The Contrast Avoidance Model in Generalized Anxiety and Depression: A Longitudinal Panel Study

by

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Abstract

Generalized anxiety disorder (GAD) and major depressive disorder (MDD) are two of the most commonly comorbid diagnoses (American Psychiatric Association, 2013), suggesting they may share etiological and maintenance processes, such as repetitive negative though (worry and rumination). The negative emotional contrast avoidance model (NECAM; Newman & Llera, 2011) provides a new framework for understanding the role of worry in GAD, but few investigations have explored the parallel role of rumination in MDD. This is problematic, as research illuminating transdiagnostic factors in GAD and MDD would prove highly influential in future conceptualizations and treatment of these disorders. This investigation sought to close this gap in this literature and hypothesized that emotional contrast avoidance would be positively associated with worry, rumination, generalized anxiety symptoms, and depressive symptoms cross-sectionally and that the relationships between emotional contrast avoidance and symptoms of generalized anxiety and depression would be longitudinally mediated by worry and rumination, respectively. Using a large adult sample, three waves of data collection over eight months, and structural equation modeling, the current study found that emotional contrast avoidance was positively associated with worry, rumination, generalized anxiety symptoms, and depressive symptoms cross-sectionally, but all hypothesized longitudinal paths were non-significant. Findings, as well as theoretical implications for the NECAM and other methodological and analytical considerations, are discussed.

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Table of Contents

List of Tables

List of Illustrations

The contrast avoidance model in generalized anxiety and depression: A longitudinal panel study

Generalized Anxiety & Major Depression

Anxiety and mood disorders represent the two most prevalent classes of mental illness in the US, with 12-month prevalence rates estimated at roughly 18% and 10%, respectively (Kessler et al., 2005). Among anxiety disorders, generalized anxiety disorder (GAD) demonstrates a lifetime morbid risk of 9-10%, and it is estimated that 2-4% of the US population (i.e., roughly one million people) cope with GAD in a given year (American Psychiatric Association [APA], 2013; Kessler et al., 2012). GAD is associated with substantial personal burden, with most adults being moderately to severely impaired (APA, 2013) and reporting notably more interpersonal concerns and dysfunction than those without GAD (Eng & Heimberg, 2006; Salzer et al., 2008). GAD is also associated with substantial occupational and societal costs, accounting for an estimated 110 million disability days per year in the US (APA, 2013; Kessler et al., 1999; Wittchen, 2002). Perhaps not surprisingly, GAD is commonly recognized as one of the most treatment-resistant anxiety disorders (Newman & Erickson, 2010). It is estimated that less than 20% of those coping with GAD will achieve full remission, and the majority of those with the disorder will have struggled with it for five to ten years prior to being successfully treated (Ballenger et al., 2001; Papp, 2010).

Among the mood disorders, major depressive disorder (MDD) is the most prevalent (APA, 2013). Estimates in the US suggest that 6-7% of the population suffer from a major depressive episode in a given year (APA, 2013; Kessler et al., 2005), and 10-15% of the population will experience a major depressive episode at some point in their lives (Kessler & Wang, 2009; Lépine & Briley, 2011). Like GAD, MDD is associated with substantial personal,

occupational, and economic burden (APA, 2013; Kessler et al., 2002). Interpersonal dysfunction, including family conflict and marital separation or divorce, is positively associated with depressive symptom severity, and the risk of attempted or completed suicide among those with MDD is more than 20 times greater than in the general population (Lépine & Briley, 2011). MDD is ranked as the eighth leading cause of disease burden worldwide when including completed suicides attributable to depression (Ferrari et al., 2013). Furthermore, recurrent (rather than singular) major depressive episodes are the norm; roughly 67% of patients successfully treated by mental health care specialists will experience relapse within the decade following their treatment (Hardeveld et al., 2010). Clearly, among the anxiety and mood disorders, the most prevalent classes of mental health conditions, GAD and MDD represent substantial sources of human suffering and societal burden.

Worse still is comorbid GAD-MDD, or the co-occurrence of these disorders within the same individual. Comorbidity is quite common among the psychiatric illnesses, with the 12-month prevalence of comorbid mental illnesses estimated at roughly 50% in the US (Calkins et al., 2015). While MDD and other mood disorders evidence high rates of comorbidity with other conditions, such as physical illnesses (e.g., heart disease; Carney & Freedland, 2009) and substance-related concerns (e.g., tobacco and alcohol use; Davis et al., 2008), MDD is most commonly comorbid with the anxiety disorders, particularly GAD (Kessler et al., 2005). Likewise, GAD is most commonly comorbid with MDD (Holaway et al., 2006). Community epidemiological surveys estimate that GAD and MDD comprise the most common anxiety-mood comorbidity, which seems to represent a genuine GAD-MDD link rather than the result of overlap in clinical constructs (Blanco et al., 2014; Hettema, 2010). Those with either MDD or GAD are roughly 17 times more likely to meet criteria for the other disorder within the same

year (Carter et al., 2001). This pattern of comorbidity is evident across the lifespan from childhood and adolescence (e.g., Avenevoli et al., 2001) to middle and late adulthood (e.g., Carter et al., 2001). Not surprisingly, comorbid GAD-MDD is associated with substantially poorer physical and occupational functioning and lower quality of life than either disorder alone (Kessler et al., 2002; Wittchen et al., 2000), and clients diagnosed with comorbid GAD-MDD evidence notably worse treatment outcomes that clients with just one of these illnesses (Calkins et al., 2015; Chambers et al., 2004).

Given the prevalence and substantial burden of both GAD and MDD alone, and the even greater burden associated with comorbid GAD-MDD, researchers have called for the development of robust transdiagnostic theories to account for the apparent link between these two debilitating disorders and to guide the development of more efficacious and effective treatments. Empirical research on the link(s) between GAD and MDD is actively underway and includes all levels of analysis, from genetics and neurophysiology (e.g., Boyer, 2000; Gorwood, 2004) to temperament and personality (e.g., Jylhä & Isometsä, 2006; Rosenbaum et al., 2000). Within the cognitive theories of GAD and MDD, various forms of repetitive negative thought are believed to play central roles in the development and maintenance of these disorders (Ehring & Watkins, 2008; Gotlib & Joormann, 2010; Harvey & Watkins, 2004; Kaplan et al., 2018). Two forms of repetitive negative thought – worry and rumination – are frequently implicated in the etiology of GAD and MDD, respectively (Papageorgiou, 2006).

Worry & Rumination

Beginning with worry, worry was once viewed as a symptom of anxiety rather than as a critical component within anxiety's etiology and course; however, the current consensus among investigators and clinicians holds worry in itself to be a valuable topic for investigation and a

fruitful target for treatment (Purdon & Harrington, 2006). Thus, investigators have sought to accurately describe its phenomenology (see Borkovec, 1994). Worry is a negatively valenced and predominantly verbal activity containing notably little mental imagery (Borkovec, 1994; Hirsch et al., 2012; Stokes & Hirsch, 2010). While falling under the broader construct of repetitive negative thought, worry is distinct from other forms of such thought (e.g., rumination) in its temporal orientation toward *future* events and in its focus on potential *threats and uncertainties* (McEvoy et al., 2013; Watkins et al., 2005). It has long been recognized that worry occurs in both anxious and non-anxious groups (Ruscio et al., 2001). Normal worry is experienced by most if not all individuals and is relatively easily controlled (Holaway et al., 2006). However, pathological worry, such as that seen in GAD, is distinguished by its greater frequency, its pervasiveness across multiple life domains, its intensity, and difficulty to control (APA, 2013; Hirsch et al., 2013).

Rumination has traditionally been studied within the depressive disorders (for a review, see Smith & Alloy, 2009). As another form of repetitive negative thought, rumination is negatively valenced and perseverative but can be distinguished from worry in its orientation to *past or present* events or circumstances and in its focus on perceived *problems, failures, or intransigent distress* (Nolen-Hoeksema et al., 2008; Watkins et al., 2005). Rumination is notably passive; it rarely leads to active problem-solving or the initiation of active efforts to change one's undesirable circumstances or remedy one's prolonged distress (Papageorgiou, 2006). Here, it is important to distinguish rumination from other past-oriented, problem-focused forms of repetitive thought, chiefly self-reflection. Reflection, in contrast to rumination, is conceptualized as either a neutral or adaptive cognitive process focused on building personal insight and facilitating problem-solving efforts (Trapnell & Campbell, 1999; Treynor et al., 2003). As might

be expected, reflection and rumination have distinct correlates. Both are positively associated with depressive symptoms concurrently, but reflection predicts less severe depression (and rumination, more severe depression) over time (Treynor et al., 2003).

While worry and rumination can be differentiated, both lead to negative affect and the development and maintenance of psychopathology (Newman et al., 2013; Papageorgiou, 2006). Worry leads to an increase in subjective negative emotionality and physiological activation, as evidenced by a wealth of empirical data. For example, high trait worry is associated with greater sympathetic nervous system activation (e.g., increased heart rate) and less parasympathetic nervous system activity (e.g., diminished heart-rate variability; Brosschot et al., 2007; Pieper et al., 2010), an association that is paralleled in studies employing experimentally induced worry (e.g., Hammel et al., 2011). Individuals with clinical diagnoses of GAD, as well as non-anxious controls, rate subjective negative emotions during in-lab worry inductions to be significantly greater than those during relaxation inductions (Llera & Newman, 2010). Beyond creating negative affect and heightened physiological arousal, worry sustains such emotionality, as seen in experimental studies (e.g., Llera & Newman, 2010) and naturalistic ambulatory monitoring studies. For example, worry periods predict higher heart rate and lower heart-rate variability in the following 1-2 hours, independently of self-reported emotional states, levels of physical activity, and other physiological indices (Pieper et al., 2010). Worry in the evening prospectively predicts cortisol levels the following morning above and beyond the effects of anxious mood, sleep, and stressors (Zoccola et al., 2011). In a treatment-seeking sample of individuals with GAD, elevated skin conductance (indicative of greater state anxiety) was observed during exposure to feared stimuli that followed in-lab worry inductions, but not during exposure that followed in-lab guided imagery of such stimuli or in-lab relaxation (Stapinski et al., 2010).

Lastly, prospective research points to the role of worry in the development of clinically significant anxiety symptoms (e.g., Calmes & Roberts, 2007; Young & Dietrich, 2015). In sum, there is a large amount of empirical support for worry's role in creating and sustaining negative emotion, including correlational and experimental designs, cross-sectional and longitudinal data, and self-report and physiological modalities.

Similarly, a wealth of research has demonstrated the etiological and maintenance role that rumination plays within depression. Considered to be a depressogenic cognitive process, rumination, like worry, has been shown to cause and maintain negative mood states, among other negative consequences (McLaughlin, Borkovec, et al., 2007; Papageorgiou, 2006). In a review of cross-sectional and prospective studies looking at the consequences of rumination, Lyubomirsky and Tkach (2004) summarized a list of deleterious outcomes following rumination, including: impaired concentration, poorer problem-solving, negatively biased thinking, diminished motivation and greater inhibition of goal-directed behavior, more frequent biopsychosocial stressors (e.g., poorer physical health, disrupted social relationships), and finally, negative emotion and depressive symptoms. Much research has linked rumination to sadness and depressed mood cross-sectionally and longitudinally, and many experimental studies have supported the causal relationship between rumination and negative emotion (for a review, see Thomsen, 2006). In a recent meta-analysis, rumination shared the strongest relationship with depression (r = .61), while other forms of repetitive thought (i.e., self-reflection) evidenced much weaker associations (r = .31; Olatunji et al., 2013). Rumination is involved in the initial development of clinically significant MDD symptoms (Burwell & Shirk, 2007; Schoofs et al., 2010) and predicts the onset of new major depressive episodes among non-depressed adolescents and adults (Huffziger et al., 2009; Nolen-Hoeksema, 2000; Rood et al., 2009). Further, greater

frequency of rumination has been shown to impair recovery from MDD during psychotherapeutic treatment (Jones et al., 2008). The deleterious consequences that consistently follow worry and rumination have left researchers and clinicians wondering why individuals continue to worry and ruminate. If the outcome of worry and rumination is so emotionally aversive, what other contingencies might reinforce these perseverative cognitive behaviors?

Avoidance Functions of Worry & Rumination

Worry has long been conceptualized as an avoidance strategy. One of the earliest and most influential models of worry came from Borkovec (1994), the cognitive avoidance model, which suggested that worry allows anxious individuals to supplant upsetting mental imagery with verbal worry, a less aversive modality. Borkovec's model also posited that worry helps to dampen an individual's physiological arousal in response to perceived threats. In one of the earliest tests of this model, Borkovec and Hu (1990) found that instructing participants to verbally worry prior to the administration of an imaginal exposure of interpersonal threat inhibited participants' cardiovascular reactivity in response to the threat, an effect replicated by others using alternative measures of physiological reactivity and different threatening stimuli (e.g., Peasley-Miklus & Vrana, 2000). Laguna and colleagues (2004) instructed two groups of participants (high trait worriers and low trait worriers) to complete a dichotomous listening task, in which imagery scripts (either threatening or neutral in content) were presented to either ear. Participants were instructed to attend to the ear receiving the imagery scripts, while neutral words presented in the other ear were to be ignored. Laguna and colleagues found that high trait worriers recalled significantly more neutral words during the presentation of the threatening script, suggesting that high worriers actively avoided the threat-based imagery via attending to neutral verbal stimuli. More recently, Fisher and Newman (2013) found worry to suppress

heartrate responses to perceived threat in control participants, high trait worriers, and those with GAD, and also, that elevated baseline sympathetic nervous system arousal suppressed stress reactivity in individuals with GAD, but not in controls or high trait worriers. Fisher and Newman concluded that their results, in conjunction with earlier investigations of Borkovec's model, showed worry to be associated with the suppression of emotional and sympathetic reactivity, or put differently, a physical and emotional bracing for perceived future threats.

