support for the efficacy of behavioral activation treatments (Cuijpers et al., 2007; Ekers et al., 2008).

This investigation demonstrates that, consistent with BA theory, avoidance and reward are important factors to consider when conceptualizing and treating depressed patients. Targeting and reducing cognitive and behavioral avoidance strategies through treatment (e.g., by building awareness, teaching approach-oriented problem-solving strategies, increasing motivation to act and engage) can help to optimize the amount and quality of reward and reinforcement an individual experiences. Depression interventions may be more effective when they recognize the relationship between avoidance and reward as a causal influence in the development of depression and address these factors accordingly. Indeed, the success of behavioral activation treatments supports this notion.

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## Appendix

Table 1.

*Descriptive Statistics for Demographic Variables and Self-Report Measures*

|                  | <u>Total Sample (n = 158)</u> |       |      | <u>Males (n = 61)</u> |       |      | <u>Females (n = 97)</u> |       |      |
|------------------|-------------------------------|-------|------|-----------------------|-------|------|-------------------------|-------|------|
|                  | Mean                          | SD    | %    | Mean                  | SD    | %    | Mean                    | SD    | %    |
| Age (years)      | 19.13                         | 2.05  |      | 19.18                 | 1.95  |      | 19.09                   | 2.12  |      |
| Caucasian        |                               |       | 77.8 |                       |       | 75.4 |                         |       | 79.4 |
| African American |                               |       | 11.4 |                       |       | 16.4 |                         |       | 8.2  |
| Asian American   |                               |       | 4.4  |                       |       | 3.3  |                         |       | 5.2  |
| Other Ethnicity  |                               |       | 6.4  |                       |       | 4.9  |                         |       | 7.2  |
| BDI              | 13.59                         | 9.42  |      | 11.25                 | 7.48  |      | 15.06                   | 10.22 |      |
| BAI              | 10.37                         | 8.20  |      | 8.46                  | 6.61  |      | 11.57                   | 8.88  |      |
| CBAS T           | 62.42                         | 20.40 |      | 60.38                 | 19.30 |      | 63.71                   | 21.06 |      |
| CBAS CA          | 33.90                         | 11.62 |      | 33.14                 | 10.40 |      | 34.38                   | 12.36 |      |
| CBAS BA          | 28.53                         | 10.47 |      | 27.24                 | 10.29 |      | 29.34                   | 10.56 |      |
| AAQ              | 36.83                         | 7.21  |      | 35.12                 | 6.80  |      | 37.90                   | 7.30  |      |
| BADS A/R         | 17.11                         | 10.60 |      | 15.20                 | 9.51  |      | 18.31                   | 11.11 |      |
| RPI T            | 57.41                         | 9.38  |      | 58.83                 | 9.08  |      | 56.52                   | 9.50  |      |
| RPI RP           | 34.28                         | 5.14  |      | 34.83                 | 5.34  |      | 33.94                   | 5.00  |      |
| RPI ES           | 23.13                         | 5.25  |      | 24.00                 | 4.41  |      | 23.58                   | 5.66  |      |
| EROS             | 27.72                         | 5.67  |      | 28.48                 | 5.75  |      | 27.24                   | 5.60  |      |
| Tot Diary        | 2.88                          | .38   |      | 3.74                  | .43   |      | 2.88                    | .38   |      |
| Adj Diary        | 2.91                          | .40   |      | 2.79                  | .44   |      | 2.71                    | .41   |      |

BDI = Beck Depression Inventory-II; BAI = Beck Anxiety Inventory; CBAS T = Cognitive-Behavioral Avoidance Scale total; CBAS CA = Cognitive-Behavioral Avoidance Scale - Cognitive avoidance subscale; CBAS BA = Cognitive-Behavioral Avoidance Scale - Behavioral avoidance subscale; AAQ = Acceptance and Action Questionnaire; BADS A/R = Behavioral Activation for Depression Scale – Avoidance/Rumination subscale; RPI T = Reward Probability Index total; RPI RP = Reward Probability Index – Reward Probability subscale; RPI ES = Reward Probability Index – Environmental Suppressors subscale; EROS = Environmental Reward Observation Scale; Tot Diary = Total Daily Diary Reward; Adj Diary = Adjusted Daily Diary Reward

Table 2.

