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Longitudinal and Experimental Studies Examining Social Support, Emotion Regulation, Depression, and Anxiety

Author

Metts, Allison

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Longitudinal and Experimental Studies Examining Social Support, Emotion Regulation, Depression, and Anxiety

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by

Allison Victoria Metts

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ABSTRACT OF THE DISSERTATION

Longitudinal and Experimental Studies Examining

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by

Allison Victoria Metts

Doctor of Philosophy in Psychology

University of California, Los Angeles, 2024

Professor Michelle Craske, Chair

Social support has a strong influence upon positive mental health outcomes, including lower risk for depression and anxiety. This dissertation contains three papers that examined how social support may lead to more adaptive mental health outcomes regarding depression and anxiety by impacting emotion regulation.

In Study 1, I addressed whether perceived social support may lessen misappraisals of symptom stressors and whether anxiety sensitivity – negative beliefs about somatic symptoms of anxiety – may influence perceived social support. I also explored whether cognitive behavioral therapy (CBT) may influence these reciprocal associations. Analyses of 961 primary care patients with anxiety disorders revealed significant reciprocal associations between perceived social support increases and anxiety sensitivity decreases. Further, CBT influenced changes in

each construct indirectly through changes in the other construct, suggesting that perceived social support or anxiety sensitivity may be suitable treatment targets.

Study 2 addressed the question of whether experiences in close adult relationships – operationalized as adult attachment security – related to symptoms of depression and anxiety indirectly through cognitive reappraisal or expressive suppression tendencies. Longitudinal analyses conducted on data from 270 young adults indicated that higher adult attachment security predicted lower subsequent use of expressive suppression. Separately, both emotion regulation tendencies predicted subsequent symptoms of anxiety and depression. However, adult attachment security did not relate to symptoms indirectly through emotion regulation tendencies. Results suggest that close relationship experiences may influence future emotion regulation and emotion regulation may relate to future symptomology.

In Study 3, I evaluated the influence of social support on cognitive reappraisal capacity using a reappraisal task in 121 undergraduate participants with elevated neuroticism. Results indicated that participants reported lower aversiveness, lower negative affect, and higher positive affect when they reinterpreted stressful images with a social support figure in mind compared to when they reinterpreted stressful images without that reminder. Results suggest that social support may enhance cognitive reappraisal and therefore may be a potential intervention target.

Together, the three papers of this dissertation underscore the value of attending to the interpersonal influence on emotion regulation and resulting depression and anxiety symptoms, in addition to the potential for intervention to impact these associations.

The dissertation of Allison Victoria Metts is approved.

Naomi I. Eisenberger

Anna S. Lau

Jennifer A. Silvers

Michelle Craske, Committee Chair

University of California, Los Angeles

2024

Dedication

To Elizabeth Metts, my sister and inspiration for pursuing clinical psychology, and Cole Ziegler, my husband and reappraisal assistant. Thank you for being model social support figures.

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List of Figures and Tables

Acknowledgements

This dissertation includes adaptations of three publications: Metts, A., Roy-Byrne, P., Stein, M. B., Sherbourne, C., D., Bystritsky, A., & Craske, M. G. (2024). Reciprocal and indirect effects among intervention, perceived social support, and anxiety sensitivity within a randomized controlled trial for anxiety disorders. *Behavior Therapy*; Metts, A., Zinbarg, R. E., Nusslock, R., Tabak, B. A., & Craske, M. G. (2024). Longitudinal Associations among adult attachment orientations, emotion regulation tendencies, and transdiagnostic anxiety and depression symptoms in young adults. *Journal of Social and Personal Relationships*; Metts, A. & Craske, M. G. (2023). Influence of social support on cognitive reappraisal in young adults elevated on neuroticism. *Behaviour Research and Therapy.* For the first two papers (Studies 1 and 2), pre-collected data was used from completed studies of which Michelle Craske was a co-principal investigator. For these publications, Allison Metts was responsible for devising the research questions, conducting data analyses, and completing manuscript write-up. Michelle Craske and co-authors provided critical feedback regarding the analytic approach and writing of the manuscript. For the third paper (Study 3), Allison Metts was the principal investigator and was responsible for study design, data collection, data analysis, and write-up. Michelle Craske provided critical feedback regarding design, implementation, and the writing of this manuscript. The research in this dissertation was supported by various funding sources. Study 1 was supported by the National Institute of Mental Health [grant numbers U01 MH070018 (Dr. Sherbourne), U01 MH058915 (Dr. Craske), U01 MH057835 (Dr. Stein), U01 MH057858 (Dr. Roy-Byrne), U01 MH070022 (Dr. Sullivan), K24 MH64122 (Dr. Stein), K24 MH065324 (Dr. Roy-Byrne)]. Study 2 was supported by a grant from the National Institute of Mental Health (NIMH) to Michelle G. Craske, Susan Bookheimer, Richard E. Zinbarg, and Robin Nusslock

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Vita

EDUCATION

2018 – 2019	University of California, Los Angeles (UCLA), Los Angeles, CA Master of Arts, Clinical Psychology; Minor in Quantitative Psychology
2011 – 2015	Princeton University, Princeton, NJ Bachelor of Arts, Psychology; Minor in Dance

HONORS, AWARDS, AND FELLOWSHIPS

2023	Senior Clinical Scientist Award, *UCLA*
2022 – 2023	Dissertation Year Fellowship, *UCLA*
2022	Charles Y. Nakamura Research, Teaching and Mentorship Award, *UCLA*
2019	Graduate Summer Research Mentorship Award, *UCLA*
2018 – 2019	Department of Psychology Fellowship, *UCLA*
2018	Alumni Association Award, *UCLA*
2015	Senior Thesis Prize in Clinical Psychology, *Princeton University*
2015	Magna Cum Laude, *Princeton University*
2015	Sigma Xi, Awarded membership, *Princeton University*

SELECTED PEER-REVIEWED PUBLICATIONS

Yarrington, J.S.[#], **Metts, A.[#]**, Wang, S., Cullen, B., Ruiz, J., Zinbarg, R.E., Nusslock, R., & Craske, M.G. (in press) Everyday discrimination and trajectories of transdiagnostic symptoms of depression and anxiety among young adults during the COVID-19 pandemic. *Stigma and Health*.

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General Introduction

Depression and anxiety are highly prevalent and disabling disorders, affecting at least 8.6% and 28.8% of adults worldwide, respectively (12-month prevalence; Kessler et al., 2012). These disorders are also major contributors to global disability (Baxter et al., 2014) and economic burden (Chisholm et al., 2016; Hendriks et al., 2015). Despite the prevalence and burden of depression and anxiety, the dominance of deficit-oriented models (i.e., problem-focused rather than strengths-focused) has yielded more knowledge on factors that contribute to—as opposed to prevent—their emergence or maintenance. Resilience—the maintenance or recovery of positive mental health following stressor exposure (Bonanno et al., 2011; Kalisch et al., 2017)—focuses on the idea that not all individuals develop negative mental health outcomes in response to stressor exposure. More attention to factors that contribute to resilience is needed given the utility of resilience models in informing prevention efforts and clinical interventions.

Relationships and Resilience

Interpersonal relationships are focal components of human resilience research (Luthar, 2006; Masten, 2014). Resilience is informed not only by factors and processes within individuals but also external factors, such as relationships that provide positive support (Sippel et al., 2015). Families provide emotional security, afford a sense of belonging, and mitigate stress (Masten & Cicchetti, 2016). Positive social interactions and friendships with peers are also fundamental throughout development, though less studied compared to family relationships in terms of resilience (Masten & Cicchetti, 2016). Whereas family and caregiver relationships are more salient in early development, relationships with friends and romantic partners become more important for resilience over time (Masten & Cicchetti, 2016). Social support – the perception or experience that one is cared for, valued, and part of a mutually beneficial social network (Taylor,

2011; Wills, 1991) – from such relationships has been shown to explain variation in mental health outcomes (e.g., Alegría et al., 2018; Sarason et al., 2001) and prospectively predict resilience (Carbonell et al., 2002; Karstoft et al., 2013; Van Harmelen et al., 2017). As such, further study of the influence of social support regarding depression and anxiety outcomes may advance prevention programs and interventions for these disorders.

Social Support

Forms and Measures

Social support can take different forms. Informational support refers to the provision of a better understanding of a stressful situation, such as assistance thinking through ways for the individual to best manage one's response to stress (Sippel et al., 2015; Taylor, 2011; Thoits, 2011). Emotional support involves the provision of warmth and comfort as well as communication that the individual is valued and cared for by others (Sippel et al., 2015; Taylor, 2011; Thoits, 2011). Support figures may also provide instrumental support (i.e., tangible assistance, material aid), such as services to help solve a practical problem, or companionate support (i.e., physical presence; Sherbourne & Stewart, 1991; Sippel et al., 2015; Taylor, 2011). Social support is measured as receiving such support (received social support) or solely the perception that these resources are available (perceived social support) (Taylor, 2011). Perceived social support has been found to exert stronger effects on health outcomes than the actual receipt of support (Thoits, 1995).