Such perceived threats surely vary across individuals and situations, but a growing body of research has begun to index emotions themselves as the motive for avoidance-based worry. High levels of worry are associated with self-reported fear of heightened negative emotions (Buhr & Dugas, 2012; Gosselin et al., 2007; Santanello & Gardner, 2007; Sexton & Dugas, 2009). In a treatment-seeking sample of individuals with a principle diagnosis of GAD, worry was uniquely related to distress and avoidance of anxiety (Lee et al., 2010). Even when controlling for negative affect, elevated worry is associated with non-acceptance of private emotions in both non-clinical (e.g., Salters-Pedneault et al., 2006) and clinical samples (e.g., McLaughlin, Mennin, et al., 2007). Thus, while worry creates and sustains negative emotion and physiological arousal, it may be negatively reinforced by the avoidance of other aspects of heightened emotional experiences.

Like worry, contemporary conceptualizations of rumination propose that it too serves an avoidance function, particularly the avoidance of active problem-solving and the distress that may arise following unsuccessful problem-solving efforts. Martell and colleagues (2001, p. 121) proposed that "although rumination may be experienced as aversive to the individual, it is possible that it is maintained by the avoidance of even more aversive conditions." That is, rumination may allow an individual to engage in an (ill-advised) alternative to true problem-

solving behaviors and thereby avoid the potential emotional distress (e.g., frustration, worsened depressed mood) that might follow unrewarded problem-solving efforts. Nolen-Hoeksema (2004) provided one of the most influential theories of rumination, the response styles theory, which framed rumination as a strategy for facilitating behavioral inactivity and withdrawal and the avoidance of the aversive emotional experience of unrewarded behaviors. Per this theory, individuals prone to rumination find that passivity or inactivity in response to perceived problems is less emotionally aversive than the frustrations that follow ineffective problem-solving (Nolen-Hoeksema et al., 2008). Thus, while rumination creates and sustains distressed mood states, it may be negatively reinforced by the absence of even more aversive emotions that would follow thwarted efforts.

The proposition that rumination serves an avoidance function is supported within the empirical literature by rumination's positive associations with various forms of avoidant behavior (e.g., Cribb et al., 2006; Moulds et al., 2007). In a diary-based study among community adolescents, Dickson and colleagues (2012) found that daily levels of cognitive avoidance were predictive of subsequent changes in daily rumination and sadness. Further, rumination longitudinally mediated the relationship between cognitive avoidance and sad mood. Dickson and colleagues interpreted this mediational effect as evidence of the vague and passive nature of rumination serving a cognitively avoidant function. Rumination has been shown to relate to overly abstract (as opposed to concrete) thinking (Watkins & Teasdale, 2001), overly general (as opposed to detailed) autobiographical memory (Park et al., 2004), and a tendency to use thought suppression as an emotion regulation strategy (Wenzlaff & Luxton, 2003). Thus, it may be that an individual's desire to cognitively avoid personally upsetting material can potentiate rumination, a vague, abstract, and passive thought process, as a maladaptive avoidance strategy.

Rumination's paradoxical effect is the worsening and maintenance of a depressed mood. Anecdotally, clients within psychotherapy for a variety of emotional disorders often describe their rumination as a form of avoidance (Watkins, 2018), and a number of emotionally avoidant motivations have been hypothesized and observed by researchers and clinicians, including: anticipating negative responses from others to avoid or minimize criticism, inhibiting behavioral responses to avoid the humiliation and distress of failure, and having control over aversive feelings (for a full discussion and clinical implications, see Watkins, 2018).

To review, worry and rumination are both related but dissociable forms of repetitive negative thought that play crucial roles in the development of GAD and MDD, respectively, two highly prevalent, debilitating, and comorbid psychiatric disorders. Both worry and rumination have been conceptualized as avoidance-based emotion regulation strategies aimed at helping individuals avoid certain aversive aspects of personal experience. Unfortunately, there has historically been little theoretical guidance for understanding the respective roles that worry and rumination play in GAD and MDD within a transdiagnostic framework. A novel model, however, has the potential to provide such a framework – the negative emotional contrast avoidance model (NECAM; Newman & Llera, 2011).

The Negative Emotional Contrast Avoidance Model

The NECAM was originally developed as an effort to reconcile discrepancies within the literature on worry and its role in creating negative emotional states; thus, the NECAM in a strict sense is a theory of worry in GAD rather than a transdiagnostic theory of repetitive negative thought in GAD and MDD. However, it will be argued below that the tenets of the NECAM are fully capable of accommodating rumination as an avoidance strategy in depression. The NECAM proposes that (1) certain individuals (e.g., those with GAD) are more sensitive to

abrupt shifts from a euthymic emotional state to a dysthymic state (i.e., negative emotional contrasts), (2) worry serves to elicit and maintain chronic negative emotion, (3) worry is negatively reinforced by attenuated negative emotional shifts that might have been more drastic had a negative emotional state not preceded them, and (4) worry is positively reinforced by transient positive emotions following the non-occurrence of feared outcomes. More succinctly, individuals who are especially sensitive and averse to abrupt shifts in their emotional experience may prefer the chronic negative emotion created by worry, so that they may guard against shifts to even more aversive emotional states.

The NECAM takes as its starting point observations that individuals with GAD report greater fear of emotions *per se* than do individuals without GAD (Llera & Newman, 2010; Roemer et al., 2005; Turk et al., 2005). Individuals with GAD also report greater difficulty understanding and recovering from heightened emotions and a greater fear of the perceived negative consequences of emotions (e.g., "going crazy," becoming dysfunctional; Llera & Newman, 2010; Mennin et al., 2005; Turk et al., 2005). Many investigations have revealed that those with GAD experience a range of emotions as more threatening, intense, and difficult to control than do those without GAD (for a review, see Newman et al., 2013). Brain-imaging studies confirm that individuals with GAD have, on average, greater amygdala volumes (the limbic structure assumed to mediate fear responses) than non-anxious individuals (Etkin, 2009; Etkin et al., 2009). Moreover, in comparison to control participants, individuals with GAD are prone to greater negative emotional reactivity, particularly within the amygdala, in anticipation of aversive and threatening images and various in-lab conditions (Nitschke et al., 2009; Schienle, Ebner, et al., 2011; Schienle, Hettema, et al., 2011). Consequently, those with GAD have a greater desire to control or prevent their experiences of negative emotion (Mennin et al., 2005;

Roemer et al., 2005; Turk et al., 2005). Regarding negative emotional contrasts specifically, Llera and Newman (2017) found individuals high in worry and generalized anxiety symptoms to report significantly more discomfort with sudden and drastic emotional shifts.

As previously mentioned, a great deal of empirical literature points to worry's role in creating subjective negative emotion and heightened, inflexible physiological arousal (i.e., the second premise of the NECAM). A recent meta-analysis further supports this proposition of the NECAM. Across 60 investigations exploring the effect of repetitive negative thought (including worry) on physiological activation, Ottaviani and colleagues (2016) found worry to reliably lead to increased heartrate, increased systolic and diastolic blood pressure, diminished heartrate variability, and higher cortisol levels.

However, in spite of these aversive outcomes, those with GAD and subclinical high worriers often report perceiving worry as a positive coping strategy, reporting that worrying makes it easier to endure and cope with subsequent negative events (or "preparing for the worst") compared to non-anxious individuals (Kim & Newman, 2016; Llera & Newman, 2014). Compelling evidence has been found in support of the NECAM's third hypothesis (i.e., worry attenuates elevations in negative emotion that might have been more drastic). Llera and Newman (2010) recruited high-anxiety/high-worry individuals, in addition to nonanxious controls, and randomly assigned them to either worry, relaxation, or neutral thought inductions for two minutes at a time. Thereafter, all participants were sequentially presented with emotionally evocative film clips to induce happy, fearful, sad, and calm emotional states. Subjective positive and negative emotions as well as objective heart rate variability were recorded following each thought induction and each emotional film clip. During the worry induction, participants reported elevated negative emotion and displayed reduced heartrate variability. Thereafter, during the

fearful clip exposure, participants continued to experience negative emotion and low heartrate variability, but no significant differences were observed on such measures between the worry induction and clip exposure. That is, worry elicited a subjective and physiological response similar to the perception of fear stimuli and precluded further increases in negative emotion or physiological activity in response to such stimuli. The opposite pattern of responding was observed following relaxation induction; participants reported less negative emotion and exhibited greater heartrate variability during relaxation, which allowed them to experience heightened negativity during the fearful clip. Extending this work beyond laboratory inductions, Crouch and colleagues (2017) conducted an 8-week naturalistic sampling study and found worry to result in avoidance of negative emotional contrasts. While both worry and negative contrasts reported throughout the eight weeks were associated with greater negative emotionality, worry attenuated the distress experienced during negative contrasts. In another naturalistic sampling study, Newman et al. (2019) surveyed participants 10 times per day over eight days. Worry was associated with negative emotion (as expected) and, importantly, it predicted attenuated negative emotional contrasts in the hour following episodes of worry. In sum, while worry generates negative emotion in those with and without GAD, those with clinically significant worry and GAD symptomatology seem to prefer to use worry in this way.

A growing body of research has begun to explore the possibility that worry is positively reinforced by brief experiences of positive emotion following the non-occurrence of feared outcomes (i.e., the fourth tenet of the NECAM). That is, worry may be maintained in part by experiences that leave those high in generalized anxiety feeling pleasantly surprised by the absence of the outcome they feared. In recent studies derived from the tenets of the NECAM, worry reduced the likelihood of negative emotional contrasts as expected and also increased the

likelihood of positive emotional contrasts (Kim & Newman, 2016; Llera & Newman, 2014; Newman et al., 2019). In order to facilitate research on such reinforcing contingencies within GAD and chronic worry, Llera and Newman (2017) developed a self-report questionnaire assessing the extent to which individuals with GAD and high worriers use worry to create positive contrasts (e.g., "I find worrying most rewarding when something good happens in the end," p. 119). Compared to nonanxious control participants, participants with clinically significant GAD symptoms scored significantly higher on this questionnaire, suggesting that worry in GAD does in fact create opportunities for positive emotional contrast.

While originally framed as a theory of worry within generalized anxiety, the NECAM is capable of accommodating rumination as a strategy for avoiding emotional contrasts in depression. In line with the first tenet of the NECAM, those highly prone to rumination report greater fears of negative emotion than low ruminators. In an investigation on the subjective and physiological emotional correlates of rumination, Giorgio et al. (2010) found that high ruminators report significantly greater tendencies toward experiential avoidance and greater fear of heightened emotional states. High ruminators also failed to demonstrate a physiological response to a depressed-mood induction, suggesting that, as a trait-like emotion-regulation strategy, rumination is associated with self-reported aversion to heightened emotion and physiologically blunted reactivity to negative stimuli. In line with the second tenet of the NECAM, rumination has been clearly and unambiguously shown to create and sustain negative emotion (Lyubomirsky & Tkach, 2004; McLaughlin, Borkovec, et al., 2007; Papageorgiou, 2006; Thomsen, 2006). Further, current conceptualizations and theories of rumination from a variety of areas of research converge on the idea that rumination represents an avoidance

behavior (e.g., rumination in bereavement and posttraumatic stress; Ehring et al., 2008; Michael et al., 2007; Stroebe et al. 2007).

However, relatively few investigations have sought to directly examine rumination's role in avoiding emotional contrasts or in potentiating positive emotional contrasts (the third and fourth tenets of the NECAM). Newman et al. (2013) suggest that negative emotional contrast avoidance might represent a transdiagnostic process across GAD and MDD, citing Nolen-Hoeksema et al.'s (2008) proposition that rumination serves to de-motivate and de-activate individuals with depression and thereby prevents them from coming into contact with disappointing outcomes and even more negative emotional states. Other researchers provide some indirect support for Newman and colleagues' suggestion. The emotional responsiveness of individuals with MDD is typically characterized by blunted reactions to evocative stimuli, a phenomenon referred to as emotional context insensitivity (Bylsma et al., 2008). Llera and Newman (2017) argue that the blunted affect of depressed individuals may represent the end-result of rumination, a chronic negative mood state aimed at preventing drastic shifts to even worse moods. When taken together with evidence of rumination's role as an avoidance strategy, Llera and Newman suggest that individuals suffering from depression seek to avoid the same emotional phenomena as those with generalized anxiety (negative emotional contrasts) and may use repetitive negative thought to accomplish this goal. In a more direct investigation of the potential contrast-avoidance role of rumination, Llera and colleagues (2016) found that a self-report measure of emotional contrast avoidance significantly predicted depressive symptoms in a large sample of undergraduates. The authors also found that worry and rumination mediated the association between emotional contrast avoidance and generalized anxiety and depressive symptoms, respectively. However, the cross-sectional design of Llera and colleagues'

investigation presents a notable limitation to drawing strong conclusions about the contrast-avoidance role of rumination. In an experimental study, Kim and Newman (2016) recruited a sample of individuals with elevated levels of generalized anxiety, elevated levels of depressive symptoms, and a-symptomatic controls. Participants were randomly assigned to engage in worry, rumination, or relaxation, and then all groups took part in emotional inductions for fear, sadness, and amusement. Across all groups, worry led to the avoidance of a negative emotional contrast after the fear induction (i.e., worry created a fearful emotional state that precluded a sharp rise in fear following the induction), and rumination led to the avoidance of a negative contrast following the sadness induction, providing support for the proposition that worry and rumination may share parallel functions (emotional contrast avoidance) but may differ in the specific emotional states they aim to prevent.