*Bivariate Correlations Among Self-Report Measures - Total Sample (n = 158)*

|               | 1 | 2     | 3     | 4     | 5     | 6     | 7     | 8      | 9      | 10     | 11     | 12     | 13     |
|---------------|---|-------|-------|-------|-------|-------|-------|--------|--------|--------|--------|--------|--------|
| 1. BDI        | 1 | .68** | .75** | .68** | .71** | .75** | .74** | -.79** | -.65** | -.78** | -.79** | -.30** | -.32** |
| 2. BAI        |   | 1     | .45** | .38** | .46** | .54** | .55** | -.54** | -.39** | -.57** | -.47** | -.13   | -.11   |
| 3. CBAS T     |   |       | 1     | .93** | .91** | .74** | .68** | -.78** | -.71** | -.69** | -.76** | -.31** | -.33** |
| 4. CBAS CA    |   |       |       | 1     | .70** | .70** | .65** | -.66** | -.60** | -.63** | -.64** | -.27** | -.29** |
| 5. CBAS BA    |   |       |       |       | 1     | .68** | .60** | -.78** | -.76** | -.65** | -.77** | -.30** | -.32** |
| 6. AAQ        |   |       |       |       |       | 1     | .68** | -.73** | -.64** | -.68** | -.72** | -.28** | -.29** |
| 7. BADS A/R   |   |       |       |       |       |       | 1     | -.69** | -.51** | -.73** | -.61** | -.16*  | -.15   |
| 8. RPI T      |   |       |       |       |       |       |       | 1      | .90**  | .91**  | .92**  | .39**  | .41**  |
| 9. RPI RP     |   |       |       |       |       |       |       |        | 1      | .63**  | .89**  | .42**  | .43**  |
| 10. RPI ES    |   |       |       |       |       |       |       |        |        | 1      | .78**  | .29**  | .31**  |
| 11. EROS      |   |       |       |       |       |       |       |        |        |        | 1      | .45**  | .47**  |
| 12. Tot Diary |   |       |       |       |       |       |       |        |        |        |        | 1      | .95**  |
| 13. Adj Diary |   |       |       |       |       |       |       |        |        |        |        |        | 1      |

\*p &lt; .05      \*\*p &lt; .01

BDI = Beck Depression Inventory-II; BAI = Beck Anxiety Inventory; CBAS T = Cognitive-Behavioral Avoidance Scale total; CBAS CA = Cognitive-Behavioral Avoidance Scale - Cognitive avoidance subscale; CBAS BA = Cognitive-Behavioral Avoidance Scale - Behavioral avoidance subscale; AAQ = Acceptance and Action Questionnaire; BADS A/R = Behavioral Activation for Depression Scale – Avoidance/Rumination subscale; RPI T = Reward Probability Index total; RPI RP = Reward Probability Index – Reward Probability subscale; RPI ES = Reward Probability Index – Environmental Suppressors subscale; EROS = Environmental Reward Observation Scale; Tot Diary = Total Daily Diary Reward; Adj Diary = Adjusted Daily Diary Reward

Table 3.

*Bivariate Correlations Among Self-Report Measures – Males (n = 61)*

|               | 1 | 2     | 3     | 4     | 5     | 6     | 7     | 8      | 9      | 10     | 11     | 12     | 13     |
|---------------|---|-------|-------|-------|-------|-------|-------|--------|--------|--------|--------|--------|--------|
| 1. BDI        | 1 | .61** | .70** | .64** | .67** | .72** | .75** | -.76** | -.72** | -.70** | -.77** | -.39** | -.40** |
| 2. BAI        |   | 1     | .50** | .45** | .48** | .57** | .58** | -.49** | -.42** | -.49** | -.43** | -.16   | -.16   |
| 3. CBAS T     |   |       | 1     | .93** | .93** | .71** | .73** | -.77** | -.78** | -.64** | -.74** | -.34** | -.33** |
| 4. CBAS CA    |   |       |       | 1     | .74** | .67** | .69** | -.67** | -.65** | -.58** | -.66** | -.30*  | -.29*  |
| 5. CBAS BA    |   |       |       |       | 1     | .65** | .68** | -.77** | -.80** | -.62** | -.72** | -.34** | -.33*  |
| 6. AAQ        |   |       |       |       |       | 1     | .71** | -.67** | -.64** | -.61** | -.67** | -.31*  | -.29*  |
| 7. BADS A/R   |   |       |       |       |       |       | 1     | -.68** | -.62** | -.66** | -.66** | -.29*  | -.30*  |
| 8. RPI T      |   |       |       |       |       |       |       | 1      | .94**  | .92**  | .93**  | .53**  | .54**  |
| 9. RPI RP     |   |       |       |       |       |       |       |        | 1      | .73**  | .89**  | .49**  | .49**  |
| 10. RPI ES    |   |       |       |       |       |       |       |        |        | 1      | .84**  | .50**  | .51**  |
| 11. EROS      |   |       |       |       |       |       |       |        |        |        | 1      | .47**  | .47**  |
| 12. Tot Diary |   |       |       |       |       |       |       |        |        |        |        | 1      | .97**  |
| 13. Adj Diary |   |       |       |       |       |       |       |        |        |        |        |        | 1      |

\*p &lt; .05      \*\*p &lt; .01

BDI = Beck Depression Inventory-II; BAI = Beck Anxiety Inventory; CBAS T = Cognitive-Behavioral Avoidance Scale total; CBAS CA = Cognitive-Behavioral Avoidance Scale - Cognitive avoidance subscale; CBAS BA = Cognitive-Behavioral Avoidance Scale - Behavioral avoidance subscale; AAQ = Acceptance and Action Questionnaire; BADS A/R = Behavioral Activation for Depression Scale – Avoidance/Rumination subscale; RPI T = Reward Probability Index total; RPI RP = Reward Probability Index – Reward Probability subscale; RPI ES = Reward Probability Index – Environmental Suppressors subscale; EROS = Environmental Reward Observation Scale; Tot Diary = Total Daily Diary Reward; Adj Diary = Adjusted Daily Diary Reward

Table 4.