Associations with Depression and Anxiety

Research consistently demonstrates negative associations between depression and social support such that more social support reduces risk for depression, whereas less social support increases risk for depression (Auerbach et al., 2011; Colarossi & Eccles, 2003; Metts et al., 2021;

Metts et al., 2022). Social support is less studied in relation to anxiety but there is some evidence demonstrating social support curbs the emergence of anxiety (Bolger & Eckenrode, 1991; Metts et al., 2021; Metts et al., 2022; Reinelt et al., 2014; Zimmermann et al., 2020).

There is extensive work on psychosocial benefits (e.g., increased self-esteem, purpose, belonging) and biological benefits (e.g., neuroendocrine; immune; cardiovascular) of social support regarding mental health outcomes (Berkman et al., 2000; Taylor & Stanton, 2007; Thoits, 2011; Uchino et al., 2004; Uchino, 2006). There are two models that describe how social support may lead to health outcomes, though they differ regarding whether benefits of social support are universal regardless of stress exposure ('general benefits' model) or offer protection primarily from the negative effects of stress ('stress-buffering' model) (Cohen & Wills, 1985). These models are well-researched regarding depression and anxiety outcomes (e.g., Metts et al., 2021; Metts et al., 2022; Rueger et al., 2016).

Emotion Regulation

Emotion regulation is the process by which individuals control their emotional experience and expression by upregulating or downregulating the magnitude or duration of an emotional response to accomplish one's goals (Gross 1998; Thompson, 1994). The most influential emotion regulation models stemming from basic research are the process model and its extension (Gross, 1998; Gross, 2015b). According to these models, the emotion regulation cycle begins with identifying a difference between one's current and desired states (i.e., identification and need evaluation), which leads to selection and implementation of emotion regulation strategies (Lincoln et al., 2022; Sun et al., 2017). Emotion regulation strategies occur at different stages of the emotion generation cycle (Lincoln et al., 2022). For example, an individual may choose not to engage in an argument with a colleague (situation selection), come

to an understanding with a colleague to ease tension (situation modification), attend to a more amicable colleague (attentional redeployment), frame an argument as a way to voice an important viewpoint (cognitive change), or mask residual anger to resolve conflict (response modulation). Emotion regulation is monitored and regarded as successful in this model if it meets an individual's goal (Gross, 1998). An extended process model (EPM) (Gross, 2015b) defined emotion regulation in terms of valuation cycles that compared what a situation offers in relation to what an individual values, wants, or needs (Gross et al., 2019). Emotion regulation strategies have been classified across many dimensions, including adaptivity (adaptive vs. maladaptive), sociality (intrapersonal vs. interpersonal), and timing of use (antecedent-focused vs. response-focused) (Lincoln et al., 2022). In addition, emotion regulation can aim to alter one's own emotions (intrinsic) or someone else's (extrinsic) (Gross, 2015b).

Emotion regulation difficulties have been increasingly incorporated into models of psychopathology (Aldao et al., 2010; Campbell-Sills and Barlow, 2007; Lincoln et al., 2022; Mennin et al., 2007). In the view of the EPM, psychopathology results from dysregulation (i.e., lack of appropriate emotion regulation that would serve goals; enacting behavior counterproductive to goals) at different points in the emotion regulation process and different components of valuation cycles (Gross, 2015b; Gross et al., 2019). To address such emotion regulation difficulties, many emotion regulation strategies have been incorporated into clinical interventions (Lincoln et al., 2022). Of the strategies targeting thoughts, cognitive reappraisal—a cognitive change strategy in which individuals re-evaluate a stressful situation or their abilities to handle the situation in an attempt to modify emotional responses (Gross, 1998)—is amongst the most widely studied given that it lends itself well to experimental manipulation (Gross, 2002) and is a prominent technique in cognitive behavioral therapy (CBT) (Clark, 2013). Despite the

prevalence of cognitive reappraisal studies and the utility of cognitive reappraisal in CBT, effects of cognitive reappraisal on depression and anxiety outcomes are small-to-medium in strength (Aldao et al., 2010; Riepenhausen et al., 2022). In addition, most longitudinal research, albeit limited, fails to support prospective predictions of cognitive reappraisal upon depression and anxiety despite evidence that suggests accounting for stress exposure may contribute to more robust cognitive reappraisal effects on symptoms (Riepenhausen et al., 2022). As such, given the proposed benefits of cognitive reappraisal, and the prevalence of cognitive reappraisal techniques in cognitive interventions, more research examining factors that may enhance cognitive reappraisal effects on depression and anxiety outcomes is needed.

Model Tested by Dissertation

Social Support, Emotion Regulation, Depression and Anxiety

Mechanistic work on the stress-buffering effect of social support relating to depression and anxiety outcomes has considered the interpersonal influence on emotion regulation in the context of stressors. Given that stressors can weaken coping-style reappraisals (Cohen & McKay, 1984), individuals under stress often turn to others for assistance in coping (Zaki & Williams, 2013). This process is an example of interpersonal emotion regulation during which individuals pursue their emotional goals through social processes and by drawing on resources from their social support networks in live interactions (Williams et al., 2018; Zaki & Williams, 2013).

This line of work – in which emotion regulation is a proposed mechanism linking the influence of interpersonal relationships to lower stress-related psychopathology – serves as the foundation for this dissertation (Figure 1). The overarching model demonstrates how social support from interpersonal relationships (perceived or received) may positively influence responses to change one's own emotions to a stressful situation during the emotion regulation

cycle (intrapersonally or interpersonally), which may lead to less severe symptoms or prevention of stress-related psychopathology.

The studies of this dissertation test a more nuanced model (Figure 2) which draws primarily from research on social reappraisal, an interpersonal emotion regulation strategy during which others (e.g., social support figures) may facilitate reinterpretations of an emotionally evocative situation or a regulator's capacity to manage the situation in attempt to change emotions in line with the regulator's goals (Reeck et al., 2016). As such, social support may positively influence an individual's tendency to select and implement cognitive change in response to stressful situations that evoke negative emotions not in line with their goals and lessen the severity of depression and anxiety outcomes.

Relevance to Intervention for Depression and Anxiety

Individuals with depression and anxiety experience emotion regulation difficulties. There is evidence documenting widespread emotion regulation difficulties including ineffective modification of emotions, cognitive reappraisal impairment, reduced toleration of negative emotions, and greater negative reactivity to emotions in depression and anxiety (Berking et al., 2014; Marroquín, 2011). Separately, individuals with depression and anxiety are characterized by cognitive biases including self-focused cognition in depression as well as biased attention toward threat-related information and distorted risk judgments in anxiety (Craske & Pontillo, 2001; Mineka & Sutton, 1992). Given that cognitive biases and emotion regulation difficulties could affect reappraisal of stressors, social support figures may benefit individuals with or at risk for depression or anxiety by providing a different perspective to reduce the emotional impact of negative thinking (Wisco & Nolen-Hoeksema, 2010) or facilitate or implement a regulatory strategy (Reeck et al., 2016). As such, the influence of social support on emotion regulation may

reduce the risk for – or decrease the severity of – depression and anxiety by helping to offset the consequences of emotion regulation difficulties and biased thinking patterns in depression and anxiety. In addition, lines of research on the foundational model (Figure 1) could indicate that evidence-based treatment and prevention programs may target interpersonal influences to enhance emotion regulation or target emotion regulation difficulties to improve social support in service of more effectively treating or preventing stress-related psychopathology. Moreover, the more nuanced model tested by this dissertation (Figure 2) could implicate cognitive behavioral therapy techniques as a way to intervene on the effect of social support to influence reappraisal processes (e.g., enhance capacities to reappraise stressors), and vice versa, and result in improved outcomes.

Limitations to Address

This dissertation aimed to address notable limitations in the literature on social support, emotion regulation, and depression and anxiety in order to strengthen the field's understanding of the foundational and tested models (Figures 1 and 2). First, there is a dearth of research on anxiety compared to depression related to social support and emotion regulation. Given the high comorbidity of anxiety and depression (Kessler et al., 2015) – and the high prevalence and impairment of anxiety disorders (Olatunji et al., 2007; Remes et al., 2016) – more attention to anxiety related to social support and emotion regulation is necessary.

In addition, much of the extant work on social support and emotion regulation relating to depression and anxiety is cross-sectional. Cross-sectional research prevents directional and prospective claims that longitudinal research could afford. Separately, because of the difficult nature of random assignment in social support research (e.g., inability to assign individuals to high quality relationships), causality of proposed pathways of social support benefits is not easily

established. Therefore, experimental manipulation of social support is crucial to clarify social support's influence on reappraisal.