Current Investigation & Hypotheses

The NECAM has put forth a specific, emotional contrast avoidance conceptualization of worry in GAD that suggests a parallel avoidance role of rumination in MDD. Together, these preliminary studies point to a novel, and potentially highly informative, transdiagnostic process underlying GAD and MDD. A path from negative emotional contrast avoidance to rumination, and from rumination to depressive symptoms, would mirror the already empirically supported path from emotional contrast avoidance to worry, and from worry to generalized anxiety symptoms. However, as a relatively novel theory, the propositions of the NECAM have yet to be investigated in large and diverse samples followed longitudinally. Furthermore, significant work remains to be done with regard to the plausible roles that emotional contrast avoidance and rumination may play in depression. The current investigation sought to address these gaps in a large and diverse sample followed over time. Such an investigation was expected to provide a

substantial and needed contribution to the growing literature on emotional contrast avoidance, worry, and the development of generalized anxiety symptoms. Findings from this investigation were also expected to provide a highly informative extension on the NECAM with the potential to deepen our understanding of the factors underlying GAD-MDD comorbidity.

In sum, the aims of the current investigation were to examine the temporal relationships among negative emotional contrast avoidance, worry and rumination, and the symptoms of generalized anxiety and depression. The following hypotheses were examined per the literature reviewed above: (1) greater emotional contrast avoidance would be positively associated with worry, rumination, generalized anxiety symptoms, and depressive symptoms cross-sectionally; (2) greater emotional contrast avoidance at Time 1 would predict greater worry and rumination at Time 2 while controlling for levels of worry and rumination at Time 1; (3) greater worry and rumination at Time 2 would predict more severe symptoms of generalized anxiety and depression, respectively, at Time 3 while controlling for symptom severity at Time 2; and finally (4) increased worry and rumination would mediate the effect of greater emotional contrast avoidance on exacerbated symptoms of generalized anxiety and depression from Time 1 to Time 3.

Neuroticism, or the tendency to experience various negative emotional states, is a well-known vulnerability across the anxious and depressive disorders (Lahey, 2009). Importantly, neuroticism may act as a third variable confound in studies such as this that seek to identify transdiagnostic risk factors for anxious and depressive disorders. That is, failure to account for neuroticism in the proposed models may lead to overinflated associations among study variables when predictors and outcomes are both substantially correlated with neuroticism (Fournier et al., 2019; Ormel et al., 2004). In order to examine the associations between emotional contrast

avoidance and the mediators and outcomes of interest in this study independent of their shared associations with neuroticism, the hypothesized effects described above were also examined after statistically controlling for trait neuroticism.

Methods

Participants & Recruitment

Participants were US adults (ages 18 to 64 years) recruited from Amazon's Mechanical Turk (MTurk), an online labor market where workers can participate in research in exchange for compensation. See below for a discussion of the proposed investigation's estimated sample size requirements. There are several advantages to recruiting online samples via MTurk (Chandler & Shapiro, 2016). Previous studies have supported the use of MTurk samples, providing ample evidence of high-quality data (Behrend et al., 2011; Buhrmester et al., 2011; Chandler & Shapiro, 2016; Hauser & Schwarz, 2016; Paolacci et al., 2010; Shapiro et al., 2013). When data quality control procedures are used, MTurk data usually evidence high degrees of internal consistency and test-retest reliability (Buhrmester et al., 2011; Schleider & Weisz, 2015; Shapiro et al., 2013) and outperform college student samples in participant attentiveness (Hauser & Schwarz, 2016). MTurk samples also tend to be more demographically diverse in comparison to other samples of convenience (Buhrmester et al., 2011). Furthermore, consistent with the research framework of the National Institute of Mental Health (NIMH, 2013), such a sample can represent clinical constructs dimensionally rather than categorically. That is, an online, general community sample should provide adequate representation of emotional contrast avoidance, worry, rumination, generalized anxiety, and depressive symptoms at low, moderate, and high levels of severity.

Pertaining to this investigation's recruitment methodology, MTurk workers are often rated by their past online "requesters" (e.g., principle investigators in whose studies workers participated) in terms of their successful and reliable completion of "HITs" (human intelligence tasks). Typically, MTurk workers with at least a 95% approval rating are recommended to ensure the collection of only the highest quality data (Paolacci & Chandler, 2014; Peer et al., 2014). Peer and colleagues found that such high-reputation workers yield data of even higher quality than workers with less than 95% approval but who were screened with alternative quality control methods (e.g., catch questions such as "Click on #4 if you are paying attention."). Thus, the proposed investigation recruited MTurk workers with no less than 95% approval ratings and who had successfully completed no fewer than 50 prior HITs (Peer et al., 2014). Nonetheless, despite the proven superiority of worker approval ratings over catch questions in recruiting high-quality samples, three catch questions (i.e., "Please select 'Much' if you are paying attention right now," "Please click on the circle at the bottom of the screen. Do not click on the scale items that are labeled 1 to 9," and "I have experienced a fatal heart attack while watching television") were embedded into survey questionnaires to be used as a screen for attentive responding. Workers who failed all three catch questions at Time 1 were excluded from subsequent waves of data collection, and their Time 1 data was omitted from analyses. Additionally, researchers have recently begun to raise awareness about data contamination due to "bot" workers, or computer programs designed to quickly and automatically complete MTurk surveys (see Yarrish et al., 2019). In order to screen for potential "bot" workers, open-ended prompts and free-text responses were examined across all Time 1 workers by the primary author and another doctoral student trained in online data collection techniques. Free-text responses were coded based on their relevance to each open-ended prompt, and the two coders then came to a consensus in

identifying likely "bot" workers, which were excluded from subsequent analyses and were not invited to participate in future waves of data collection.

Readers are referred to Table 1 for a summary of changes in this study's sample size following longitudinal attrition and the investigator's additional steps for ensuring data quality. An initial sample of 999 participants was recruited from the MTurk worker pool at Time 1. Of these, 38 workers (3.80%) failed all three catch questions embedded within study surveys. Another 42 workers (4.20%) were identified as "bot" workers. These 80 workers were excluded from subsequent waves of data collection and study analyses, leaving a final sample of 919 workers at Time 1. Recruitment at Time 2 and Time 3 yielded 579 and 493 returning workers, respectively. Screenings of free-text responses were repeated at Time 2 and Time 3 to detect and exclude those workers who began to rely on computer programs for completing MTurk HITs during the lags since Time 1. At Time 2, three previously valid workers were determined to have been replaced by "bots," and their data at Times 2 and 3 were deleted and treated as missing. At Time 3, five previously valid workers were determined to have been replaced by "bots," and their data at Time 3 was deleted and treated as missing. In sum, Time 2 comprised a total of 576 valid cases (62.68%), and Time 3 comprised a total of 488 valid cases (53.10% retention rate). See Table 2 for sample descriptive statistics, including worker sex, race, ethnicity, English-speaking status, and other demographic characteristics at Time 1.

Measures

The Contrast Avoidance Questionnaires (CAQs)

The CAQs were recently developed by Llera and Newman (2017) to provide self-report measures for testing the central tenets of the NECAM. Two questionnaires are available. The CAQ-Worry is a 30-item measure that assesses the role that worry plays in the avoidance of

negative emotional contrasts. Its items assess worry's effect in creating and sustaining negative emotion (e.g., "Worry keeps me in a bad mood"), facilitating the avoidance of negative emotional contrasts (e.g., "When I'm worrying, I feel like I'm more in control of my emotions"), and in facilitating the creation of transient, positive emotional contrasts (e.g., "I enjoy success the most when I worried about failure"). The second CAQ, the CAQ-General Emotion, is a 25-item, non-specific counterpart to the CAQ-Worry that assesses contrast avoidance beliefs and behaviors in general. Its items assess respondents' dispositional sensitivity and aversion to sharp changes in emotional experience (e.g., "When my emotions fluctuate, it makes me feel out of control") and strategies used to create negative mood states and avoid negative emotional contrasts (e.g., "I prefer to feel bad now, so I don't have to endure losing my happiness later"). Both measures ask respondents to rate how true each item is of them on a 5-point Likert scale (1 [*Not at all true*] to 5 [*Absolutely true*]). Scores on the CAQ-Worry and CAQ-General Emotion range from 30 to 150 and 25 to 125, respectively, with higher scores on both reflecting a greater tendency toward emotional contrast avoidance. In their initial development and validation study, both CAQs demonstrated excellent internal consistency (CAQ-Worry $\alpha = 0.94$; CAQ-General Emotion $\alpha = 0.95$). Support for the CAQs convergent validity was found via moderate to strong correlations with perceived threat from negative emotions (the Perceptions of Threat from Emotions Questionnaire, *r*s = .43 to .53). Further, the CAQs' concurrent validity was established by strong correlations with measures of worry (the Penn State Worry Questionnaire, *r*s = .55 and .61) and GAD symptomatology (the Generalized Anxiety Disorder Questionnaire-IV, *r*s = .53 and .56). Both measures demonstrated discriminative validity in distinguishing individuals who likely meet criteria for GAD from non-anxious individuals (Cohen's *d*s = 1.89 and 3.18) and predicting membership within a GAD analogue group with good sensitivity and specificity,

correctly classifying 88-89% of GAD-analogue and non-anxious individuals. Finally, the CAQs demonstrated strong 1-week test-retest reliability (CAQ-Worry r = .90; CAQ-General Emotion r = .93). Internal consistency values of both CAQ measures in the current sample were adequate across all timepoints, and test-retest reliabilities were strong across all data collection lags. See Table 3 for a summary of psychometric statistics on all variables of interest.

The Penn State Worry Questionnaire – Short Form (PSWQ-10)

The PSWQ-10 is a 10-item self-report measure of worry frequency and severity (Yao et al., 2016). As in the original 16-item measure (Meyer et al., 1990), the PSWQ-10's items, such as "My worries overwhelmed me" and "I was always worrying about something," reflect worry that is excessive and difficult to control, consistent with the nature of worry in GAD. However, unlike the original 16-item PSWQ, the PSWQ-10 has no negatively worded statements and thereby reduces respondent burden and avoids problems associated with method effects in reversed-scored items (Brown, 2003). Respondents are asked to rate on a 7-point Likert scale (0 [*Never*] to 6 [*Almost always*]) how frequently they experienced excessive worry in the past week. Scores range from 0 to 60, with higher scores indicating more frequent/severe worry. The PSWQ-10 demonstrates good to excellent internal consistency across a range of diagnostic groups (αs = .93 to .96 within anxiety disorders, .83 to .97 in trauma- and stress-related disorders, and .94 in obsessive-compulsive disorder [Yao et al., 2016]). The measure also demonstrates strong test-retest reliabilities at one month (r = .77) and one year (r = .81; Schroder et al., 2019). Convergent validity is indicated by moderate to strong associations with other measures of worry (e.g., the Worry Domains Questionnaire, r = .49 [Schroder et al., 2019]) and cognitive apprehension (e.g., the Beck Anxiety Inventory, Cognition items, r = .49 [Calmes & Roberts, 2007]). Concurrent validity is evidenced by strong correlations with measures of

anxiety (e.g., the Beck Anxiety Inventory, Somatic items, r = .41 [Calmes & Roberts, 2007]; the State-Trait Anxiety Inventory, r = .55 [Schroder et al., 2019]). Further, the PSWQ-10 has been shown to be sensitive to changes in worry severity over time (Yao et al., 2016). Internal consistency of the PSWQ-10 in the current sample was adequate across all timepoints, and test-retest reliabilities were strong across all data collection lags (see Table 3).

The Rumination-Reflection Questionnaire – Rumination Subscale (RRQ-Rumination)

The RRQ-Rumination (Trapnell & Campbell, 1999) is a 12-item measure of ruminative thought developed with the explicit intention of distinguishing negatively-valenced and unproductive rumination from neutrally- to positively-valenced self-reflection. As noted before, research on the assessment of perseverative thought processes has called attention to this distinction and its importance in understanding differential relations with psychopathology (Smith & Alloy, 2009). The RRQ-Rumination has proven capable of capturing rumination (e.g., "I always seem to be rehashing in my mind recent things I've said or done," "I often reflect on episodes in my life that I should no longer concern myself with"), while avoiding conflation with other neutral or adaptive forms of self-focused thought (Trapnell & Campbell, 1999). Respondents are asked to rate their agreement with such statements on a 5-point Likert scale (1 [*Strongly disagree*] to 5 [*Strongly agree*]). Scores range from 12 to 60, with higher scores reflecting greater ruminative tendencies. The RRQ-Rumination has demonstrated good to excellent internal consistency (αs = .88 to .93; Joireman et al., 2002; Puterman et al., 2010]). The measure also demonstrates strong 3-week test-retest reliability (r = .80; Takano & Tanno, 2009). Convergent validity of the RRQ-Rumination is evidenced by strong positive correlations with other measures of rumination (e.g., the Response Styles Questionnaire, Short Form, r = .54; Liao & Wei, 2011). The measure also shares moderate to strong relationships with various forms of

psychopathology, including depression (e.g., the Beck Depression Inventory, *r*s = .36 to .38*;* Trapnell & Campbell, 1999) and general distress (e.g., the Depression Anxiety Stress Scales, *r*s = .29 to .38; Liao & Wei, 2011), and negative associations with quality of life (e.g., the Satisfaction with Life Scale, *r* = -.29; Harrington & Loffredo, 2010). Discriminant validity and an appropriate lack of overlap with positively-valenced and productive self-reflection is evidenced by trivial and non-significant relations with various measures (e.g., the RRQ-Reflection subscale, *r* = .07 [Joireman et al., 2002]; the NEO-Openness to Experience Scale, *r*s = .05 to .10 [Trapnell & Campbell, 1999]; the Need for Cognition Scale, *r*s = -.14 to .01 [Trapnell & Campbell, 1999]). Finally, the RRQ-Rumination has proven to be sensitive to changes in rumination over time (e.g., Shapiro et al., 2008). Internal consistency of the RRQ-Rumination in the current sample was adequate across all timepoints, and test-retest reliabilities were strong across all data collection lags (see Table 3).