*Bivariate Correlations Among Self-Report Measures – Females (n = 97)*

|               | 1 | 2     | 3     | 4     | 5     | 6     | 7     | 8      | 9      | 10     | 11     | 12     | 13     |
|---------------|---|-------|-------|-------|-------|-------|-------|--------|--------|--------|--------|--------|--------|
| 1. BDI        | 1 | .69** | .78** | .70** | .73** | .75** | .73** | -.81** | -.63** | -.80** | -.81** | -.24*  | -.28** |
| 2. BAI        |   | 1     | .43** | .34** | .45** | .51** | .53** | -.55** | -.37** | -.59** | -.48** | -.09   | -.07   |
| 3. CBAS T     |   |       | 1     | .93** | .90** | .76** | .65** | -.78** | -.67** | -.71** | -.77** | -.28** | -.32** |
| 4. CBAS CA    |   |       |       | 1     | .69** | .71** | .63** | -.66** | -.51** | -.65** | -.63** | -.26*  | -.29** |
| 5. CBAS BA    |   |       |       |       | 1     | .69** | .55** | -.78** | -.73** | -.67** | -.80** | -.26** | -.31** |
| 6. AAQ        |   |       |       |       |       | 1     | .66** | -.76** | -.64** | -.71** | -.75** | -.24** | -.27*  |
| 7. BADS A/R   |   |       |       |       |       |       | 1     | -.68** | -.44** | -.75** | -.58** | -.07   | -.06   |
| 8. RPI T      |   |       |       |       |       |       |       | 1      | .88**  | .91**  | .91**  | .29**  | .32**  |
| 9. RPI RP     |   |       |       |       |       |       |       |        | 1      | .59**  | .88**  | .36**  | .38**  |
| 10. RPI ES    |   |       |       |       |       |       |       |        |        | 1      | .75**  | .17    | .21*   |
| 11. EROS      |   |       |       |       |       |       |       |        |        |        | 1      | .42**  | .46**  |
| 12. Tot Diary |   |       |       |       |       |       |       |        |        |        |        | 1      | .94**  |
| 13. Adj Diary |   |       |       |       |       |       |       |        |        |        |        |        | 1      |

\*p &lt; .05      \*\*p &lt; .01

BDI = Beck Depression Inventory-II; BAI = Beck Anxiety Inventory; CBAS T = Cognitive-Behavioral Avoidance Scale total; CBAS CA = Cognitive-Behavioral Avoidance Scale - Cognitive avoidance subscale; CBAS BA = Cognitive-Behavioral Avoidance Scale - Behavioral avoidance subscale; AAQ = Acceptance and Action Questionnaire; BADS A/R = Behavioral Activation for Depression Scale – Avoidance/Rumination subscale; RPI T = Reward Probability Index total; RPI RP = Reward Probability Index – Reward Probability subscale; RPI ES = Reward Probability Index – Environmental Suppressors subscale; EROS = Environmental Reward Observation Scale; Tot Diary = Total Daily Diary Reward; Adj Diary = Adjusted Daily Diary Reward

Table 5.

*Partial Correlations Between Depression and Avoidance, Controlling for Anxiety (BAI)*

|                                | BDI | CBAS T | CBAS CA | CBAS BA | AAQ  | BADS |
|--------------------------------|-----|--------|---------|---------|------|------|
| Total Sample ( <i>n</i> = 158) |     |        |         |         |      |      |
| BDI                            | 1   | .68*   | .62*    | .61*    | .61* | .59* |
| CBAS T                         |     | 1      | .92*    | .89*    | .66* | .58* |
| CBAS CA                        |     |        | 1       | .65*    | .63* | .57* |
| CBAS BA                        |     |        |         | 1       | .57* | .47* |
| AAQ                            |     |        |         |         | 1    | .55* |
| BADS                           |     |        |         |         |      | 1    |
| Males ( <i>n</i> = 61)         |     |        |         |         |      |      |
| BDI                            | 1   | .58*   | .51*    | .54*    | .57* | .61* |
| CBAS T                         |     | 1      | .92*    | .91*    | .60* | .63* |
| CBAS CA                        |     |        | 1       | .67*    | .57* | .59* |
| CBAS BA                        |     |        |         | 1       | .52* | .56* |
| AAQ                            |     |        |         |         | 1    | .56* |
| BADS                           |     |        |         |         |      | 1    |
| Females ( <i>n</i> = 97)       |     |        |         |         |      |      |
| BDI                            | 1   | .74*   | .68*    | .66*    | .64* | .59* |
| CBAS T                         |     | 1      | .92*    | .88*    | .70* | .55* |
| CBAS CA                        |     |        | 1       | .64*    | .66* | .56* |
| CBAS BA                        |     |        |         | 1       | .60* | .42* |
| AAQ                            |     |        |         |         | 1    | .54* |
| BADS                           |     |        |         |         |      | 1    |

\**p* < .001

BDI = Beck Depression Inventory-II; BAI = Beck Anxiety Inventory; CBAS T = Cognitive-Behavioral Avoidance Scale total; CBAS CA = Cognitive-Behavioral Avoidance Scale - Cognitive avoidance subscale; CBAS BA = Cognitive-Behavioral Avoidance Scale - Behavioral avoidance subscale; AAQ = Acceptance and Action Questionnaire; BADS = Behavioral Activation for Depression Scale – Avoidance/Rumination subscale

Table 6.