Existing research examining social support's influence on reappraisal also lacks clinical application. Specifically, little attention has been given to how social support may be incorporated into clinical interventions – independent of, or related to, emotion regulation – despite clear evidence linking social support to positive mental health outcomes. As such, research examining social support and emotion regulation within the context of treatment may improve our understanding of the utility of attending to social support in interventions. Separately, existing work on social support benefitting depression and anxiety restricts outcomes to diagnostic status or symptoms of each disorder, as opposed to distress that is shared by depression and anxiety. Research using transdiagnostic outcomes can yield information on interventions that could be relevant for both depression and anxiety, as opposed to specific to one class of disorders.

Overview of Studies

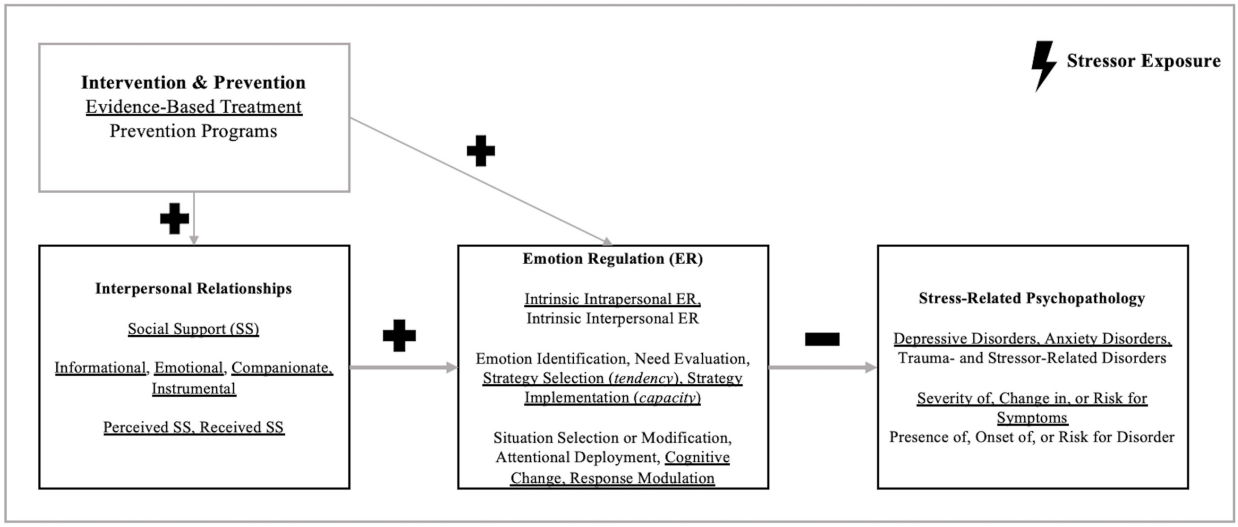
The overarching goals of this work were (1) to gain more specific knowledge about how social support may confer benefit to individuals regarding depression and anxiety outcomes through emotion regulation and (2) to address the notable limitations of existing research on this topic. I accomplished these goals through the aims of three studies, which were either longitudinal or experimental in nature. Of note, I operationalized the constructs of interest in a diverse manner across studies given data available for Studies 1 and 2 (Figure 2). Social support was operationalized as perceived social support (Study 1), adult attachment security in close relationships (Study 2), and the reminder of a social support figure (i.e., imagining received support) (Study 3). Emotion regulation was operationalized as reductions in misappraisals

regarding somatic symptoms of anxiety (i.e., anxiety sensitivity) (Study 1), cognitive reappraisal or expressive suppression tendencies (Study 2), and cognitive reappraisal capacity (Study 3). Depression and anxiety outcomes were operationalized as broad symptoms of depression and anxiety (Study 1), symptom distress shared by depression and anxiety (Study 2), and aversiveness and affect ratings (Study 3).

In Study 1, I aimed to investigate the hypothesis of perceived social support as a driver of change in misappraisals of anxiety-related sensations, and vice versa, following cognitive behavioral therapy for anxiety disorders. I examined reciprocal relationships between perceived social support and anxiety sensitivity as well as the indirect effects of intervention on these constructs. In Study 2, I tested how experiences in close adult relationships could influence emotion regulation. Specifically, I assessed whether adult attachment security influenced distress shared by depression and anxiety indirectly through tendencies to use emotion regulation strategies. In Study 3, I aimed to better understand the influence of social support on cognitive reappraisal in a novel emotion regulation paradigm. The paradigm was designed to examine aversiveness and affect outcomes following reappraisal of stressful images with and without a social support figure in mind.

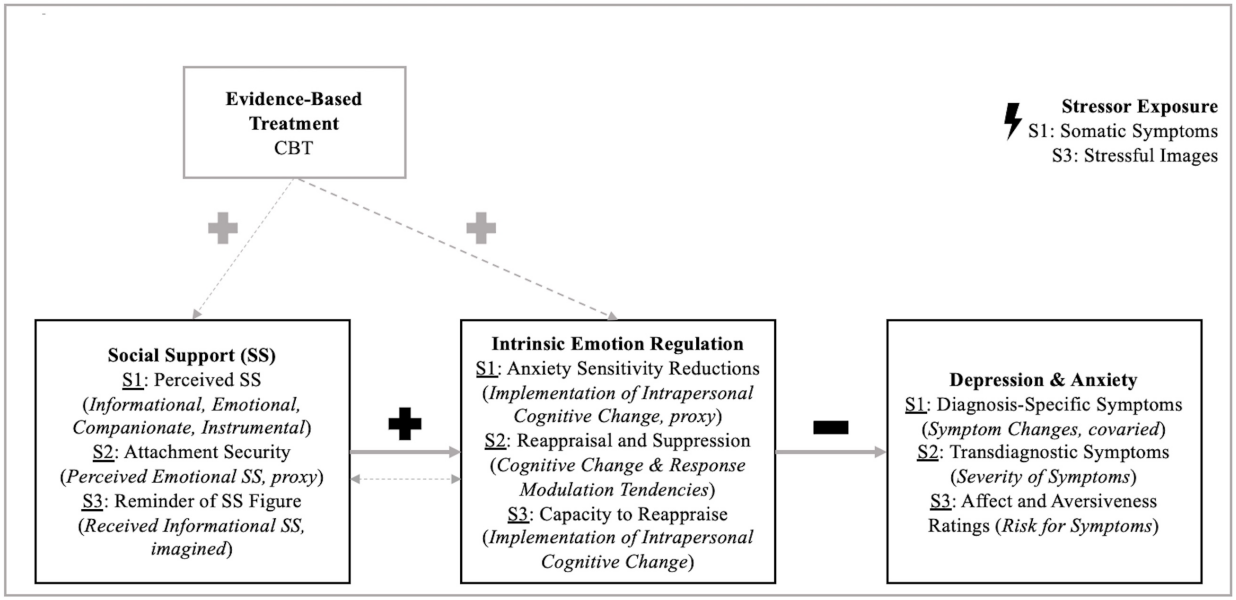
Through this series of studies, I aimed to contribute knowledge to ways in which we can enhance resilience in individuals through prevention efforts that account for the benefits of social support on emotion regulation and improve clinical interventions through increased attention to social support.

Figure 1. Model Serving as Foundation for Dissertation



Note. Underlined constructs are tested in this dissertation and specified in Figure 2.

Figure 2. Specific Model Tested by Dissertation



Note. Intervention paths and the bidirectional path between social support and emotion regulation are shown in gray because they are tested in Study 1 only and not a focus across studies. "S1" refers to Study 1. "S2" refers to Study 2. "S3" refers to Study 3.

Study 1: Reciprocal and Indirect Effects among Intervention, Perceived Social Support, and Anxiety Sensitivity within a Randomized Controlled Trial for Anxiety Disorders

Abstract

Social support may facilitate adaptive reappraisal of stressors, including somatic symptoms. Anxiety sensitivity refers to negative beliefs about somatic symptoms of anxiety, which may influence one's perception of social support. Evidence-based treatment may impact these associations. The current longitudinal study evaluated reciprocal relationships between perceived social support and anxiety sensitivity, and explored indirect intervention effects, in a randomized controlled trial for anxiety disorders that compared cognitive behavioral therapy with or without medications (CALM) to usual care. Data collected over 18 months from 961 primary care patients were examined in a series of random intercept cross-lagged panel models. There were significant reciprocal associations between perceived social support increases and anxiety sensitivity decreases over time. There were significant indirect effects from intervention to perceived social support increases through anxiety sensitivity decreases and from intervention to anxiety sensitivity decreases through social support increases. These data suggest that, relative to usual care, CALM led to changes in one construct, which led to subsequent changes in the other. Secondary analyses revealed an influence of anxiety and depressive symptoms on reciprocal associations and indirect effects. Findings suggest that future treatments could specifically address perceived social support to enhance reappraisal of somatic symptoms, and vice versa.