The Generalized Anxiety Disorder Scale (GAD-7)

The GAD-7 (Spitzer et al., 2006) is a brief screening measure of the seven symptoms of GAD, specifically, the presence of excessive and uncontrollable worry, negative affective experiences of anxiety or nervousness, and associated somatic (e.g., fatigue, muscle tension) and affective (e.g., irritability) symptoms. Respondents are asked to rate how frequently they have experienced each symptom in the past two weeks on a 4-point Likert scale (0 [*Not at all*] to 3 [*Nearly every day*]). Scores range from 0 to 21, with higher scores reflecting more severe GAD symptomatology and a greater likelihood that a respondent would pass the diagnostic threshold of clinically diagnosed GAD. The GAD-7 demonstrates adequate to excellent internal consistency (αs = .79 to .92; Dear et al., 2011; Spitzer et al., 2006) and strong 1-week test-retest reliability (*r* = .83; Spitzer et al., 2006). Convergent validity of the GAD-7 is indicated by strong

positive correlations with measures of pathological anxiety (e.g., the Beck Anxiety Inventory, *r* = .72; the Hopkins Symptom Checklist-Anxiety subscale, *r* = .74). Its concurrent validity is indicated by strong relationships with measures of worry (e.g., the PSWQ, *r*s = .51 to .64; Dear et al., 2011; Kertz et al., 2013). The GAD-7 also evidences moderate to strong associations with multiple dimensions of functional impairment (*r*s = .30 to .46; Spitzer et al., 2006), life satisfaction (*r* = -.34; Löwe et al., 2008), and well-being (*r* = -.53; Kertz et al., 2013). Psychometrically validated cutoff scores (between 8 and 10) have been suggested for identifying likely cases of clinical GAD (see Plummer et al., 2016). However, taxometric evidence suggests that GAD is better conceptualized dimensionally (see Haslam, 2003). Using the GAD-7's total score as a continuous measure adequately reflects mild, moderate, and severe levels of generalized anxiety symptoms (Spitzer et al., 2006). Moreover, the GAD-7 has proven to be sensitive to changes in GAD severity (Dear et al., 2011). Therefore, in line with the recommendations of the National Institute of Mental Health (NIMH, 2013) and other researchers (Haslam, 2003; Widiger & Samuel, 2005), the GAD-7's total score was used in the current investigation to represent generalized anxiety symptoms dimensionally. Internal consistency of the GAD-7 in the current sample was adequate across all timepoints, and test-retest reliabilities were strong across all data collection lags (see Table 3).

The Patient Health Questionnaire (PHQ-8)

The PHQ-8 (Kroenke & Spitzer, 2002) is a brief screening measure of depression. Paralleling the instructions of the GAD-7, respondents are asked how frequently they have experienced eight (out of nine) symptoms of depression in the past two weeks on a 4-point Likert scale (0 [*Not at all*] to 3 [*Nearly every day*]). Scores range from 0 to 24, with higher scores indicating more severe depressive symptoms and a greater likelihood that a respondent is

experiencing a depressive episode. The PHQ-8 demonstrates good internal consistency (αs = .86 to .91; Choi et al., 2014; Corson et al., 2004) and strong 2-week test-retest reliability (*r* = .86 Wang et al., 2014). Convergent validity of the PHQ is indicated by strong positive correlations with other common measures of depression (e.g., the Beck Depression Inventory II, *r*s = .67 to .81 [Kung et al., 2013]; the Center for Epidemiologic Studies-Depression Scale, *r* = .88 [Pilkonis et al., 2013]) and poor mental health (the General Health Survey, Mental Health subscale, *r* = .73; Kroenke et al., 2001). The measure also demonstrates concurrent validity via moderate to strong associations with multiple dimensions of functional impairment (*r*s = .33 to .55; Kroenke et al., 2001). Psychometrically validated cutoff scores (between 10 and 12; Gilbody et al., 2007) have been suggested for identifying likely cases of clinical depression. However, as with GAD, taxometric evidence suggests that depression is better understood as a dimensional construct (see Haslam, 2003). Using the PHQ-8's total score continuously provides adequate coverage of mild, moderate, and severe levels of depression (Kroenke et al., 2010), and the PHQ-8 has been shown to be sensitive to longitudinal changes in depressive symptom severity (Kroenke et al., 2010; Löwe et al., 2004; Löwe et al., 2006). Therefore, the PHQ-8's total score was used in the current investigation to represent depressive symptoms continuously. Internal consistency of the PHQ-8 in the current sample was adequate across all timepoints, and test-retest reliabilities were strong across all data collection lags (see Table 3).

The Big Five Inventory-10, Neuroticism subscale (BFI-10-Neuroticism)

The BFI-10 (Rammstedt & John, 2007) is a brief measure of the Big Five personality traits of openness, conscientiousness, extraversion, agreeableness, and neuroticism. Its items ("I see myself as someone who is relaxed and handles stress well," "I see myself as someone who gets nervous easily") are rated on a 5-point Likert scale (1 [*Disagree strongly*] to 5 [*Agree*

strongly]), and higher scores reflect higher levels of each personality trait. Validated in multiple English- and German-speaking samples for the purposes of maximizing generalizability, the BFI-10 has demonstrated strong correlations with the original 44-item BFI (*r*s = .70 to .90), adequate test-retest reliability across 6- and 8-week intervals (*r*s = .65 to .87), moderate to strong associations with other measures of related personality traits (e.g., the NEO-PI-R; *r*s = .35 to .57), and moderate associations with peer ratings of personality traits (mean *r* = .44; Rammstedt & John, 2007). To assess and control for trait neuroticism, the Neuroticism items of the BFI-10 (quoted above) were used in the present study, thereby examining the possibility that trait neuroticism might be responsible for any observed effects between emotional contrast avoidance and endogenous variables. Given the brevity of the 2-item subscale and its possession of a reverse-coded item, it is perhaps not surprising that internal consistency of the BFI-10-Neuroticism subscale varied from adequate to questionable across timepoints (αs = .65 to .72). However, test-retest correlations were strong across all data collection lags (see Table 3), bolstering confidence in the reliability of this brief scale.

Study Design

Longitudinal data are paramount to investigations of proposed mediational effects, but longitudinal investigations of such effects are strikingly rare within psychological literature (Maxwell & Cole, 2007). Researchers often rely on cross-sectional research designs and analyses, which are unable to confirm that all conditions of causation have been met (i.e., temporal precedence) and are inherently prone to biases within model estimates (Maxwell & Cole, 2007; Maxwell et al., 2011). Therefore, the proposed investigation utilized a cross-lagged panel model (CLPM), one of the most common research designs and analytical methods for assessing longitudinal mediation in psychological investigations (Preacher, 2015). The CLPM is

based on structural equation modeling (SEM) for repeated measures, in which the predictor, proposed mediator, and outcome all depend, in part, on prior measurements of themselves and on temporally precedent causal relationships (Preacher, 2015; Rovine & Liu, 2012). Requiring at least three waves of data collection (Preacher, 2015), the CLPM rightly assumes that causal inferences are bolstered by staggering the measurements of proposed predictors, mediators, and outcomes across "lags" in time.

Regarding data collection lags, several authors have called attention to the potential pitfalls of choosing lag durations that are either too short or too long (Cole & Maxwell, 2009; Oud, 2007). Given the novelty of the NECAM, prior research on the temporal relationships between emotional contrast avoidance and other constructs of interest is insufficient at this time to shed light on this issue. Therefore, consideration of appropriate lag durations must come from other sources, such as the clinical literature on generalized anxiety and depression. The diagnostic criteria of GAD specify that symptoms must be present for at least six months (APA, 2013), and the median and mean durations of depressive episodes are estimated at three months (Eaton et al., 2008) and nine months (Ferrari et al., 2013), respectively. Therefore, lags in the current study were set at four months each (eight months of data collection in total) to maximize the chances of capturing clinically significant changes in generalized anxiety and depressive symptoms. As added assurance, 4-month lags are consistent with other longitudinal studies of anxiety and depression (e.g., MacKinnon et al., 2014; Young & Dietrich, 2015).

Analytic Strategy

Researchers have long known about the risks of drawing inferences from imperfectly measured constructs (Bollen, 1989), but renewed warnings have been raised (Cole & Preacher, 2014). As estimating latent constructs via SEMs is recommended to overcome the measurement

error inherent in observed variables (Westfall & Yarkoni, 2016), the current investigation computed latent variables to avoid measurement error. Analyses were conducted in both SPSS (version 26) and MPlus 8.4 (Muthén & Muthén, 2017). Missing data were handled via full information maximum likelihood (FIML), and models were estimated with a maximum likelihood (ML) estimator. Two fully cross-lagged mediational models were proposed. The first tested the proposed mediational effect of worry between emotional contrast avoidance and generalized anxiety symptoms, and the second tested the proposed mediational effect of rumination between emotional contrast avoidance and depressive symptoms. Both of these were tested first without trait neuroticism and then with trait neuroticism as a covariate (see Figures 1 and 2 for the worry and rumination model without neuroticism, respectively). Following the recommendations of this project's committee members, these two models were combined such that all endogenous variables were examined within one unified model to explore the proposed parallel indirect effects of emotional contrast avoidance on generalized anxiety symptoms (via worry) and depressive symptoms (via rumination; see Figure 3). This model was also tested with and without trait neuroticism as a covariate. In total, six models were evaluated.

Model fit was evaluated by way of four commonly recommended statistics (Hu & Bentler, 1999; Kline, 2016): the comparative fit index (CFI; good fit ≥ .95), the Tucker-Lewis index (TLI; good fit ≥ .95), the standardized root mean square residual (SRMR; good fit < .08), and the root mean square error of approximation (RMSEA; good fit ≈ .05 and < .10). In line with recommendations for assessing the significance of indirect effects (Hayes & Scharkow, 2013), bias-corrected bootstrapping was used to estimate the 95% confidence intervals around indirect effect parameters. Confidence intervals that did not include zero were considered indicative of a

significant mediating effect. All parameter estimates that are reported are fully standardized (i.e., STDYX).

Sample Size Requirement

While SEMs have many advantages over other analytic approaches, including their ability to handle different kinds of data and to easily test competing models, these same features make SEMs difficult for researchers to estimate required sample sizes a priori (Gagné & Hancock, 2006). In a review of simulation studies considering appropriate sample sizes for a variety of SEMs, Hoyle and Gottfredson (2015) conclude that commonly reported model fit indices (e.g., Tucker-Lewis Index) are most reliable with samples of no less than 400 cases. Further, Kim's (2005) methodology shows that SEMs with a large number of degrees of freedom (as in the models of this investigation) obtain greater power, and nearly perfect power and reliable fit indices (e.g., RMSEA) can be expected from a sample of 400 or more participants. Thus, the current study aimed to retain at least 400 participants at the final wave of data collection. Attrition is a ubiquitous problem within longitudinal research. While no known estimate has been published on the overall attrition rate in longitudinal MTurk samples, investigators using such samples commonly report attrition rates of about 25% on average (e.g., Christenson & Glick, 2013; Daly & Nataraajan, 2015; Paas et al., 2018; Schleider & Weizs, 2015; Shapiro et al., 2013; Stoycheff, 2016; Vine et al., 2014; Wiens & Walker, 2015). With a desired final sample of at least 400 participants at Time 3 and an expected attrition rate of 25% across two data collection lags, the current investigation sought to collect an initial sample of 800 individuals at Time 1 (approximately 600 at Time 2 and approximately 450 at Time 3). With a predicted total of approximately 1850 observations, this sample was expected to afford adequate power (> .80), avoid biased parameter estimates, ensure solution propriety, and improve the

reliability of model fit indices (Gagné & Hancock, 2006; Hoyle & Gottfredson, 2015; Kim, 2005). As noted above, retention rates at both Times 2 and 3 were less than expected (*n*s = 576 and 488, respectively) but still fulfilled the minimum requirement of $n \geq 400$ at Time 3. Across all timepoints, 72% of all possible observations were accounted for. The proportion of missing data in the full dataset was deemed nonignorable but was able to be remediated through the use of modern missing data handling techniques (i.e., FILM; Enders & Bandalos, 2001). See below for details on the steps taken to assess missingness patterns.