*Indirect Effects of Avoidance on Depression through RPI Total Using Bootstrapping**Technique – Total Sample (n = 158; 5000 bootstrap samples)*

|                         |                | <u>BCa 95% CI</u> |       | <u>BCa 99% CI</u> |       |
|-------------------------|----------------|-------------------|-------|-------------------|-------|
|                         | Point Estimate | Lower             | Upper | Lower             | Upper |
| Simple Mediation        |                |                   |       |                   |       |
| Total Avoidance         | .1901          | .1428             | .2478 | .1312             | .2656 |
| Cognitive Avoidance     | .3271          | .2536             | .4127 | .2319             | .4479 |
| Behavioral Avoidance    | .4927          | .3306             | .5490 | .3002             | .5915 |
| Controlling for Anxiety |                |                   |       |                   |       |
| Total Avoidance         | .1145          | .0766             | .1611 | .0663             | .1757 |
| Cognitive Avoidance     | .1874          | .1279             | .2610 | .1133             | .2918 |
| Behavioral Avoidance    | .2775          | .2035             | .3725 | .1780             | .4048 |

BCa CI = Bias-corrected and accelerated confidence interval. Confidence intervals containing zero (i.e., negative lower bounds) are interpreted as not significant.

Table 7.

*Indirect Effects of Avoidance on Depression through Adjusted Daily Diary Reward Using Bootstrapping Technique – Total Sample (n = 158; 5000 bootstrap samples)*

|                         |                | <u>BCa 95% CI</u> |       | <u>BCa 99% CI</u> |       |
|-------------------------|----------------|-------------------|-------|-------------------|-------|
|                         | Point Estimate | Lower             | Upper | Lower             | Upper |
| Simple Mediation        |                |                   |       |                   |       |
| Total Avoidance         | .0129          | -.0003            | .0342 | -.0035            | .0415 |
| Cognitive Avoidance     | .0324          | .0062             | .0766 | -.0006            | .0936 |
| Behavioral Avoidance    | .0306          | .0030             | .0742 | -.0018            | .0938 |
| Controlling for Anxiety |                |                   |       |                   |       |
| Total Avoidance         | .0165          | .0035             | .0368 | .0001             | .0467 |
| Cognitive Avoidance     | .0317          | .0091             | .0672 | .0044             | .0859 |
| Behavioral Avoidance    | .0379          | .0115             | .0825 | .0054             | .0963 |

BCa CI = Bias-corrected and accelerated confidence intervals. Confidence intervals containing zero (i.e., negative lower bounds) are interpreted as not significant.

Table 8.

*Indirect Effects of Avoidance on Depression through RPI Total Using Bootstrapping**Technique – Males (n = 61; 5000 bootstrap samples)*

|                         |                | <u>BCa 95% CI</u> |       | <u>BCa 99% CI</u> |       |
|-------------------------|----------------|-------------------|-------|-------------------|-------|
|                         | Point Estimate | Lower             | Upper | Lower             | Upper |
| Simple Mediation        |                |                   |       |                   |       |
| Total Avoidance         | .1642          | .0865             | .2862 | .0692             | .3296 |
| Cognitive Avoidance     | .2914          | .1639             | .4845 | .1366             | .5550 |
| Behavioral Avoidance    | .3417          | .1957             | .5119 | .1546             | .5851 |
| Controlling for Anxiety |                |                   |       |                   |       |
| Total Avoidance         | .1305          | .0736             | .2380 | .0589             | .2976 |
| Cognitive Avoidance     | .2071          | .1085             | .3988 | .0855             | .5304 |
| Behavioral Avoidance    | .2661          | .1631             | .4437 | .1430             | .4862 |

BCa CI = Bias-corrected and accelerated confidence interval. Confidence intervals containing zero (i.e., negative lower bounds) are interpreted as not significant.

Table 9.

*Indirect Effects of Avoidance on Depression through Adjusted Daily Diary Reward Using Bootstrapping Technique – Males (n = 61; 5000 bootstrap samples)*

|                         |                | <u>BCa 95% CI</u> |       | <u>BCa 99% CI</u> |       |
|-------------------------|----------------|-------------------|-------|-------------------|-------|
|                         | Point Estimate | Lower             | Upper | Lower             | Upper |
| Simple Mediation        |                |                   |       |                   |       |
| Total Avoidance         | .0240          | .0013             | .0749 | -.0037            | .0985 |
| Cognitive Avoidance     | .0488          | .0030             | .1532 | -.0060            | .2002 |
| Behavioral Avoidance    | .0478          | .0026             | .1327 | -.0066            | .1748 |
| Controlling for Anxiety |                |                   |       |                   |       |
| Total Avoidance         | .0245          | .0002             | .0654 | -.0058            | .0797 |
| Cognitive Avoidance     | .0437          | .0018             | .1230 | -.0155            | .1504 |
| Behavioral Avoidance    | .0468          | .0007             | .1149 | -.0126            | .1429 |

BCa CI = Bias-corrected and accelerated confidence intervals. Confidence intervals containing zero (i.e., negative lower bounds) are interpreted as not significant.