Introduction

Cognitive behavioral therapy (CBT) and pharmacotherapy effectively treat anxiety disorders (Bandelow et al., 2017; Norton & Price, 2007; Roy-Byrne & Cowley, 2007), but almost half of patients who receive these treatments fail to achieve full remission (Springer et al., 2018; Stein & Craske, 2017). Most prior work on treatment response has focused on how certain treatments lead to changes to symptomology. However, there is also value in examining associations among mechanisms affected by treatment, which can ultimately enhance treatment efficacy. Two constructs relevant to anxiety treatment are perceived social support and anxiety sensitivity (Birkeland et al., 2020; Price et al., 2018; Smits et al., 2008). The present secondary analysis aims to examine reciprocal associations between perceived social support and anxiety sensitivity within the context of a randomized controlled trial (RCT) for anxiety disorders, and whether cognitive behavioral therapy with pharmacological augmentation indirectly leads to change in anxiety sensitivity through perceived social support, or vice versa, to gain more knowledge about mechanistic change in treatment.

Social Support

Perceived social support refers to global impressions of the availability of support for assisting with responses to challenges (i.e., informational support), providing warmth or comfort (i.e., emotional support), providing tangible assistance (i.e., instrumental support), and making oneself available for companionship (i.e., companionate support) (Thoits, 2011). Higher social support has been linked to reduced risk for depression and anxiety (Auerbach et al., 2011; Metts et al., 2021; Zimmermann et al., 2020) and more positive treatment outcomes for depression and anxiety (Bosworth et al., 2008; Jakubovski & Bloch, 2016; Oxman & Hull, 2001; Saghafi et al., 2007; Sherbourne et al., 2004). Separately, perceived social support has been found to increase

with cognitive behavioral therapy (CBT) in trauma-exposed youth (Birkeland et al., 2020) and prolonged exposure in veterans (Price et al., 2018), serving as evidence of malleability of perceived social support in evidence-based behavioral treatments.

Anxiety Sensitivity

Anxiety sensitivity refers to beliefs that anxiety-related sensations are harmful (Reiss et al., 1986) by leading to physical harm, social embarrassment, or mental incapacitation (Smits et al., 2008). These negative reappraisals of somatic symptoms are implicated in the etiology and maintenance of anxiety and mood disorders (Schmidt et al., 2006). Meta-analytic research has shown that CBT effectively reduces anxiety sensitivity (Smits et al., 2008). Moreover, anxiety sensitivity has been demonstrated to mediate the effects of CBT (Asnaani et al., 2020; Meuret et al., 2010). As such, anxiety sensitivity may both be changed and lead to change within evidence-based treatment for anxiety disorders.

Theory Linking Social Support and Anxiety Sensitivity

Recent efforts have moved beyond psychosocial pathways through which social support confers benefits to examine other mechanisms of social support. One such line of mechanistic work focuses on reappraisal assistance. Stressors can weaken coping-style reappraisals (Cohen & McKay, 1984) and individuals under stress often turn to others for assistance in coping (Zaki & Williams, 2013). During such 'interpersonal emotion regulation,' others may facilitate reappraisal of a situation or one's capacity to manage the situation. Consequently, higher levels of social support are posited to strengthen coping reappraisals of stressful situations relative to lower levels of social support.

In the case of anxiety disorders, negative appraisals of somatic symptoms (i.e., anxiety sensitivity) render somatic symptoms a source of stress. As such, the current study extends prior

work on interpersonal emotion regulation to stressors in the form of somatic symptoms. Specifically, anxious individuals with stronger social support may become less stressed by their somatic sensations than anxious individuals without such social support because support figures facilitate adaptive reappraisal of their somatic sensations. For example, social support figures could provide cognitive support, such as lending more helpful ways to think about symptoms, or assist with attention reallocation and help individuals shift their attention to more positive or neutral stimuli (Marroquín, 2011). Notably, adaptive reappraisal assistance contrasts with maladaptive interpersonal emotion regulation wherein social support contributes to anxiety and depression, such as 'partner accommodation' when partners alter their behaviors to prevent or decrease distress in ways that inadvertently reinforce anxiety or avoidance (Baucom et al., 2019; Hofmann, 2014). Adaptive reappraisal is measurable through reductions in anxiety sensitivity.

There are several reasons to believe that anxiety sensitivity in turn impacts perceived social support. Anxiety sensitivity includes fear of social evaluative consequences from somatic symptoms (Smits et al., 2008), and extends to sensitivity to negative evaluation in social interactions (Casale et al., 2014). There is limited evidence for negative correlations between fear of negative evaluation and perceived social support (Casale et al., 2014). Therefore, individuals with high anxiety sensitivity, who appraise their sensations as harmful, may be more likely to interpret their social interactions as less supported. Conversely, individuals with low anxiety sensitivity, who do not view their sensations as harmful, may perceive their social interactions as more supportive. In line with this proposed relationship, there is some evidence, albeit limited, for negative correlations between perceived social support and anxiety sensitivity (Latifi et al., 2019; Latifi & Kiani, 2021; Molero Jurado et al., 2021).

Potential Impact of Treatment upon Anxiety Sensitivity and Perceived Support

Reappraisal skills are central to cognitive restructuring and behavioral hypothesis testing exercises within CBT (Clark & Beck, 2010), including CBT for anxious beliefs that somatic symptoms are harmful (i.e., anxiety sensitivity) (Smits et al., 2008). Given that (1) CBT has been found to increase social support, even when not directly targeted (Birkeland et al., 2020; Price et al., 2018), (2) social support can facilitate reappraisal of stressful situations (Zaki & Williams, 2013), and (3) anxiety sensitivity functions as appraisal of a somatic-related stressor, then CBT may lead to decreases in anxiety sensitivity indirectly through the effects of social support. Alternatively, given that (1) reappraisal of anxiety-related sensations is central to CBT which in turn effectively reduces anxiety sensitivity (Smits et al., 2008), (2) anxiety sensitivity includes fears of negative evaluation and extends to more general social evaluative concerns (Casale et al., 2014), and (3) fears of negative evaluation influence perceived social support (Casale et al., 2014), then CBT may lead to increases in perceived social support indirectly through the effects of reducing anxiety sensitivity.

The Present Study

The current study seeks to examine the reciprocal relationships between perceived social support and anxiety sensitivity throughout treatment for anxiety disorders. We extend prior work on social support in relation to life stressors by testing the relationship between perceived social support and appraisals of anxiety symptoms. Additionally, we explore whether changes in anxiety sensitivity lead to subsequent changes in perceived social support. Further, we examine whether CBT combined with pharmacological augmentation leads to changes in anxiety sensitivity or perceived social support indirectly through the other construct. Our examination of two potential treatment mechanisms simultaneously can lead to more informed and targeted approaches for interventions. Specifically, from this approach we examine dynamic relationships

among constructs affected by treatment, and how one specific intervention may lead to changes in another construct not directly targeted by the intervention. These questions were addressed in a secondary analysis of 961 primary care patients with anxiety disorders who were randomized to CBT with or without pharmacotherapy (Coordinated Anxiety Learning and Management; CALM) or usual care (UC) for anxiety disorder treatment (Roy-Byrne et al., 2010).

Prior published findings demonstrate greater effects from CALM upon 12- and 18-month anxiety and depression symptoms compared to UC (Craske et al., 2011; Roy-Byrne et al., 2010). One study previously examined perceived social support as a mediator of anxiety and depression symptom change using path analysis in this sample (Dour et al., 2014). Results indicated that perceived social support mediated depression and anxiety symptom change over 18 months, with effects being stronger in CALM compared to UC. However, this analytic approach did not decompose within- and between-person variance, making it unclear whether observed associations were due to stable, between-person differences or dynamic, within-person changes. Within-person changes are particularly important to consider when examining whether intervention produces changes over time beyond influencing average construct levels. The present study builds upon prior work by examining whether within-person changes in anxiety sensitivity relate to within-person changes in perceived social support, and by examining whether these within-person associations are influenced by the CALM intervention.

Our primary hypothesis was that perceived social support changes would negatively predict subsequent anxiety sensitivity changes over an 18-month period, and that CALM (compared to UC) would have indirect effects on decreases in anxiety sensitivity through perceived social support. Our secondary hypothesis was that anxiety sensitivity changes would negatively predict subsequent perceived social support changes over an 18-month period, and

that CALM (compared to UC) would have indirect effects on increases in perceived social support through anxiety sensitivity. As a secondary analysis, we explored whether reciprocal associations and indirect effects of CALM on perceived social support increases and anxiety sensitivity decreases would remain when accounting for symptoms of anxiety and depression.