Procedure

All procedures were approved by the local Internal Review Board. A description of the proposed investigation, including an estimation of the study's duration (between 20 and 50 minutes per timepoint) and an explanation of its longitudinal nature, was provided to interested participants via the MTurk platform. Interested participants provided informed consent electronically prior to the administration of study questionnaires, and in doing so, agreed at Time 1 to be invited by the primary investigator to participate in later waves of data collection. To encourage participants to return for subsequent timepoints, compensation increased at each wave (Time 1 = $1.75, Time 2 = $2.00, Time 3 = $2.25) and amounted to a maximum of $6.00 per participant, which is commensurate with the rate of compensation in other MTurk studies of similar length (e.g., Fergus & Dolan, 2014). At each timepoint, interested participants accepted a HIT for this study on the MTurk platform, and from there they were directed to Qualtrics, an online surveying platform, to complete study surveys. The median lag durations between Times 1 and 2 and between Times 2 and 3 were 4.11 months and 4.33 months, respectively, yielding a total median duration of 8.43 months of participation. The median duration of survey administration was 38.67 minutes at Time 1, 35.80 minutes at Time 2, and 33.60 minutes at

Time 3. Thus, participants who completed all three waves of data collection were compensated with $6.00 for a median duration of 1.80 hours of study time.

Results

Preliminary Analyses

Missingness Considerations

As noted above, given the proportion of missing data within the recruited sample, an examination of missingness patterns and an explicit assessment of missing completely at random (MCAR), missing at random (MAR), and missing not at random (MNAR) assumptions was warranted. Participants who were retained at Times 2 and 3 were compared to those who attrited at Times 2 and 3 across a wide set of demographic variables (sex, age, race, ethnicity, English language status, level of education, employment status, and annual household income) and across all variables of interest in the current investigation (CAQ-Worry, CAQ-General Emotion, PSWQ-10, RRQ-Rumination, GAD-7, PHQ-8, and BFI-10-Neuroticism).

In comparison to participants who were lost to attrition from Time 1 to Time 2, those who were retained were significantly older (mean difference = 5.44 years; $t = 7.46$, $df = 833.81$, $p < .001$ [equal variances not assumed]), were more likely to be female ($\chi^2 = 9.94$, $df = 2$, $p = .007$), were more likely to be White/European-American ($\chi^2 = 15.77$, $df = 6$, $p = .02$), were more likely to be first-language English speakers ($\chi^2 = 7.43$, $df = 1$, $p < .01$), and were more likely to be retired or unemployed ($\chi^2 = 14.09$, $df = 5$, $p = .02$). No other significant differences were found in demographic characteristics between those lost at Time 2 and retained at Time 2. In comparison to participants who were lost to attrition from Time 1 to Time 3, those who were retained were again significantly older (mean difference = 6.39 years; $t = 9.17$, $df = 900.60$, $p < .001$ [equal variances not assumed]), were more likely to be White/European-American ($\chi^2 =$

17.52, $df = 6$, $p < .01$), and were more likely to be non-Hispanic/Latinx ($\chi^2 = 7.27$, $df = 1$, $p < .01$). No other significant differences were found in demographic characteristics between those lost at Time 3 and retained at Time 3. These demographic differences between retained and attrited participants were not deemed to be of substantive interest in the current investigation, as similar patterns have been found in other longitudinal MTurk studies with similar lag durations (e.g., Christenson & Glick, 2013) and similar overall length (e.g., Hall et al., 2018).

A series of paired-samples T-tests were used to assess for significant differences between the means of study variables across timepoints. No significant differences were found between means across Times 1 and 2 for any variable of interest, and the same was true for all but one variable across Times 1 and 3. The only significant mean difference was found between the means of the RRQ-Rumination, (mean difference = -0.86; $t = -2.47$, $df = 487$, $p = .01$), reflecting a tendency for retained participants to report less rumination from Time 1 to Time 3.

In sum, given significant differences in one key study variable between retained participants and lost participants, the MCAR assumption was considered untenable. However, the assumption of MAR was deemed plausible, depending on the ability to control for missingness in this study's variables of interest given other observed data. A sizable literature has arisen on practical methods for handling missing data and bolstering the assumption of MAR (see Graham, 2009, for a review). One such method includes modern missing data handling techniques, such as FILM. The RRQ-Rumination at Time 3 was the only variable of substantive interest to differ across retained and attrited participants. Inclusion of the RRQ-Rumination scale at Time 1 and Time 2, paired with the use of FIML, was deemed an appropriate strategy for conditioning missingness in this variable, thereby bolstering confidence in the MAR assumption (Graham, 2009).

Confirmatory Factor Analyses

Confirmatory factor analyses (CFAs) were conducted on each measure (except the BFI-10-Neuroticism subscale, due to its possession of only two items) in order to confirm the appropriateness of modeling them in accordance with their commonly cited factor structure. This step was deemed particularly important for the CAQs, whose structure to date has been examined in only one known publication (Llera & Newman, 2017). The CFAs used data from Time 1 with ML estimation and were evaluated based on commonly recommended fit statistics (described above).

Regarding the CAQ-Worry, three models were examined: (1) a 1-factor model, in which all items loaded onto one general contrast avoidance factor, (2) a correlated 3-factor model, in which items loaded onto their respective subscale (per Llera & Newman, 2017) with correlations modeled between these three factors, and (3) a hierarchical model, in which items loaded onto their respective subscale, and the three resulting factors loaded onto a higher-order general contrast avoidance factor. All fit indices of the 1-factor model failed to meet recommended guidelines. Model fit of the correlated 3-factor model was adequate, as evidenced by all fit statistics meeting recommended guidelines. The original hierarchical model yielded an inadmissible solution, specifically a small negative residual variance (-0.01) for the CAQ-Worry's positive contrast subscale ("I enjoy success the most when I worried about failure"). Per recommendations from Múthen and Múthen (2017), this residual variance was constrained to be greater than zero, and the model was re-run. Model fit of this adjusted hierarchical model was adequate and identical to the model fit of the correlated 3-factor model. Given the adequacy of the both the correlated 3-factor model and hierarchical model, paired with the need for a single

metric of contrast avoidance in relation to worry, the hierarchical model of the CAQ-Worry was retained and used in subsequent analyses. See Table 4 for fit indices of the retained model.

Per its original publication, the CAQ-General Emotion possesses two subscales. The first subscale assesses the use of non-specific strategies for avoiding negative emotional contrasts ("I tend to expect the worst outcome so that I am not emotionally caught off guard"), and the second assesses respondents' dispositional aversion to emotional shifts ("Strongly fluctuating emotions are particularly unpleasant for me"). With only two subscales, a hierarchical model of the CAQ-General Emotion cannot be estimated. Two models were assessed via CFA: (1) a 1-factor model including all items loading onto a general factor, and (2) a reduced 1-factor model including only the items from the first factor specific to emotional contrast avoidance strategies. The fit of the 1-factor model including all items was largely poor, indicated by the failure of all fit statistics to meet recommended guidelines (except for SRMR = .06). However, the reduced 1-factor model including only items reflecting non-specific strategies for avoiding emotional contrasts demonstrated adequate fit to the data, as indicated by all fit indices meeting recommended guidelines (see Table 4). Thus, this reduced 1-factor model of the CAQ-General Emotion was retained and used in primary analyses.

All other self-report measures (except the BFI-10-Neuroticism) were subjected to CFAs to ensure these scales could be accurately modeled as singular and unidimensional latent constructs in primary analyses. A 1-factor solution for each scale was modeled, in which each scales' items loaded onto one general factor reflecting the scales' purported construct (e.g., all 10 PSWQ-10 items loaded onto a single worry factor), and model fit indices were examined in relation to the commonly recommended guidelines described above. Unidimensional solutions for the PSWQ-10, GAD-7, and PHQ-8 demonstrated acceptable fit, indicated by a majority of fit

statistics derived from each model meeting recommended guidelines (see Table 4). The model fit of the RRQ-Rumination's original 1-factor solution was poor, as evidenced by the failure of all fit statistics (save SRMR = .08) to meet recommended guidelines. Modification indices were examined and suggested that model fit would improve substantially if the residual variances of the RRQ-Rumination's three reverse-coded items were allowed to covary (modification indices = 196.35 to 247.01; STDYX expected parameter changes = .47 to .52), signifying a method effect of reverse-coded items well known to scale development researchers (Dalal & Carter, 2015). The 1-factor model was amended such that the residual variances of these three items could covary. Model fit of this adjusted solution was adequate (see Table 4), and thus, it was retained for primary analyses.

Primary Analyses

Worry & Generalized Anxiety Symptoms

Model Fit. This model's RMSEA value, and the upper estimate of RMSEA 90% CI were within recommended guidelines (RMSEA = .038 [90% CI = .038, .039]), but CFI (.88), TLI (.88), and SRMR (.10) failed to meet recommended guidelines. Given arguments for evaluating model fit continuously rather than as a dichotomous good/bad decision (Iacobucci, 2010), path estimates from the worry/generalized anxiety model were evaluated, but with added caution. Refer to Figure 1 for a depiction of the worry/generalized anxiety model. This model was run a second time with neuroticism entered as a covariate. Model fit of this modified model was similar to the fit of the original model, with RMSEA (.038) and the upper limit of RMSEA 90% CI (.038, .039), meeting recommended guidelines, but CFI (.88), TLI (.88), and SRMR (.10) failing to meet recommended guidelines.

Hypothesis 1. The hypothesis that greater emotional contrast avoidance would be positively associated with worry and generalized anxiety symptoms cross-sectionally was supported. Greater emotional contrast avoidance was significantly associated with greater worry and more severe generalized anxiety symptoms at Time 1, *r*s = .69 and .62, respectively, *p*s < .001. These associations remained large and significant after controlling for trait neuroticism, *r*s = .69 and .62, respectively, *p*s < .001.

Hypothesis 2. The hypothesis that greater emotional contrast avoidance at Time 1 would predict greater worry at Time 2 while controlling for levels of worry at Time 1 was not supported. After accounting for the autoregressive effect of worry from Time 1 to Time 2 (β = .46, *p* < .001), and the effect of generalized anxiety symptoms from Time 1 to Time 2 in this fully cross-lagged model, the association between emotional contrast avoidance at Time 1 and worry at Time 2 was non-significant, β = .07, *p* = .14. These results were unchanged by the addition of trait neuroticism entered as a covariate at Time 1, that is, the effect of Time 1 contrast avoidance on Time 2 worry remained small and non-significant, β = .08, *p* = .15.

Hypothesis 3. The hypothesis that greater worry at Time 2 would predict more severe symptoms of generalized anxiety at Time 3 while controlling for symptom severity at Time 2 was not supported. After estimating the autoregressive effect of generalized anxiety symptoms from Time 2 to Time 3 (β = .73, *p* < .001), and the effects of contrast avoidance at Time 1 and Time 2 (βs = -.04 and .03, *p*s = .53 and .65, respectively) in this fully cross-lagged model, worry at Time 2 did not predict generalized anxiety symptoms at Time 3, β = .12, *p* = .14. This effect remained nonsignificant and similar in magnitude when including trait neuroticism as a covariate, β = .00, *p* = .99.

Hypothesis 4. Finally, the hypothesis that increased worry at Time 2 would mediate the effect of greater emotional contrast avoidance at Time 1 on exacerbated symptoms of generalized anxiety at Time 3 was not supported. The indirect effect of Time 1 emotional contrast avoidance on Time 3 generalized anxiety symptoms via Time 2 worry was estimated to be small (.01) and non-significant (bias-corrected bootstrap 95% CI = -.002, .038). These results were unchanged by the addition of trait neuroticism as a covariate; the indirect effect coefficient was estimated to be .00 (bias-corrected bootstrap 95% CI = -.02, .02).

Rumination & Depressive Symptoms

Model Fit. This model's RMSEA value, the upper estimate of RMSEA 90% CI, and SRMR were all within recommended guidelines (RMSEA = .044 [90% CI = .043, .045]; SRMR = .07), while CFI (.87) and TLI (.86) failed to meet recommended guidelines. Refer to Figure 2 for a depiction of the rumination/depression model without neuroticism. A modified model with neuroticism entered as a covariate evidenced similar fit as the original model, with RMSEA (.043), the upper limit of RMSEA 90% CI (.043, .044), and SRMR (.07) meeting recommended guidelines, but CFI (.86) and TLI (.86) failing to meet recommended guidelines.

Hypothesis 1. The hypothesis that greater emotional contrast avoidance would be positively associated with rumination and depressive symptoms cross-sectionally was supported. Greater emotional contrast avoidance was significantly associated with greater rumination and more severe depressive symptoms at Time 1, rs = .53 and .68, respectively, ps < .001. These associations were unchanged after controlling for trait neuroticism, rs = .53 and .68, respectively, ps < .001.

Hypothesis 2. The hypothesis that greater emotional contrast avoidance at Time 1 would predict greater rumination at Time 2 while controlling for levels of rumination at Time 1 was not

supported. After accounting for the autoregressive effect of rumination from Time 1 to Time 2 (β = .72, $p < .001$), as well as the non-significant effect of Time 1 depressive symptoms in this fully crossed-lagged model (β = .06, $p < .15$), the association between emotional contrast avoidance at Time 1 and rumination at Time 2 was non-significant, β = .06, $p = .10$. These results were unchanged by the addition of trait neuroticism as a covariate, β = .06, $p = .17$.