Table 10.

*Indirect Effects of Avoidance on Depression through RPI Total Using Bootstrapping**Technique – Females (n = 97; 5000 bootstrap samples)*

|                         |                | <u>BCa 95% CI</u> |       | <u>BCa 99% CI</u> |       |
|-------------------------|----------------|-------------------|-------|-------------------|-------|
|                         | Point Estimate | Lower             | Upper | Lower             | Upper |
| Simple Mediation        |                |                   |       |                   |       |
| Total Avoidance         | .1963          | .1380             | .2633 | .1161             | .2795 |
| Cognitive Avoidance     | .3350          | .2485             | .4382 | .2162             | .4705 |
| Behavioral Avoidance    | .4629          | .3286             | .6260 | .2869             | .6731 |
| Controlling for Anxiety |                |                   |       |                   |       |
| Total Avoidance         | .1053          | .0592             | .1561 | .0467             | .1740 |
| Cognitive Avoidance     | .1818          | .1162             | .2642 | .0890             | .2944 |
| Behavioral Avoidance    | .2816          | .1780             | .4026 | .1426             | .4519 |

BCa CI = Bias-corrected and accelerated confidence interval. Confidence intervals containing zero (i.e., negative lower bounds) are interpreted as not significant.

Table 11.

*Indirect Effects of Avoidance on Depression through Adjusted Daily Diary Reward Using Bootstrapping Technique – Females (n = 97; 5000 bootstrap samples)*

|                         |                | <u>BCa 95% CI</u> |       | <u>BCa 99% CI</u> |       |
|-------------------------|----------------|-------------------|-------|-------------------|-------|
|                         | Point Estimate | Lower             | Upper | Lower             | Upper |
| Simple Mediation        |                |                   |       |                   |       |
| Total Avoidance         | .0048          | -.0105            | .0278 | -.0173            | .0389 |
| Cognitive Avoidance     | .0200          | -.0091            | .0716 | -.0204            | .0868 |
| Behavioral Avoidance    | .0173          | -.0103            | .0674 | -.0199            | .0939 |
| Controlling for Anxiety |                |                   |       |                   |       |
| Total Avoidance         | .0110          | -.0032            | .0353 | -.0082            | .0481 |
| Cognitive Avoidance     | .0246          | .0008             | .0699 | -.0078            | .0884 |
| Behavioral Avoidance    | .0306          | -.0007            | .0902 | -.0106            | .1145 |

BCa CI = Bias-corrected and accelerated confidence intervals. Confidence intervals containing zero (i.e., negative lower bounds) are interpreted as not significant.

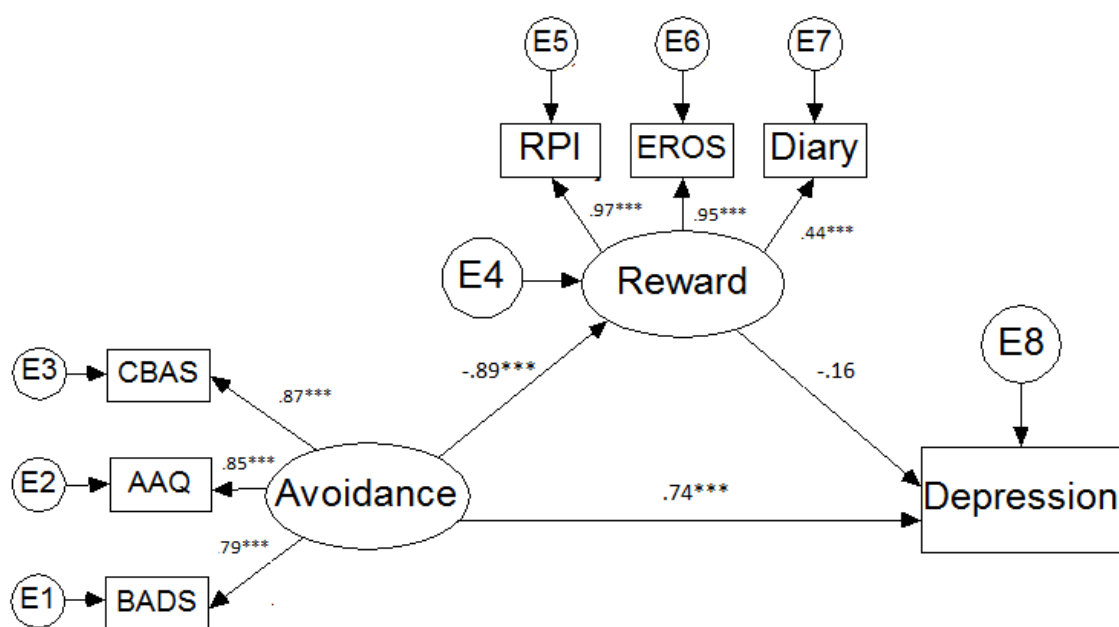


Figure 1. Tests of Indirect Effects of Avoidance on Depression through Reward – Total Sample ( $n = 158$ )