Method

Participants

Participants were 961 adults with diagnoses of panic disorder, generalized anxiety, social anxiety, or posttraumatic stress disorder (Craske et al., 2011; Roy-Byrne et al., 2010). They were referred by primary care physicians, clinic nursing staff, and providers, recruited via advertisements and distribution of promotional materials, or found via brief screenings available over a two-year period with providers in 17 clinics, across four sites: Little Rock, Los Angeles, San Diego, and Seattle. Eligibility criteria were between age of 18-75 years, met diagnostic criteria for at least one of the aforementioned anxiety disorders, and scored $\geq$ 8 on the Overall Anxiety Severity and Impairment Scale (OASIS) (Norman et al., 2006). Exclusion criteria were ongoing CBT or psychotropic medication, limited fluency in English or Spanish, unstable medical conditions, marked cognitive impairment, active suicidal ideation (intent or plan), psychosis, bipolar I disorder, or substance abuse/dependence other than alcohol or marijuana abuse. See full details in the primary outcomes paper for this randomized clinical trial (RCT) (Roy-Byrne et al., 2010).

Sixteen hundred and twenty individuals consented to be screened for eligibility, of whom 1,062 met criteria and 1,036 gave written informed consent. Because of communication difficulties and dropout, only 1,004 of those individuals were randomized. Given our hypotheses pertaining to the effects of CBT compared to usual care, 43 patients in the CALM arm who

received medication only were excluded from analyses. The resulting sample was 961 patients (CALM n = 460; UC n = 501). Participants were 56.8% White and 71.3% female with an average age of 43.46 (SD = 13.50) years. Participants presented with a variety of anxiety disorder diagnoses (many of which were comorbid), including 74.8% with generalized anxiety disorder, 47.7% with panic disorder, 39.9% with social anxiety disorder, and 18.1% with post-traumatic stress disorder. There was also substantial mood disorder comorbidity in the sample, with 63.8% meeting criteria for major depressive disorder. The majority had received at least 12 years of education and had private insurance. The CALM intervention and usual care groups did not differ in age, gender, race, education, insurance status, or diagnosis (ps $\geq$ .14). All participants provided written informed consent prior to intervention and assessment onset.

Design

Data were collected within the context of an RCT comparing two treatments (CALM and UC) delivered in a primary care setting. Study procedures complied with all participating institutional review boards. Participants who were referred to the study underwent eligibility screening conducted by specially trained clinicians and anxiety clinical specialists (ACS). ACSs were master-level or recent doctoral-level individuals who had little to no prior CBT experience prior to their roles as behavioral health specialists (Roy-Byrne et al., 2005). After screening, participants were randomized to CALM or UC. Randomization was conducted using an automatic computer program at RAND and stratified by clinic and by presentation of major depressive disorder comorbidity (Roy-Byrne et al., 2010). Participants were assessed at four timepoints, 6-months apart.

CALM

In CALM, participants received CBT or CBT and medication management for up to 12 months, although the average number of CBT sessions was 7.47 (*SD* = 3.60, range: 1-21). The resulting distribution of treatments was: 34% CBT only, 9% medication management only (excluded from the present study), and 57% CBT and medication management (Roy-Byrne et al., 2010). CBT consisted of the following modules: (1) self-monitoring, (2) psychoeducation, (3) fear hierarchy, (4) breathing retraining, (6) cognitive restructuring, (7) exposure and (8) relapse prevention. Some modules were tailored to the most distressing and disabling anxiety disorder (e.g., exposure) and some were generic (e.g., breathing retraining). The ACSs guided participants through CBT with the aid of a computer program and implemented motivational interviewing for engagement or additional cognitive restructuring and behavioral activation for depressed mood when necessary (Craske et al., 2009). PCPs, within whom ACSs had regular contact, prescribed medication, with study psychiatrists providing consultation as deemed appropriate. Initial use of selective serotonin reuptake inhibitors or serotonin and norepinephrine reuptake inhibitors was emphasized. If the patient presented with minimal or no improvement, another antidepressant was prescribed in addition to or instead of the originally prescribed medication in most cases. ACSs provided medication adherence monitoring and counseling in avoidance of caffeine or alcohol, sleep hygiene, and behavioral activities by phone or in person.

Usual Care

PCPs provided the usual care that would be given to patients with anxiety disorders. This practice included no intervention, medication, counseling, or referral to a mental health specialist.

Measures

All measures were completed at baseline (Time 1), and 6 months (Time 2), 12 months (Time 3), and 18 months (Time 4) during telephone assessments conducted by interviewers at the RAND Corporation who were blind to treatment condition and timing of assessment.

Perceived Social Support

The MOS social support survey (Sherbourne & Stewart, 1991) was used to assess perceived social support. This 4-item self-report measure assesses how often each kind of support—companionate, instrumental, informational, emotional—is available to participants if support is needed. Items are rated on a 5-point Likert scale ranging from 1 (*none of the time*) to 5 (*all of the time*). The original version was developed to be easily administered to medical care patients. The abbreviated version demonstrates good fit with the original version and good psychometric properties (Gjesfjeld et al., 2008). Of note, the measure used in the present study uses the item "someone to get together with for relaxation" whereas the original version (Gjesfjeld et al., 2008) instead used the item "someone to do something enjoyable with." High interitem reliability was observed in our sample at baseline ($\alpha = .80$).

Anxiety Sensitivity

Anxiety sensitivity was assessed using the Anxiety Sensitivity Index (ASI) (Reiss et al., 1986). The ASI is a 16-item[1] self-report measure that assesses threatening beliefs regarding the social, mental, and physical consequences of anxiety symptoms (Reiss & McNally, 1985). Items are rated on a 5-point Likert scale ranging from 0 (*very little*) to 4 (*very much*). Examples of cognitive symptoms on this measure include fears of feeling nervous and feeling faint. The ASI

[1] Subsequent versions of the ASI have more items (i.e., the ASI-R contains 36 items and the ASI-3 contains 18 items).

has demonstrated good reliability (Peterson & Heilbronner, 1987). High interitem reliability was observed in our sample at baseline (α = .88).

Anxiety Symptoms

The Brief Symptom Index (BSI-18) was used to assess anxiety symptoms (Derogatis, 1993). The BSI-18 is a self-report measure that assesses psychological symptoms, such as restlessness and spells of panic (Derogatis, 1993). The current study used 12 items comprising the anxiety and somatic subscales but excluded the depression subscale. Items are rated on a 5-point Likert scale ranging from 0 (*not at all*) to 4 (*extremely*). This measure has demonstrated good psychometric properties (Meijer et al., 2011) and good test-retest reliability (Derogatis, 1993). High interitem reliability was observed in our sample at baseline (α = .87).

Depression Symptoms

Depression symptoms were assessed using the Patient Health Questionnaire (PHQ-8) (Kroenke et al., 2001). The PHQ-8 is an 8-item self-report scale assesses depressive symptom severity on a 4-point Likert scale ranging from 0 (*not at all*) to 3 (*nearly every day*). The suicidality item was excluded from the current analyses. The PHQ-8 demonstrated high validity in a primary care setting (Kroenke et al., 2007) with excellent test-retest reliability (Löwe et al., 2004). High interitem reliability was observed in our sample at baseline (α = .85).

Data Analysis

We tested cross-lagged paths between perceived social support and anxiety sensitivity as well as indirect paths of intervention on these constructs as part of a single random-intercept cross-lagged panel model (RI-CLPM) (Hamaker et al., 2015). This approach decomposes longitudinal panel data into stable, between-person differences and dynamic, within-person

differences, which controls for reverse causality and for between- and within- third variable confounds.

The primary RI-CLPM of interest is shown in Figure 1. All analyses included intervention (CALM = 1, UC = 0) as a between-level predictor, perceived social support (stable between-person levels; dynamic, within-person differences), and anxiety sensitivity (stable between-person levels; dynamic, within-person differences). In our model, variances of observed variables were constrained to zero, allowing all variance to be captured by the within-person and between-person latent factors. Trait-like, between-person differences in perceived social support and anxiety sensitivity were captured by random intercepts, which were created by loading observed variables at all four timepoints onto the latent factor. These loadings were constrained to one. Each latent factor was regressed onto age, gender, and ethnicity to account for these demographic differences at the between-person level. Correlations among between-person parameters (i.e., random intercepts) were estimated to examine between-person associations among constructs.

To model within-person change in social support and anxiety sensitivity, each observed construct was loaded onto its own latent factor. These loading factors were also constrained to one. These latent factors were used to model within-time correlations across domains, autoregressive stability over time, and cross-lagged paths. Autoregressive stability paths were modeled for perceived social support at Time T to Time T + 1 and Time T + 2 as well as anxiety sensitivity at Time T to Time T + 1 and Time T + 2. Direct cross-lagged paths from (a) perceived social support at Time T to anxiety sensitivity at Time T + 1 as well as Time T + 2 and (b) anxiety sensitivity at Time T to perceived social support at Time T + 1 as well as Time T + 2. Autoregressive and direct cross-lagged paths from Time T to Time T + 2 in were added to

improve model fit and account for additional meaningful variance that was not yet captured in the model. Direct effects of intervention on within-person changes in social support and anxiety sensitivity were also modeled.