Hypothesis 3. The hypothesis that greater rumination at Time 2 would predict more severe symptoms of depression at Time 3 while controlling for symptom severity at Time 2 was not supported. After estimating the autoregressive effect of depressive symptoms from Time 2 to Time 3 (β = .88, $p < .001$), as well as the non-significant effect of Time 2 contrast avoidance (β = -.01, $p < .91$), rumination at Time 2 shared no significant association with depressive symptoms at Time 3, β = .04, $p = .19$. This effect remained non-significant and similar in magnitude with the addition of trait neuroticism as a covariate, β = -.02, $p = .61$.

Hypothesis 4. Finally, the hypothesis that increased rumination at Time 2 would mediate the effect of greater emotional contrast avoidance at Time 1 on exacerbated symptoms of depression at Time 3 was not supported. The indirect effect of Time 1 emotional contrast avoidance on Time 3 depressive symptoms via Time 2 rumination was estimated to be small (.003) and non-significant (bias-corrected bootstrap 95% CI = -.001, .012). These results were unchanged by the addition of trait neuroticism to the model (-.001, bias-corrected bootstrap 95% CI = -.01, .002).

Unified Worry/Rumination Model

Model Fit. For the unified model, RMSEA (.039), upper estimate of RMSEA 90% CI (90% CI = .039, .040), and SRMR (.06) were within recommended guidelines, but CFI (.86) and TLI (.86) failed to meet conventional recommendations for acceptable fit. As with the primary

models above, hypothesized path coefficients were interpreted with caution. Refer to Figure 3 for a depiction of the unified worry/rumination model without neuroticism. A modified model with neuroticism entered as a covariate evidenced similar fit as the original model, RMSEA = .039 (90% CI = .038, .040), SRMR = .06, CFI = .86, and TLI = .85.

Hypothesis 1. The hypothesis that emotional contrast avoidance would be significantly and positively associated with worry, generalized anxiety symptoms, rumination, and depressive symptoms was supported in his unified model. Contrast avoidance exhibited large and significant cross-sectional correlations with worry (r = .70), rumination (r = .53), generalized anxiety symptoms (r = .66), and depressive symptoms (r = .68, all ps < .001) at Time 1. These associations with worry, rumination, generalized anxiety symptoms, and depression remained significant and identical in magnitude despite the inclusion of neuroticism as a covariate, rs = .70, .53, .66, and .68, respectively.

Hypothesis 2. The hypothesized longitudinal effects of Time 1 contrast avoidance on Time 2 worry and rumination were not supported; after accounting for worry and rumination's autoregressive effects, as well as the effects of generalized anxiety and depressive symptoms at Time 1 in this fully cross-lagged model, Time 1 contrast avoidance shared small and non-significant associations with worry and rumination at Time 2, βs = .05 and .05, ps = .27 and .18 respectively. The non-significance and magnitude of these effects were unchanged by the addition of trait neuroticism as a covariate, βs = .05 and .05, ps = .29 and .19.

Hypothesis 3. The hypothesized longitudinal effects of Time 2 worry and rumination on Time 3 generalized anxiety symptoms and depressive symptoms, respectively, were not supported. After accounting for autoregressive and fully cross-lagged effects, Time 2 worry shared a small and non-significant relationship with Time 3 generalized anxiety symptoms, β =

.08, p = .38, and Time 2 rumination shared a similarly small and non-significant effect with Time 3 depressive symptoms, βs = .05, p = .21. The magnitude of these coefficients was attenuated, and they remained non-significant after the addition of trait neuroticism as a covariate, βs = -.01 and -.003, ps = .95 and .94.

Hypothesis 4. The hypothesized mediating effect of Time 2 worry between Time 1 contrast avoidance and Time 3 generalized anxiety symptoms was small and non-significant, indirect effect = .004, 95% CI = -.003, .027. Similarly, the hypothesized mediating effect of Time 2 rumination between Time 1 contrast avoidance and Time 3 depressive symptoms was small and non-significant, indirect effect = .002, 95% CI = -.001, .012. These effects were unchanged by the inclusion of trait neuroticism as a covariate, indirect effect of worry = .00 (95% CI = -.02, .013.), indirect effect of rumination = .00, (95% CI = -.007, .004).

Discussion

The NECAM seeks to account for the persistence of pathological worry, and investigations into its central tenets have yielded promising findings (Newman & Llera, 2011, Newman et al., 2014). This investigation sought to add to this budding literature base by exploring the longitudinal effect of negative emotional contrast avoidance on the development of worry and generalized anxiety symptoms in a large community sample, and furthermore, to extend the explanatory power of the NECAM by exploring a hypothesized parallel role of rumination in depressive symptoms, thereby providing evidence of a theoretically plausible but as yet untested transdiagnostic process across GAD and MDD. While significant cross-sectional associations were found between contrast avoidance and both sets of cognitive processes and symptom outcomes (Hypothesis 1), study predictions about the longitudinal effects of emotional contrast avoidance were not supported.

The null results regarding emotional contrast avoidance, worry, and generalized anxiety symptoms are surprising given the current state of empirical support for the NECAM. As reviewed above, the NECAM posits that those who are more sensitive to abrupt shifts in emotion use worry to maintain a chronic negative mood state and that using worry in this way is both negatively and positively reinforced by the attenuation of sharp negative shifts in emotions and by the facilitation of transient positive emotion when worrisome outcomes are not realized. All four of the NECAM's central tenets have received at least some support within the existing literature: those higher in generalized anxiety symptoms find strong emotions themselves threatening (see Newman et al., 2013, for a review) and report greater motivation to avoid strong negative emotions and sharp changes therein than those lower in generalized anxiety symptoms (Llera & Newman, 2017; Mennin et al., 2005; Turk et al., 2005). Worry is consistently associated with negative mood states and elevated physiological arousal (Ottaviani et al., 2016). Despite the aversive experience elicited by worry, those higher in generalized anxiety symptoms report that worry is helpful in allowing them to brace for future negative events (Kim & Newman, 2016; Llera & Newman, 2010), and empirical investigations find that worry does in fact prevent future negative emotional contrasts (Crouch et al., 2017; Llera & Newman, 2010). Lastly, while not as frequently explored as the NECAM's third tenet (avoidance of negative emotional contrasts), its fourth tenet (creation of brief positive emotional contrasts) has received a small amount of support within the existing literature, suggesting that worry within GAD may also be positively reinforced by brief moments of positive emotion (e.g., relief) when feared outcomes do not come to pass ("I find worrying most rewarding when something good happens in the end," Llera & Newman, 2017, p. 119).

There are a number of possible explanations for this study's null results in regard to worry and generalized anxiety symptoms, and nearly all such explanations concern this study's methodological design. First, the community sample recruited for this study may not have optimally captured pathological worry within generalized anxiety. Worry is a dimensional construct (Ruscio et al., 2001), and not all worry is pathological (Tallis et al., 1992). Unlike worry that occurs within GAD, worry that occurs outside of GAD is generally less frequent, less intense, less distressing, is more circumscribed in its focus, and is perceived to be more controllable (Hoyer et al., 2001; Ruscio et al., 2001). Such worry is normal within the general population and may in fact be adaptive within proper contexts (e.g., as a means for staying organized, motivating action to prevent an undesirable outcome, or helping to foresee obstacles when making plans; Davey 1994; McNeill & Dunlop, 2016; Sweeny & Dooley, 2017; Szabó & Lovibond, 2016). While readers can be assured that the community sample of this study captured all levels of worry severity and generalized anxiety symptoms (as evidenced by the full range and normal distribution of PSWQ-10 and GAD-7 scores across timepoints), it is possible that the tenets of the NECAM are better applied to pathological worry within generalized anxiety and that other factors are needed to account for non-pathological worry in the general population (e.g., problem-solving efforts; Davey, 1994). If a sizable number of participants in this study reported not on pathological worry but on normative experiences of worry (which is likely within this community-based convenience sample), associations between emotional contrast avoidance, worry, and generalized anxiety symptoms may not have aligned with study predictions, especially when examined longitudinally, as normative worry tends to be transient (Dupuy et al., 2001; Ruscio, 2002).

A second methodological consideration in regard to this study's null results relates to the 4-month lag duration chosen for the data collection schedule. As previously mentioned, no known study has examined the tenets of the NECAM across time, save for an 8-week dairy-based study (Crouch et al., 2017) and an 8-day ecological momentary assessment study (Newman et al., 2019). No known information exists on the duration of time needed for contrast avoidance motivations to exert their influence on worry in an appreciable way. As discussed above, the 4-month lags used within this study were chosen based on the clinical literature around GAD and MDD, specifically criterion C of GAD per the DSM-5, which stipulates that GAD symptoms must be present for a minimum of six months (APA, 2013), and epidemiological studies on the median and mean durations of major depressive episodes (estimated at three months and nine months, respectively; Eaton et al., 2008; Ferrari et al., 2013). Therefore, lag durations of four months were reasoned to maximize the chances of capturing clinically meaningful changes in this study's final outcomes, applying the recommendation of other researchers that the overall duration of the study (eight months) should span the interval of theoretical interest (Cole & Maxwell, 2003). As added assurance, such a lag duration was on par with other longitudinal investigations of anxiety and depression (e.g., MacKinnon et al., 2014; Young & Dietrich, 2015). However, despite these assurances, lag durations within this investigation may not have been optimized to capture the influence of negative emotional contrast avoidance on worry and rumination.

While the effects of inappropriate lag durations on path estimates can vary, of particular importance to the aims of this study is an attenuated relationship between study variables. Cole and Maxwell (2003) discuss this issue and in particular the importance of assessment timing when testing mediation effects, explaining that the magnitude of the association between one's

predictor (X) and mediator (M) will vary as a function of the stability of these two variables and the duration of the lag between assessments. The more stable X and M, the longer one's lags need to be in order to maximize the estimate of X → M. Given that the CAQ-Worry and the PSWQ-10 both demonstrated strong stability in this study (autoregressive βs = .34 to .73; moderate to very large effects per Funder & Ozer, 2019), it could be that 4-month lags were too short to allow for the maximal influence of contrast avoidance to unfold on worry. Were this the case, the longitudinal effect of contrast avoidance on worry would have been underestimated. Unfortunately, it is not possible to test this explanation directly without additional data collected over a variety of lag durations.

Setting aside methodological critiques, there remains the possibility of accepting the null results of this investigation at face value. This is the first and still only known longitudinal investigation of the NECAM in a community sample. Its null findings may point to an inability of the NECAM to fully account for the persistence of worry and the development of generalized anxiety symptoms across time. Many theories have been put forth to account for pathological worry, several focused on negative reinforcement contingencies in the maintenance of worry (i.e., avoidance, but varying in the stimuli/experiences to be avoided; see Behar et al., 2009, for a review and Newman & Llera, 2011, for a comparison of these models with the NECAM), and some focused on information processing biases and/or deficits in executive functions as a cognitive breeding ground for problematic worry (e.g., Hirsch & Mathews, 2012; Songco et al., 2020). While the NECAM's hypotheses have been supported in many investigations since its recent development, so have the hypotheses of many other competing theories around worry. It may be that worry and the subsequent development of generalized anxiety symptoms are more complex processes than can be accounted for by the NECAM when examined across time,

processes with multiple etiological and maintaining factors, the exclusion of which renders both theoretical conceptualization and statistical model inadequate.

Regarding this investigation's statistical models, readers will recall that model fit indices were not fully in agreement. While RMSEA values and the upper limit of RMSEA 90% CIs met recommended guidelines across all tested models involving worry and generalized anxiety symptoms, CFI and TLI were consistently below their respective threshold, and SRMR was elevated above its recommended guideline within the worry/generalized anxiety models. RMSEA provides a test of approximate fit and the upper limit of its 90% CI provides a test of poor fit. Both of these fit indices typically reward models with large χ^2 values and many degrees of freedom. CFI and TLI are two related goodness-of-fit statistics that reflect the incremental improvement in model fit above a baseline model (e.g., CFI = .90 suggests that the proposed model's fit is 90% better than the fit of the baseline model). TLI works in a similar way but takes into account the degrees of freedom in both the proposed and baseline models, thereby penalizing model complexity. Lastly, SRMR is a badness-of-fit statistic that provides the mean absolute correlation residual in standardized terms, reflecting the overall discrepancy between observed correlations and predicted correlations (see Kline, 2016, for a full description and discussion of these indices). Looking more closely at the fit of this study's worry/generalized anxiety models, fit indices suggested that these may have had acceptable fit to the data (RMSEAs = .038; 90% CIs = .038 to .039), but may still have had limited incremental improvement over a baseline model (CFI = .88, TLI = .88), and more specifically, may have had one or more notable problems with correlation residuals (SRMR = .10). Cole and Maxell (2003) recommend testing an overall model in which all variables are allowed to correlate with each other as a way to appraise the viability of one's more specified models; a poor fitting overall

model would suggest that study hypotheses may be misguided. The fit of an overall model with the CAQ-Worry, PSWQ-10, and GAD-7 across all timepoints (RMSEA = .038 [90% CI = .038, .039], CFI = .88, TLI = .88, SRMR = .09) reflected the same ambiguous results as the specified worry/generalized anxiety model, casting doubt on the rationale of this study's hypotheses and perhaps also on the central tenets of the NECAM. That is, taking this investigation's results at face value and with ample consideration of the suboptimal model fit just described, it may be that much work remains to be done to fully understand the emotional contrast avoidance functions of worry in the development of generalized anxiety symptoms. Nonetheless, the significant cross-sectional effects found in this investigation and the preponderance of findings in support of the NECAM within existing literature should encourage future researchers to continue exploring the merits (and limits) of this novel theory of worry in generalized anxiety.