Note. Estimates are standardized

\*\*\* $p < .001$

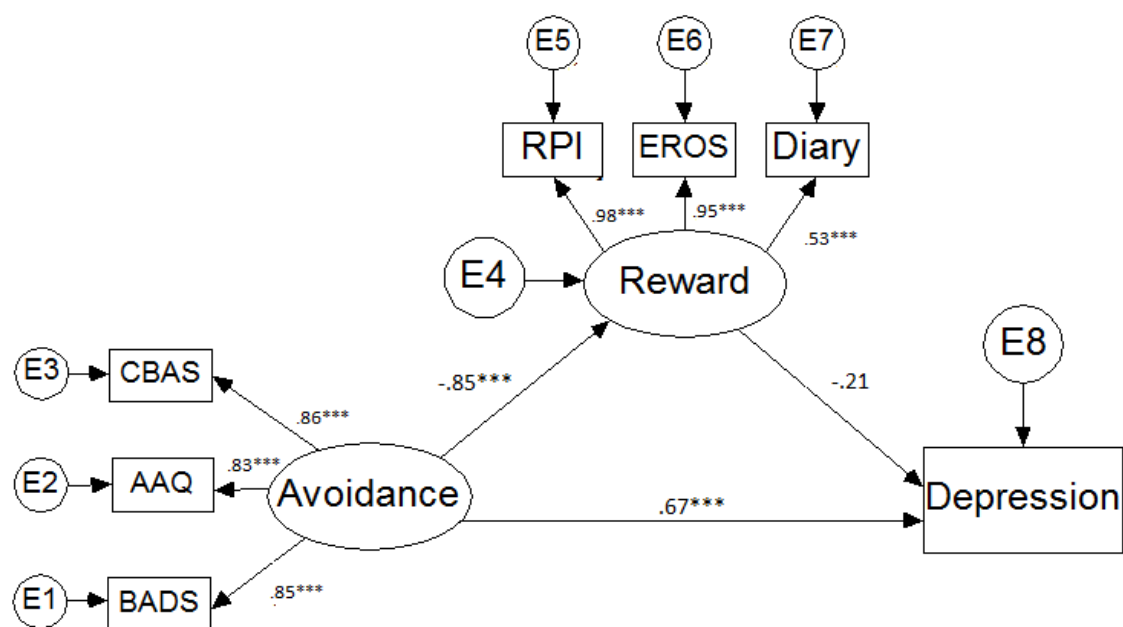


Figure 2. Tests of Indirect Effects of Avoidance on Depression through Reward – Males ( $n = 61$ )

Note. Estimates are standardized

\*\*\* $p < .001$

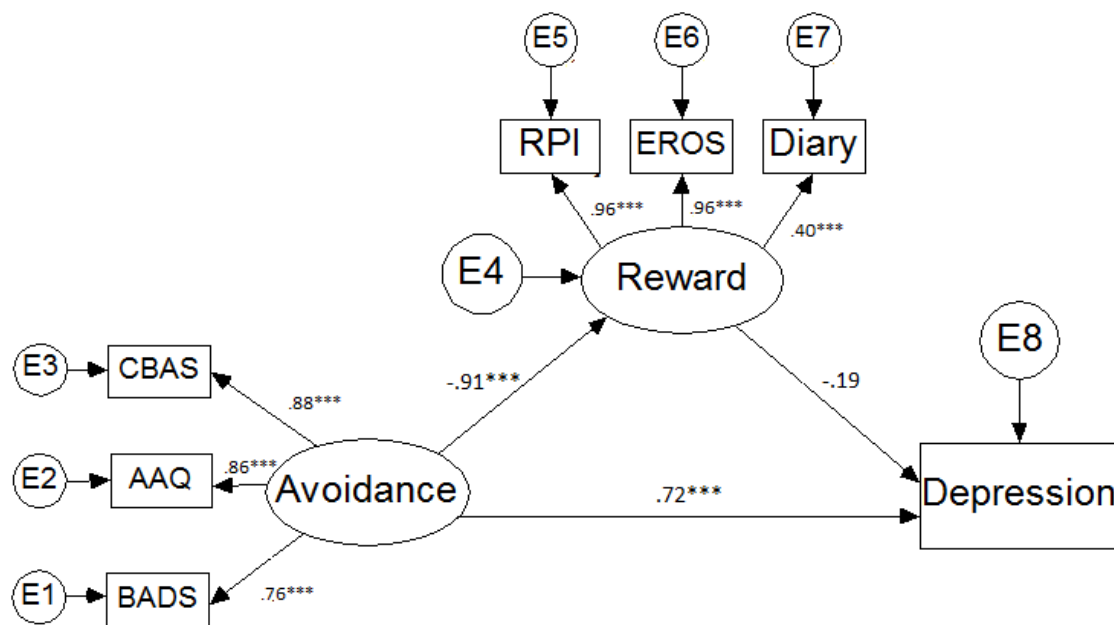


Figure 3. Tests of Indirect Effects of Avoidance on Depression through Reward – Females ( $n = 97$ )