Analyses were conducted using Mplus Version 8 (Muthén & Muthén, 1998-2017). Full information maximum likelihood, which uses unbiased estimates when data is both missing completely at random and missing at random (Enders & Bandalos, 2001), was used to address missing data (0% at baseline, 12.2% at 6 months, 18.4% at 12 months, 19.5% at 18 months). Fit indices were examined to assess overall fit of the model according to established cutoffs for RMSEA ($\leq .06$), CFI ($\geq .95$), and SRMR ($\leq .08$) (Hooper et al., 2008) as well as χ^2 values and their degrees of freedom and *p*-values, with nonsignificant values indicating good fit. The level of statistical significance was $p < .05$ for cross-lagged paths (two-tailed). The indirect effects of intervention on perceived social support at time T + 2 and anxiety sensitivity at time T + 2 were calculated using the MODEL INDIRECT command in Mplus. The indirect paths of interest were (1) intervention to Time 2 perceived social support to Time 3 perceived social support to Time 4 anxiety sensitivity, (2) intervention to Time 2 perceived social support to Time 3 anxiety sensitivity to Time 4 anxiety sensitivity, (3) intervention to Time 2 anxiety sensitivity to Time 3 anxiety sensitivity to Time 4 perceived social support and (4) intervention to Time 2 anxiety sensitivity to Time 3 perceived social support to Time 4 perceived social support. The bootstrapped method (1,000 iterations) was employed (Cheung & Lau, 2008).

For our secondary analysis, we included symptoms of anxiety and of depression in a single model to examine whether reciprocal and indirect associations held when accounting for

symptomology.[2] This analysis used the primary analysis model as the base and added a random intercept and modeled within-person changes for a composite score of anxiety and depression symptoms. Intervention effects on symptoms, autoregressive stability paths within symptoms, and cross-lagged paths including symptoms were accounted for in the model.

Results

Descriptive Statistics

Descriptive statistics by condition and bivariate correlations for the full sample are displayed in Table 1. Social support was significantly higher in CALM than UC at 6-month follow-up, 12-month follow-up, and 18-month follow-up (all *p*s < .007), but there were no significant differences in social support levels at baseline ($p = .73$). Anxiety sensitivity, anxiety symptoms, and depression symptoms were significantly lower in CALM than UC at 6-month follow-up, 12-month follow-up, and 18-month follow-up (all *p*s < .001), but there were no significant differences in these constructs at baseline (all *p*s > .68). Perceived social support demonstrated significant weak negative correlations with anxiety sensitivity as well as significant weak to moderate correlations with anxiety symptoms and depression symptoms across timepoints. Anxiety sensitivity demonstrated significant strong positive correlations with anxiety symptoms and depression symptoms across timepoints.

Model Fit

Model fit for the focal RI-CLPM was good ($\chi^2(24) = 27.76$, $p = .27$; RMSEA = .01; CFI > .99; SRMR = .01). Model fit for the secondary analysis model was also good ($\chi^2(36) = 38.09$, $p = .37$; RMSEA = .01; CFI = 1.00; SRMR = .01).

[2] We did not examine social anxiety symptoms as a covariate because it was not a main outcome in the CALM trial and only collected for a subsample of participants.

Within-Person Cross-Lagged Effects

Table 2 reports statistics for paths estimated in the primary model. Results supported some reciprocal within-person relations between perceived social support and anxiety sensitivity. Specifically, the direct paths from perceived social support increases at Time 1 to anxiety sensitivity decreases at Time 2 and Time 3 were significant. In addition, the direct path from perceived social support increases at Time 2 to anxiety sensitivity decreases at Time 3 was significant. There was also evidence of anxiety sensitivity decreases predicting perceived social support increases across time. Specifically, the direct path from anxiety sensitivity decreases at Time 2 to perceived social support increases at Time 3 as well as anxiety sensitivity decreases at Time 3 to perceived social support increases at Time 4 were significant.

Intervention to Within-Person Indirect Effects

Of the two indirect pathways of interest from intervention to anxiety sensitivity decreases at Time 4, one was significant. The significant indirect effect was from intervention to Time 2 perceived social support increases, to Time 3 anxiety sensitivity decreases, to Time 4 anxiety sensitivity decreases. This indirect effect indicates that, relative to UC, the CALM intervention led to increases in perceived social support, that in turn led to subsequent decreases in anxiety sensitivity. Of the two indirect pathways of interest from intervention to perceived social support increases at Time 4, one was significant. The significant indirect effect was from intervention to Time 2 anxiety sensitivity decreases, to Time 3 anxiety sensitivity decreases, to Time 4 perceived social support increases. This indirect effect indicates that, relative to UC, the CALM intervention led to decreases in anxiety sensitivity, that in turn led to subsequent increases in perceived social support.

Ratio Effects

Ratios of the specific indirect effects over the total effect of intervention to the 18-month outcome of interest were calculated to provide an estimate of the percentage of total effect of intervention accounted for by indirect effects of interest. The significant indirect effect of intervention to Time 2 perceived social support increases, to Time 3 anxiety sensitivity decreases, to Time 4 anxiety sensitivity decreases accounted for 5.95% of the effect of intervention on anxiety sensitivity. The significant indirect effect of from intervention to Time 2 anxiety sensitivity decreases, to Time 3 anxiety sensitivity decreases, to Time 4 perceived social support increases accounted for 20.09% of the effect of intervention on perceived social support.

Secondary Analysis

Results from the analysis that included anxiety and depression symptoms in the primary model are reported in Table 3. Some reciprocal associations remained significant and were unaffected substantially in magnitude. However, the paths from Time 1 perceived social support increases to Time 2 anxiety sensitivity decreases (effect reduced by 4.44%) and Time 2 anxiety sensitivity decreases to Time 3 perceived social support increases (magnitude of effect unchanged) reduced to nonsignificance. In addition, the indirect effect of intervention on Time 4 anxiety sensitivity changes remained significant (b = -.18, p = .046), but reduced in magnitude by 25%. The effect of intervention on Time 4 changes in perceived social support reduced to nonsignificance (b = .03, p = .057) and reduced in magnitude by 40%.

Discussion

In this study, we examined reciprocal associations between changes in perceived social support and changes in anxiety sensitivity, as well as indirect effects of intervention on such changes, within the context of a randomized controlled trial for anxiety disorders over 18 months. Within-person results provided some evidence of bidirectional relationships between

increases in perceived social support and decreases in anxiety sensitivity over time. Significant indirect effects suggest that increases in perceived social support mediate subsequent anxiety sensitivity decreases, and that decreases in anxiety sensitivity mediate increases in subsequent perceived social support, following baseline of evidence-based treatment for anxiety. These effects were not the result of time alone or following any treatment given that these effects were stronger in CALM compared to usual care. Secondary analysis results also suggest that reciprocal associations between perceived social support and anxiety sensitivity, as well as the indirect effect on anxiety sensitivity decreases through perceived social support increases, seem to be explained in part by anxiety and depression symptoms.

Within-person reciprocal effects suggest that changes in these variables, over and above average levels, are significantly associated with one another. These associations are in line with previous research demonstrating significant negative correlations among perceived social support and anxiety sensitivity (Latifi & Kiani, 2021; Latifi et al., 2019; Molero Jurado et al., 2021). However, we add to existing work by demonstrating predictive associations at the within-person level over time. Further, these results are consistent with the idea that perceived social support enhances adaptive reappraisal of symptoms, resulting in decreased anxiety sensitivity. This finding aligns with the notion of interpersonal emotion regulation (Zaki & Williams, 2013) whereby social support may offer assistance with the reappraisal of stressors. Our results extend previous work by applying this framework to stressors of anxiety-related symptoms. Reciprocal association results also support the idea that a decrease in harmful appraisals of anxiety-related sensations may result in more positive perceptions of social support. Future work specifically testing the impact of perceived social support on anxiety sensitivity, and vice versa, is needed to lend more confidence to support these theories.

The indirect effect from intervention at the between-person level to within-person anxiety sensitivity decreases at 18 months suggest that within-person increases in perceived social support throughout the CALM intervention may contribute to anxiety sensitivity reduction. Our results demonstrate that CBT with or without pharmacotherapy strengthens the impact of perceived social support upon reappraisal as measured by decreases in anxiety sensitivity. These results add to previous work demonstrating perceived social support as a mediator of symptom outcomes from CALM between-person in this sample (Dour et al., 2014) and suggest that perceived social support has a positive benefit on not only symptoms, but also target processes (i.e., beliefs about anxiety symptoms) within CBT.