The null results regarding emotional contrast avoidance, rumination, and depressive symptoms, while disappointing, are less surprising than the null results concerning worry and generalized anxiety symptoms, as the tenets of the NECAM had yet to be rigorously applied to depression-related processes and outcomes prior to this investigation. Current conceptualizations of rumination recognize that it maintains emotional distress and perpetuates depressive symptoms (see Lyubomirsky & Tkach, 2004, for a review); however, rumination may also serve as a means to avoid active problem-solving and the emotional distress that might follow thwarted efforts (Lyubomirsky & Tkach, 2004; Nolen-Hoeksema et al., 2008). That is, like worry, rumination creates and maintains subjective emotional distress, but it may also serve an emotion regulation function aimed at preventing the experience of even more distressing mood states (i.e., negative emotional contrast avoidance). Such a proposition is consistent with budding empirical

literature and anecdotal accounts of why individuals with depression ruminate (e.g., Kim & Newman, 2016; Watkins, 2018).

As with the null results regarding worry and generalized anxiety symptoms, there are a number of possible explanations for why this investigation's rumination- and depression-related hypotheses were unsupported. Some of the same methodological issues described above (i.e., lag duration) apply here. Returning to Cole and Maxwell's (2003) warning about the underestimation of relationships between study variables when X and M are stable and measured too close together, the CAQ-General Emotion and RRQ-Rumination both proved highly stable in this study (autoregressive βs = .69 to .88; very large effects per Funder & Ozer, 2019). With such stability, the 4-month lags used in this study may have been too short to detect a meaningful longitudinal relationship between contrast avoidance and rumination. Turning again to the issue of model fit, fit indices for this study's rumination/depressive symptom models were not fully in agreement. RMSEA values (.043 to .044), the upper limit of RMSEA 90% confidence intervals (.044 to .045), and SRMR (.07) were all in support of the fit of the rumination/depressive symptom models, while CFI (.86 to .87) and TLI (.86) were not. Testing an overall model in which all measurements of the CAQ-General Emotion, RRQ-Rumination, and PHQ-8 were allowed to correlate with each other produced similarly ambiguous fit (RMSEA = .044 [90% CI = .043 to .044], CFI = .87, TLI = .86, SRMR = .07), suggesting that the hypotheses tested within this investigation, and the ability of the NECAM to account for contrast avoidance functions of rumination in depression, may be without merit.

However, other methodological issues previously discussed (i.e., sample characteristics) may be of less concern when considering this investigation's null rumination- and depression-specific findings. Both rumination and depressive symptoms were well represented in this

sample, evidenced by the full range and normal distribution of RRQ-Rumination and PHQ-8 scores at all timepoints (the only exception being a slight restriction in the PHQ-8's range at Time 3: scores = 0 to 22 rather than 0 to 24). Furthermore, in comparison to clinical samples of both currently depressed individuals and individual with a history of major depressive episodes (e.g., Jermann et al., 2013), the current sample demonstrated comparable levels of rumination as measured by the RRQ-Rumination, with a large proportion of the current study (20%) reporting levels of rumination on par with levels reported by clinically depressed individuals.

Taking this investigation's null rumination and depression results at face value, it may be that rumination does not serve a negative emotional contrast avoidance function. It is true that many theorists have conceptualized rumination as an avoidance behavior, for example, as avoidance of active problem-solving (Nolen-Hoeksema et al., 2008). However, not all theories of rumination focus on avoidance. The goal progress theory of rumination (Martin et al., 2004) posits that rumination is a highly verbalized and protracted example of the Zeigarnik effect, or the tendency for information pertaining to incomplete tasks to remain in working memory longer than information pertaining to complete tasks. Per this theory, rumination is instigated when individuals perceive their goals (e.g., finding a romantic relationship, progressing in their career, attaining personal contentment) to be unfinished or progressing too slowly. When used adaptively and in conjunction with effective problem-solving skills, rumination may serve to keep information related to these pursuits in working memory and thereby help to generate viable avenues to their resolution (see Brotman & Derubeis, 2004, for a comparison of the goal progress theory to other theories of rumination). In short, the avoidance-based function proposed within the NECAM may not apply to rumination. Furthermore, in comparison to worry, rumination may have a more complex etiology than was conceptualized in this study. As

evidence, the content of rumination tends to be more self-referential than worry ("Why do I always react this way?" compared to "What if something bad happens?"; Papageorgiou, 2006), reflecting a possibility that self-schema (e.g., the self as fundamentally damaged or ineffective) may play a larger role in rumination than in worry. Indeed, theorists have pointed out that one of the central themes of ruminative thought is low self-worth, while the content of worry tends to focus on future threats and how to prepare for them (Nolen-Hoeksema, 2008). Still, as this is the only known investigation to apply the tenets of the NECAM to rumination and depressive symptoms in a large sample followed longitudinally, future research would do well to continue this line of investigation until such time that questions around emotional contrast avoidance motivations in rumination can be definitively answered.

All study findings, both significant and nonsignificant, should be weighed in balance with this investigation's strengths and limitations. Beginning with its strengths, the large, community-based sample recruited for this study very likely provided a greater range of clinical concerns than other samples of convenience (Chandler & Shapiro, 2016), as evidenced by the full to nearly full range and normal distribution of GAD-7 and PHQ-8 scores seen at each timepoint. Further, this study's sample reflected a fair degree of diversity across a number of demographic variables (e.g., age, race, ethnicity, income, and employment). While not perfectly representative of the general US population, the sample recruited for this investigation (and other MTurk samples reported in the literature) provided greater coverage of the adult population than other convenience samples (e.g., undergraduates), thereby bolstering confidence in the generalizability of its results (Chandler & Shapiro, 2016). Beyond sample characteristics, this investigation was able to follow its sample longitudinally across three timepoints. Longitudinal data are essential for a true test of mediation, but to the consternation of many researchers, cross-sectional data

remain the norm within psychological research (Maxwell & Cole, 2007). In recruiting and following its sample across eight months of data collection, this investigation was able to test proposed mediation effects in an analytically sound fashion (Maxwell & Cole, 2007; Maxwell et al., 2011). Finally, this study's analytic plan reflected many of the current conventional guidelines and aspirational goals of psychological research. The use of SEM and latent variable modeling provided a considerable safeguard against a danger that is ubiquitous to all empirical investigations – measurement error – as latent variables allow researchers to parcel out nuisance variance unrelated to the constructs of interest (Kline, 2016). Additionally, this investigation tested its hypotheses within one of the most commonly used longitudinal designs, the cross-lagged panel model (CLPM; Preacher, 2015), whose advantages include the estimation of autoregressive effects across timepoints and the ability to model a host of possible causal relationships simultaneously (i.e., a fully cross-lagged model with all T1 variables predicting all T2 variables, and so on). The CLPM provides the advantages of longitudinal data in allowing time for proposed causes to influence proposed mediators and outcomes, and it provides much stronger inferences about the direction of causation relative to cross-sectional data and reduces parameter biases that are largely inherent in cross-sectional analyses (Maxwell et al., 2011; Selig & Preacher, 2009).

Study limitations included the same methodological considerations discussed above: the potential shortcomings of a non-clinical convenience sample and a lack of empirical guidance on appropriate lag durations. An additional limitation pertains to the limits of the CLPM in general, that is, its focus on group-level change in variables of interest and its statistical neglect of the passage of time. While the CLPM does well in estimating effects at the group-level, it is unable to provide information on intra-individual changes in study variables across time; this is a

notable limitation, given that longitudinal data might be better thought of as multilevel data nested across both waves of data collection and individuals (see Hamaker et al., 2015, for an examination of the CLPM's capacities and limitations in this regard). Further, the CLPM does not model time explicitly; rather, it assumes that staggering the measurement of study variables across lags in time will be sufficient to allow longitudinal effects to come forth in the data. The statistical neglect of time in analyses based on the CLPM has been explored by other researchers (e.g., Oud, 2007), who demonstrate that modeling time explicitly and as a continuous variable in analyses can improve coefficient estimations. Future researchers may wish to investigate the tenets of the NECAM with other statistical models, such as multilevel modeling and latent growth curve models, which can account for both group- and individual-level change and can more flexibly account for change over time (Kline 2016).

In conclusion, the NECAM has proven to be a promising new theory of worry within generalized anxiety, capable of generating a slew of testable hypotheses around the individual motivations and operant contingencies that make worry a distressing but perplexingly persistent behavior. While this study failed to find support for the NECAM's central tenets within its longitudinal analyses, negative emotional contrast avoidance was significantly associated with worry and generalized anxiety symptoms, as well as with rumination and depressive symptoms in cross-sectional analyses, leaving open opportunities for future research into the role of emotional contrast avoidance and repetitive negative thought within the emotional disorders broadly. It is hoped that this investigation will spur additional research in this area and will guide future researchers in crafting theoretically, methodologically, and analytically sound investigations of the NECAM.

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Appendix

Table 1

Recruitment, Exclusions, & Attrition

	Initial Sample	Excluded for Data Quality	Clean Sample
Time 1	999	80 (8.01%)	919 (91.99%)
Time 2	579	3 (0.52%)	576 (99.48%)
Time 3	493	5 (1.01%)	488 (98.99%)
	Time 1	Time 2	Time 3
Total *N*s (% Retained)	919 (100.00%)	576 (62.68%)	488 (53.10%)

Table 2

Descriptive Statistics at Time 1

Mean Age (*SD*)	36.91 (11.00)	Employment	
Biological Sex		Home-maker	44 (4.79%)
Female	473 (51.47%)	Full-time employee	610 (66.38%)
Male	444 (48.31%)	Part-time employee	131 (14.25%)
Intersex	2 (0.22%)	Full-time student	58 (6.31%)
Race and Ethnicity		Part-time student	17 (1.85%)
White/European-American	666 (72.47%)	Unemployed/Retired	59 (6.42%)
Black/African-American	145 (15.78%)	Annual Income	
Asian/Asian-American	54 (5.88%)	Less than $20,000	93 (10.12%)
Native American	25 (2.72%)	$20,000 – $40,000	210 (22.85%)
Other Races	29 (3.16%)	$40,000 – $60,000	243 (26.44%)
Hispanic/Latinx	112 (12.19%)	$60,000 – $80,000	165 (17.95%)
ESL Speakers	118 (12.84%)	$80,000 – $100,000	102 (11.10%)
Education		$100,000 – $200,000	95 (10.34%)
No high school diploma	8 (0.87%)	More than $200,000	11 (1.20%)
High school diploma/GED	82 (8.92%)	Sexual Orientation	
Tech. training/Some college	267 (29.05%)	Heterosexual	767 (83.46%)
Bachelor's degree	376 (40.91%)	Bisexual	99 (10.77%)
Some grad school/Master's	166 (18.06%)	Homosexual	19 (2.07%)
Doctorate	20 (2.18%)	All other orientations	34 (3.70%)

Note. "ESL" – English as a second language; The sum of employment status percentages is greater than 100%, as participants were allowed to select multiple employment options.

Table 3

Observed Variable Intercorrelations & Psychometric Statistics

		CAQ-Worry	CAQ-Gen.	PSWQ-10	RRQ-Rum.	GAD-7	PHQ-8	BFI-N
Time 1	1.	.96						
	2.	.84	.97					
	3.	.73	.73	.98				
	4.	.51	.52	.67	.93			
	5.	.65	.68	.79	.57	.94		
	6.	.60	.68	.70	.51	.84	.92	
	7.	.45	.47	.62	.63	.56	.48	.65
	Means	75.22	57.03	23.59	37.46	6.17	6.68	5.62
	(*SDs*)	(26.69)	(24.89)	(16.94)	(11.19)	(5.78)	(6.26)	(2.30)
Time 2	1.	.97						
	2.	.86	.98					
	3.	.71	.71	.98				
	4.	.54	.52	.67	.93			
	5.	.69	.67	.83	.57	.95		
	6.	.65	.66	.75	.53	.81	.93	
	7.	.51	.50	.67	.67	.57	.50	.72
	Means	72.67	54.77	22.00	37.34	5.59	6.11	5.58
	(*SDs*)	(27.38)	(25.65)	(17.94)	(11.87)	(5.87)	(6.33)	(2.47)
Time 3	1.	.96						
	2.	.86	.98					
	3.	.72	.73	.98				
	4.	.62	.62	.71	.94			
	5.	.63	.63	.82	.61	.94		
	6.	.61	.65	.73	.57	.80	.92	
	7.	.52	.56	.60	.65	.56	.51	.72
	Means	71.63	52.71	20.63	35.84	5.23	5.30	5.38
	(*SDs*)	(26.89)	(25.20)	(17.38)	(12.02)	(5.52)	(5.82)	(2.44)
Test-retest	T1-T2 *r*s	.74	.78	.78	.77	.77	.79	.82
	T2-T3 *r*s	.79	.83	.78	.83	.77	.83	.82
	T1-T3 *r*s	.76	.76	.76	.79	.71	.78	.79

Note. Cronbach's αs displayed on the diagonal; All correlations significant at $p < .001$.