Note. Estimates are standardized

\*\*\* $p < .001$

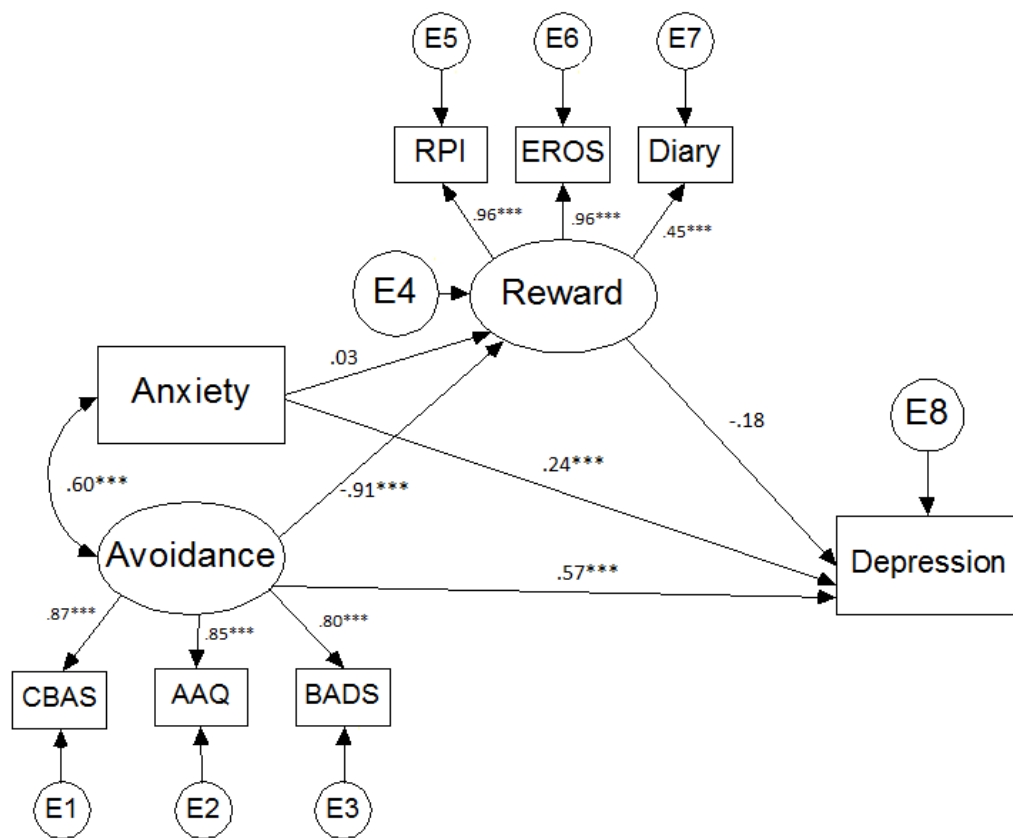


Figure 4. Tests of Indirect Effects of Avoidance on Depression through Reward, Covarying for Anxiety – Total Sample ( $n = 158$ )