The indirect effect from intervention to perceived social support increases at 18 months suggests that decreases in anxiety sensitivity might lead to subsequent increases in perceived social support, indicating that anxiety sensitivity may function as a mediator of improvement in perceived social support following CBT with or without pharmacotherapy for anxiety disorders. Interestingly, the magnitude of the indirect effect of intervention on social support increases (20.09%) seems to be more robust than that on anxiety sensitivity through social support (5.95%), suggesting some specificity in terms of directionality and potency of effects. Previous work has demonstrated that anxiety sensitivity is implicated in the etiology and maintenance of anxiety disorders (Schmidt et al., 2006) and predicts treatment outcomes (Blakey et al., 2017). These results extend previous work by demonstrating that anxiety sensitivity impacts perceived social support, a factor which appears to have a broad positive impact on psychopathology and treatment response (e.g., Auerbach et al., 2011; Metts et al., 2021; Zimmermann et al., 2020).

Secondary analysis results suggest that reciprocal effects between perceived social support and anxiety sensitivity as well as indirect effects of intervention were influenced by

depression symptoms and anxiety symptoms, indicating a role of psychological distress in these associations. Specifically, intervention effects on reduced anxiety sensitivity and increased perceived social support seem to be in part due to reduced depression and anxiety symptoms. The influence of symptoms on reciprocal associations was less robust compared to symptom influence on indirect effects of intervention. In addition, the influence of symptoms on the indirect effect of intervention on perceived social support appears stronger than that on the indirect effect of intervention on anxiety sensitivity. In line with this influence of symptoms on the effect of intervention on perceived social support, previous research in this sample has demonstrated how higher perceived social support over time are associated with lower depression and anxiety following evidence-based intervention (Dour et al., 2014). Nevertheless, our results suggest that there is still some variance to be explained in reciprocal associations and indirect effects of intervention apart from that shared with depression and anxiety symptoms.

The current findings are consistent with prior evidence for CBT to lead to increases in social support (Birkeland et al., 2020; Price et al., 2018) and decreases in anxiety sensitivity (Asnaani et al., 2020; Meuret et al., 2010; Smits et al., 2008). This is the first study to demonstrate that perceived social support may increase through changes in anxiety sensitivity and, conversely, that anxiety sensitivity may decrease through changes in perceived social support. Most prior studies have examined social support independent of anxiety sensitivity (Cowan et al., 2008; Dour et al., 2014).

Treatment implications from the present findings include specifically targeting social support in cognitive and behavioral intervention strategies in order to bolster reappraisal of anxiety-related sensations. Strategies could include thorough assessment of social support, psychoeducation on the utility of social support for reappraising harmful beliefs about

symptoms, challenging perceptions of social support through cognitive restructuring (i.e., looking for evidence to come to more realistic conclusions about support availability), and environmental changes to increase access to adequate support. Findings also speak to the potential value of including a support person in therapy for reappraisal assistance. Studies have explored involving partners in anxiety treatment previously to address partner accommodation (Cerny et al., 1987; Craske et al., 1989). Future RCTs specifically testing these interventions targeting social support and anxiety sensitivity are needed to test the proposed benefits on these constructs.

Despite notable strengths, including a large outpatient sample, examining changes in constructs over time, and examining between- and within-person reciprocal and indirect effects, the present study is not without limitations. First, our measure of social support was rudimentary and therefore may not capture the complexity of social support (i.e., indicators of felt closeness, network size, and availability of support). In addition, our measure was subjective and assesses one's perception of social support. Perceived social support is distinct from enacted social support (Cohen et al., 2000). Future work should include more comprehensive and objective measures of social support, such as an interview conducted by an independent rater that assesses multiple support indicators within interpersonal relationships (Hammen et al., 1987). In addition, mechanisms that may account for the observed associations in this study, including adaptive reappraisal, are not directly measured. Further, study results may be limited in terms of generalizability as the sample did not include patients with current suicidality, bipolar disorder, psychosis, and substance abuse or dependence. Anxiety sensitivity has also been found to associate positively with suicidal ideation and suicide risk (Stanley et al., 2018). As such, our exclusion of patients with active suicidal ideation is a limitation and the strength of effects of

anxiety sensitivity may have been impacted by our exclusion of patients with active suicidal ideation.

Conclusions

The present study found reciprocal effects between perceived social support increases and anxiety sensitivity decreases as well as indirect effects of intervention on these constructs over time in patients who underwent evidence-based treatment for anxiety disorders. The results suggest that cognitive behavioral therapy for anxiety may be enhanced by increasing social support over treatment to strengthen adaptive reappraisals and coping with anxiety-related symptoms and that perceptions of support may increase after evidence-based treatment because of improved appraisals of somatic symptoms.

Table 1. Bivariate correlations among study variables and descriptive statistics by timepoint

	Full Sample				CALM		Usual Care	
Measure	1	2	3	4	*M*	*SD*	*M*	*SD*
Baseline (*N* = 961)								
Social Support	--				3.16	1.05	3.19	1.08
Anxiety Sensitivity	-.13*	--			29.52	13.69	29.89	13.89
Anxiety	-.14*	.64*	--		16.30	8.97	12.43	6.27
Depression	-.24*	.48*	.58*	--	12.43	6.27	12.47	5.86
6-Month Follow-Up (*N* = 844)								
Social Support	--				3.53	1.06	3.33	1.08
Anxiety Sensitivity	-.27*	--			19.15	13.20	23.70	14.60
Anxiety	-.33*	.66*	--		8.80	8.16	11.53	8.54
Depression	-.36*	.59*	.72*	--	7.28	5.98	9.01	6.21
12-Month Follow-Up (*N* = 784)								
Social Support	--				3.65	1.03	3.40	1.08
Anxiety Sensitivity	-.25*	--			16.48	13.18	22.00	14.27
Anxiety	-.28*	.66*	--		7.79	7.86	10.69	8.55
Depression	-.33*	.58*	.72*	--	6.38	5.99	8.77	6.38
18-Month Follow Up (*N* = 774)								
Social Support	--				3.64	1.09	3.42	1.10
Anxiety Sensitivity	-.25*	--			15.94	12.87	20.00	14.21
Anxiety	-.32*	.65*	--		7.66	8.18	9.69	8.23
Depression	-.34*	.56*	.72*	--	6.09	5.75	7.82	6.07

Note. * $p < .001$

Table 2. Focal RI-CLPM Results

Parameter	*b*	Beta	*SE*	*b/SE*	*p*	95% CI	Ratios
Cross-Lagged Effects							
$SS_1 \rightarrow AS_2$	-2.48	-.16	1.21	-2.06	.04	-4.85, -.12	--
$SS_1 \rightarrow AS_3$	-2.48	-.17	.76	-3.27	.00	-3.97, -.99	--
$AS_1 \rightarrow SS_2$	-.01	-.13	.01	-1.88	.06	-.02, .00	--
$AS_1 \rightarrow SS_3$	-.00	-.02	.00	-.30	.77	-.01, .01	--
$SS_2 \rightarrow AS_3$	-2.74	-.20	.83	-3.29	.00	-4.36, -1.11	--
$SS_2 \rightarrow AS_4$	-.48	-.04	.61	-.79	.43	-1.68, .72	--
$AS_2 \rightarrow SS_3$	-.01	-.19	.01	-2.47	.01	-.02, -.00	--
$AS_2 \rightarrow SS_4$	-.00	-.04	.01	-.49	.63	.23, .45	--
$SS_3 \rightarrow AS_4$	.27	.10	.56	.48	.63	-.83, 1.37	--
$AS_3 \rightarrow SS_4$	-.02	-.32	.01	-3.98	.00	-.04, -.01	--
Intervention Effects							
Int $\rightarrow SS_2$	.23	.14	.06	3.96	.00	.11, .34	--
Int $\rightarrow SS_3$	.14	.09	.06	2.24	.03	.02, .25	--
Int $\rightarrow SS_4$	.06	.04	.07	.80	.42	-.09, .20	--
Int$\rightarrow AS_2$	-4.53	-.20	.76	-5.95	.00	-6.02, -3.04	--
Int $\rightarrow AS_3$	-2.64	-.12	.75	-3.52	.00	-4.12, -1.17	--
Int $\rightarrow AS_4$	-.41	-.02	.69	-.59	.55	-1.75, .94	--
Between Person Effect							
RI_SS with RI_AS	-.34	-.05	1.11	-.31	.76	-2.51, 1.83	--
Specific Indirect Effects							
Int$\rightarrow SS_2 \rightarrow ASI_3 \rightarrow ASI_4$	-.24	-.01	.10	-2.44	.02	-.43, -.02	5.95%
Int$\rightarrow SS_2 \rightarrow SS_3 \rightarrow ASI_4$	.02	.001	.03	.44	.66	-.05, .08	-.37%
Int $\rightarrow ASI_2 \rightarrow SS_3 \rightarrow SS_4$	.01	.004	.01	1.06	.29	-.01, .02	2.62%
Int $\rightarrow ASI_2 \rightarrow ASI_3 \rightarrow SS_4$	.05	.03	.02	3.05	.00	.02, .08	20.09%

Note. Autoregressive path results were omitted for brevity. SS = Social support; AS = Anxiety Sensitivity; "Int" = Intervention; Covariates were gender, ethnicity, and age. "RI" = Random Intercept.