Table 4

Fit Indices for Final CFAs & CLPMs

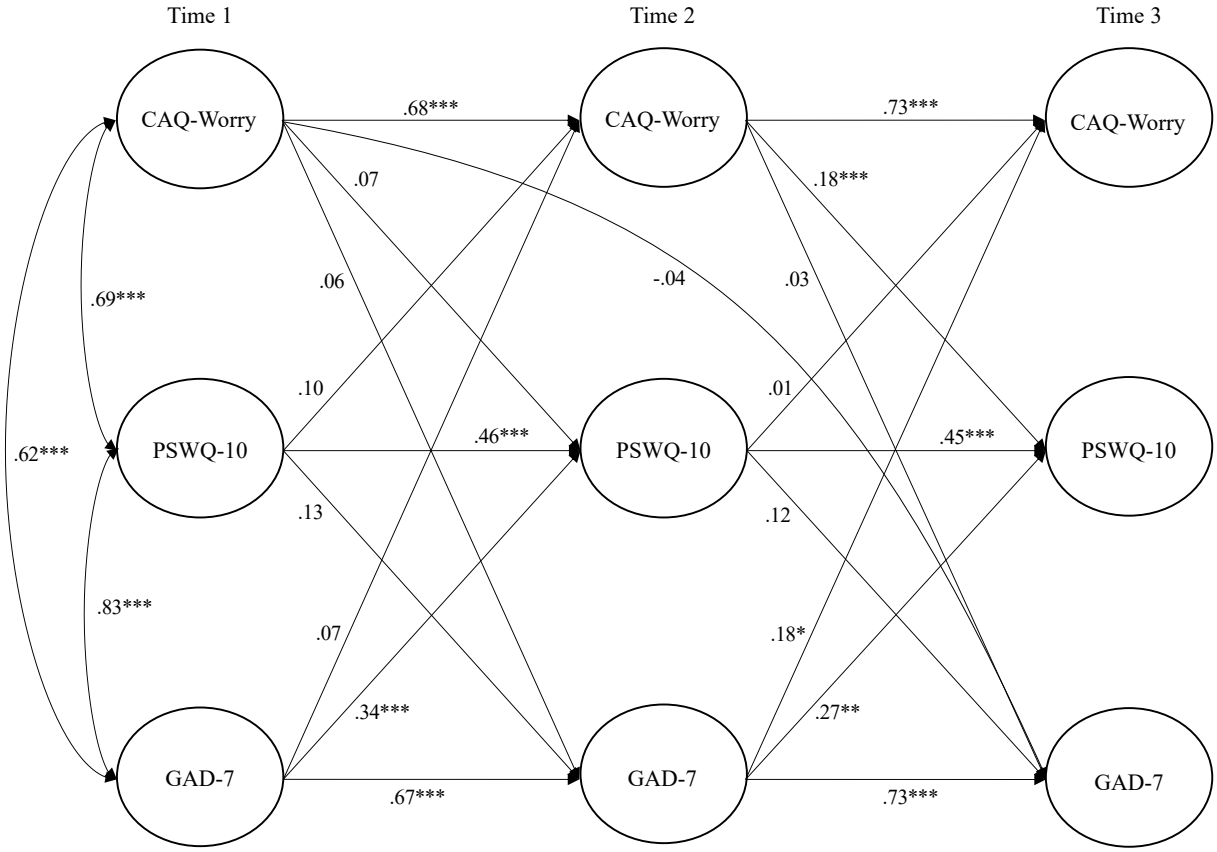
	χ^2 (*df*)	RMSEA (90% CI)	CFI	TLI	SRMR
CAQ-Worry	1647.02 (402)	.058 (.055, .061)	.95	.95	.06
CAQ-General Emotion-F1	957.28 (135)	.081 (.077, .086)	.95	.95	.03
PSWQ-10	268.69 (35)	.085 (.076, .095)	.98	.97	.02
RRQ-Rumination	396.37 (51)	.086 (.078, .094)	.96	.94	.03
GAD-7	123.03 (14)	.092 (.077, .107)	.98	.97	.02
PHQ-8	257.49 (20)	.114 (.102, .126)	.95	.93	.03
Worry/Generalized Anxiety Model (w/o Neuroticism)	22885.25 (9692)	.038 (.038, .039)	.88	.88	.10
Rumination/Depression Model (w/o Neuroticism)	17351.67 (6290)	.044 (.043, .045)	.87	.86	.07
Unified Model (w/o Neuroticism)	31981.28 (13274)	.039 (.039 .040)	.86	.86	.06
Worry/Generalized Anxiety Model (w/Neuroticism)	23360.10 (9964)	.038 (.038, .039)	.88	.88	.10
Rumination/Depression Model (w/Neuroticism)	17823.94 (6508)	.043 (.043, .044)	.86	.86	.07
Unified Model (w/Neuroticism)	32614.17 (13588)	.039 (.038, .040)	.86	.85	.06

Note. CFAs – confirmatory factor analyses; CLPMs – cross-lagged panel models; RMSEA – root mean square error of approximation; CI – confidence interval; CFI – comparative fit index; TLI – Tucker-Lewis index; SRMS – standardized root mean square residual; CAQ-Worry – Contrast Avoidance Questionnaire-Worry; CAQ-General Emotion-F1 – Contrast Avoidance Questionnaire-General Emotion-Factor 1 only; PSWQ-10 – Penn State Worry Questionnaire; RRQ-Rumination – Rumination-Reflection Questionnaires-Rumination scale; GAD-7 – 7-item

Generalized Anxiety Disorder Scale; PHQ-8 – 8-item Patient Health Questionnaire; All χ^2 values significant at $p < .001$.

Figure 1

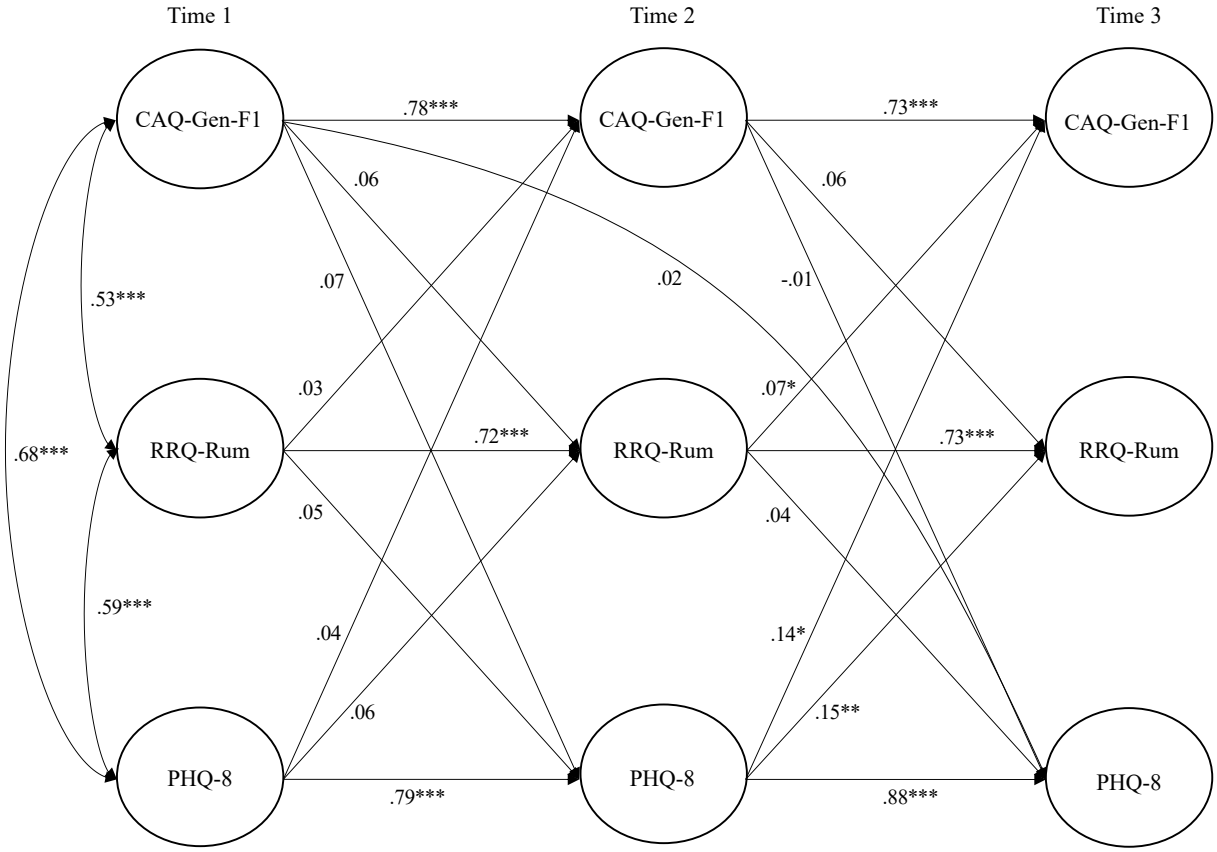
Worry/Generalized Anxiety Model



Note. For ease of interpretation, item and factor loadings, cross-sectional correlations, and error terms are not displayed. CAQ-Worry – Contrast Avoidance Questionnaire-Worry; PSWQ-10 – Penn State Worry Questionnaire; GAD-7 – 7-item Generalized Anxiety Disorder Scale; * $p < .05$; ** $p < .01$; *** $p < .001$.

Figure 2

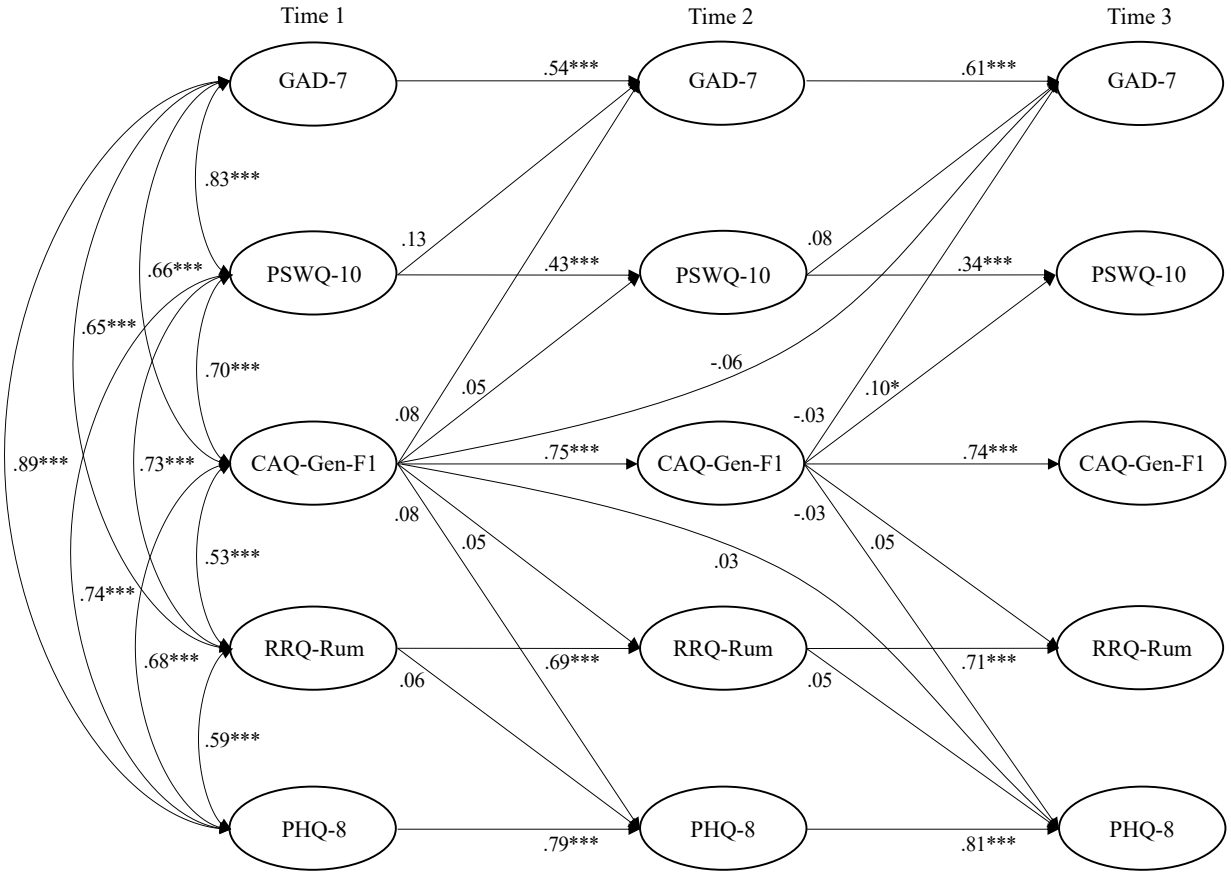
Rumination/Depression Model



Note. For ease of interpretation, item and factor loadings, cross-sectional correlations, and error terms are not displayed. CAQ-Gen-F1 – Contrast Avoidance Questionnaire-General Emotion-Factor 1 only; RRQ-Rum – Reflection-Rumination Questionnaire-Rumination scale; PHQ-8 – 8-item Patient Health Questionnaire; * $p < .05$; ** $p < .01$; *** $p < .001$.

Figure 3

Unified Worry/Rumination Model



Note. For ease of interpretation, item and factor loadings, cross-sectional correlations, error terms, and cross-lagged coefficients not of hypothetical interest are not displayed. CAQ-General Emotion-F1 – Contrast Avoidance Questionnaire-General Emotion-Factor 1 only; PSWQ-10 – Penn State Worry Questionnaire; RRQ-Rumination – Rumination-Reflection Questionnaires-Rumination scale; GAD-7 – 7-item Generalized Anxiety Disorder Scale; PHQ-8 – 8-item Patient Health Questionnaire; * $p < .05$; ** $p < .01$; *** $p < .001$.