Note. Estimates are standardized

\*\*\* $p < .001$

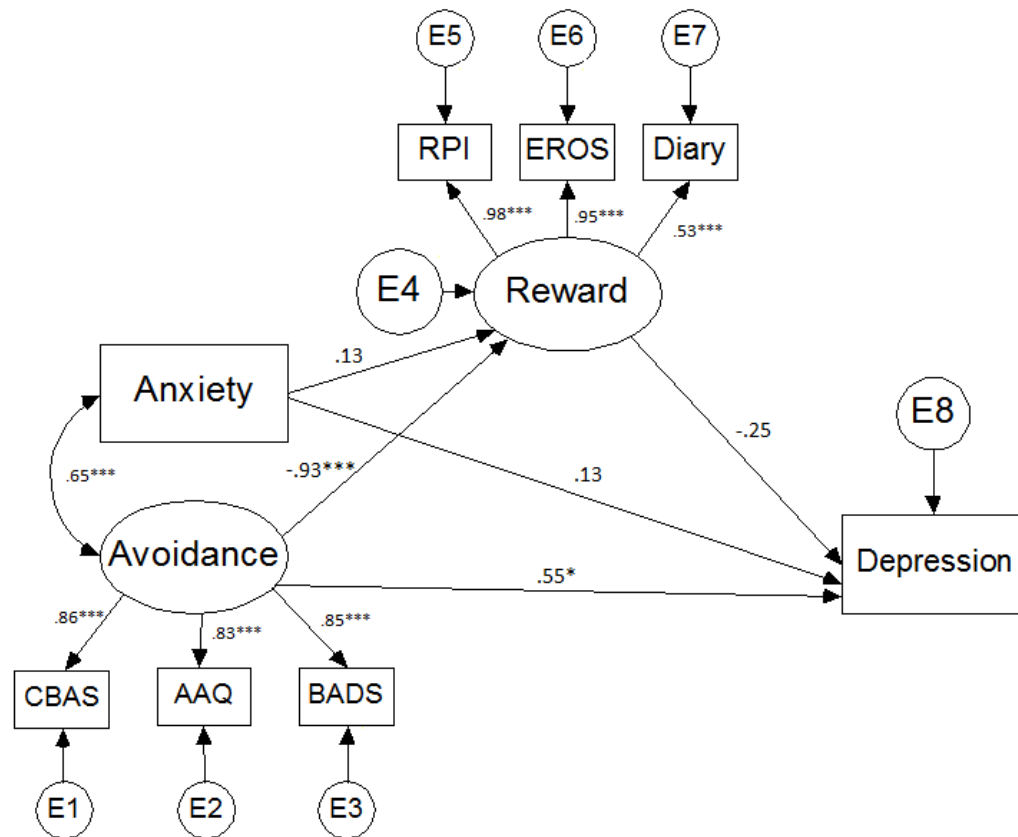


Figure 5. Tests of Indirect Effects of Avoidance on Depression through Reward, Covarying for Anxiety – Males ( $n = 61$ )

Note. Estimates are standardized

\* $p < .05$ , \*\*\* $p < .001$

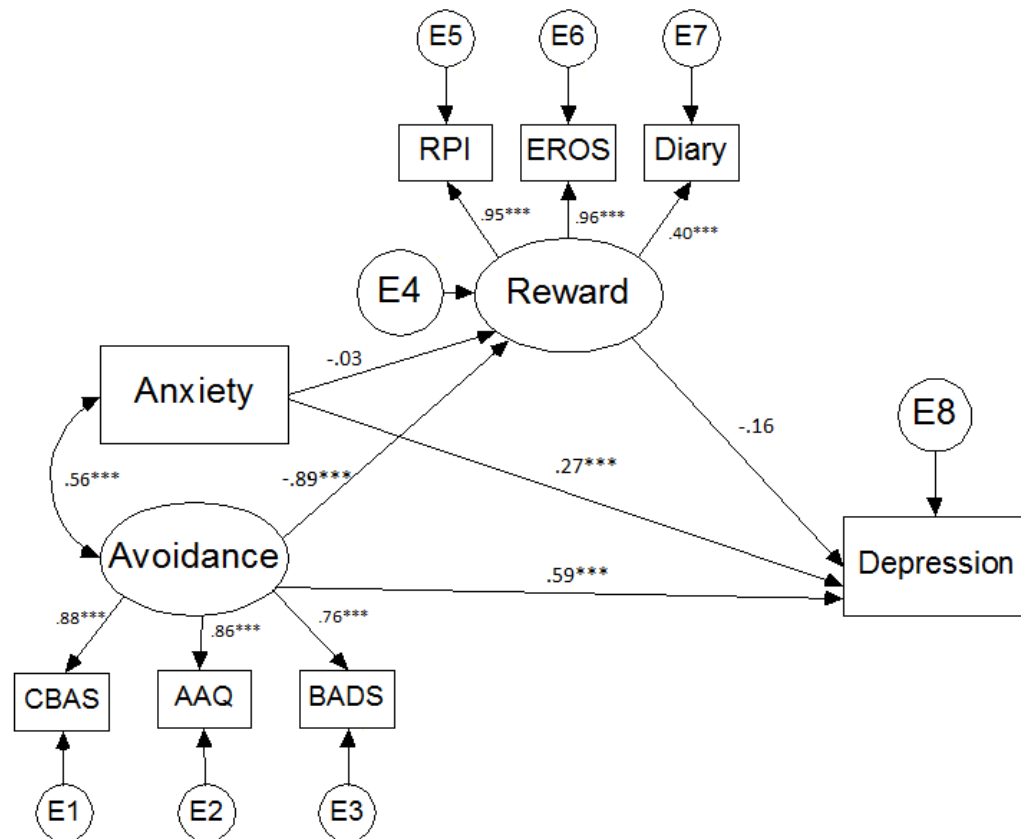


Figure 6. Tests of Indirect Effects of Avoidance on Depression through Reward, Covarying for Anxiety – Females ( $n = 97$ )

Note. Estimates are standardized

\*\*\* $p < .001$

### **Vita**

John Paul Carvalho graduated from Providence College in Providence, Rhode Island in 2004 with a B.A. in Psychology. From 2004 to 2006 he worked as a Senior Research Assistant and Study Coordinator for the Mood Disorders Research Program of Butler Hospital in Providence. In 2006 he entered the doctoral program in clinical psychology at the University of Tennessee, Knoxville. He received his Master's of Arts degree in Clinical Psychology from the University of Tennessee in 2008. Since 2006 he has worked as a graduate research assistant under the supervision of Dr. Derek Hopko studying the efficacy of behavioral activation therapy in treating depressed cancer patients, as well as other topics related to depression and anxiety. His own research has provided support for behavioral theories of depression. In addition to his research pursuits, John has been working as a graduate student clinician at the University of Tennessee Psychological Clinic from 2007 to present. Since August 2008, he also has been working as a therapist for Cherokee Health Systems in New Tazewell and Knoxville, Tennessee.