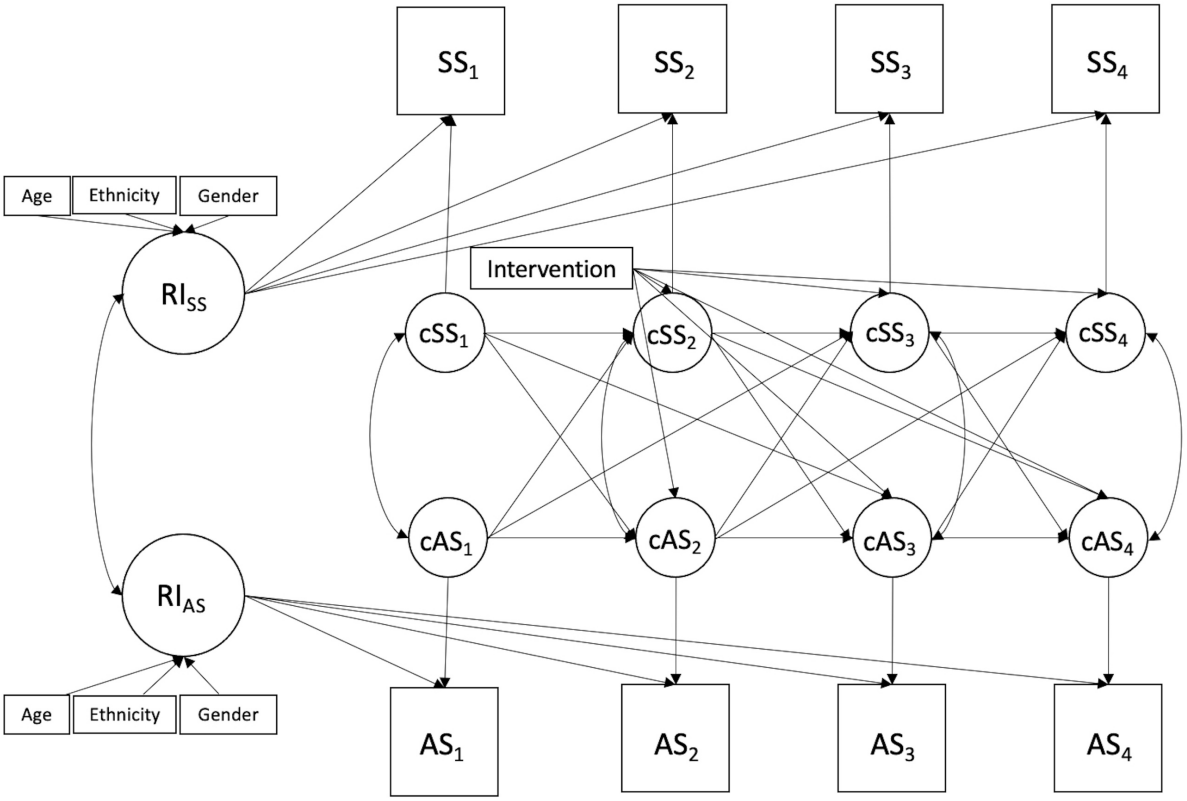
Table 3. Secondary RI-CLPM Results accounting for anxiety and depression symptoms

Parameter	*b*	Beta	*SE*	b/SE	*p*	95% CI	Ratios
Cross-Lagged Effects							
$SS_1 \rightarrow AS_2$	-2.10	-.14	1.22	-1.71	.09	-4.50, .30	--
$SS_1 \rightarrow AS_3$	-2.37	-.17	.79	-3.02	.003	-3.91, -.83	
$SS_1 \rightarrow Sx_2$	-.26	-.13	.17	-1.51	.13	-.60, .08	--
$SS_1 \rightarrow Sx_3$	-.11	-.06	.12	-1.00	.33	-.35, .12	--
$AS_1 \rightarrow SS_2$	-.01	-.14	.01	-1.64	.10	-.02, .00	--
$AS_1 \rightarrow SS_3$	-.01	-.08	.01	-1.07	.28	-.02, .01	--
$AS_1 \rightarrow Sx_2$	.01	.09	.01	.91	.37	-.01, .04	--
$AS_1 \rightarrow Sx_3$	-.01	-.05	.01	-.70	.48	-.03, .01	--
$Sx_1 \rightarrow SS_2$	.04	.07	.06	.66	.51	-.07, .15	--
$Sx_1 \rightarrow SS_3$	.07	.13	.05	1.47	.14	-.02, .17	--
$Sx_1 \rightarrow AS_2$	.80	.10	.84	.95	.34	-.85, 2.46	--
$Sx_1 \rightarrow AS_3$	.04	.00	.65	.06	.96	-1.24, 1.31	--
$SS_2 \rightarrow AS_3$	-2.39	-.17	.88	-2.73	.01	-4.10, -.67	--
$SS_2 \rightarrow AS_4$	.02	-.01	.08	.23	.80	-1.46, 1.08	--
$SS_2 \rightarrow Sx_3$	-.18	-.10	.12	-1.55	.12	-.41, .05	--
$SS_2 \rightarrow Sx_4$	-.01	-.00	.09	-.08	.94	-.18, .16	--
$AS_2 \rightarrow SS_3$	-.01	-.11	.01	-1.02	.31	-.31, .10	--
$AS_2 \rightarrow SS_4$	.01	.09	.01	.93	.35	-.18, .16	--
$AS_2 \rightarrow Sx_3$	.03	.21	.01	2.27	.02	.00, .02	--
$AS_2 \rightarrow Sx_4$	.01	.04	.01	.60	.55	-.01, .02	--
$Sx_2 \rightarrow SS_3$	-.06	-.12	.06	-1.15	.25	-.17, .05	--
$Sx_2 \rightarrow SS_4$	-.09	-.17	.05	-1.82	.07	-.19, .01	--
$Sx_2 \rightarrow AS_3$	-2.39	.13	.88	-2.73	.01	-.59, 2.49	--
$Sx_2 \rightarrow AS_4$	.79	.11	.52	1.52	.13	-.23, 1.80	--
$SS_3 \rightarrow AS_4$	.56	.04	.58	.95	.34	-.59, 1.70	--
$SS_3 \rightarrow Sx_4$	-.01	-.01	.08	-.12	.90	-.17, .15	--
$AS_3 \rightarrow SS_4$	-.02	.14	.01	-2.20	.03	-.03, -.002	--
$AS_3 \rightarrow Sx_4$	.02	.14	.01	1.84	.07	-.001, .04	--
$Sx_3 \rightarrow SS_4$	-.07	-.12	.06	-1.19	.24	-.17, .04	--
$Sx_3 \rightarrow AS_4$	.53	.07	.45	1.18	.24	-.35, 1.40	--
Intervention Effects							
Int $\rightarrow SS_2$	.23	.15	.06	3.97	.00	.12, .34	--
Int $\rightarrow SS_3$	.13	.09	.06	2.03	.04	.004, .25	--
Int $\rightarrow SS_4$	.04	.03	.07	.54	.59	-.10, .18	--
Int$\rightarrow AS_2$	-4.53	-.21	.76	-5.97	.00	-6.02, -3.05	--
Int $\rightarrow AS_3$	-2.50	-.12	.78	-3.22	.001	-4.03, -.98	--
Int $\rightarrow AS_4$	-.27	-.01	.70	-.38	.70	-1.63, 1.10	--
Int $\rightarrow Sx_2$	-.62	-.22	.10	-6.00	.00	-.83, -.42	--
Int $\rightarrow Sx_3$	-.38	-.13	.11	-3.39	.001	-.61, -.16	--
Int $\rightarrow Sx_4$	-.03	-.01	.11	-.27	.79	-.24, .18	--
Between Person Effects							
RI_SS with RI_AS	-.75	-.11	1.02	-.73	.46	-2.75, 1.25	--
RI_SS with RI_Sx	-.29	-.33	.13	-2.20	.03	-.55, -.03	--

RI_AS with RI_Sx	6.48	.63	2.72	2.38	.02	1.15, 11.81	--
Specific Indirect Effects of Interest							
Int→ SS_2 → AS_3 → AS_4	-.18	-.01	.09	-2.00	.046	-.35, -.003	4.47%
Int→ SS_2 → SS_3 → AS_4	.03	.00	.03	.89	.37	-.03, .08	-.65%
Int → AS_2 → SS_3 → SS_4	.00	.00	.01	.53	.60	-.01, .01	1.32%
Int → AS_2 → AS_3 → SS_4	.03	.02	.01	1.91	.057	-.001, .05	11.45%

Note. Autoregressive path results were omitted for brevity. SS = Social support; AS = Anxiety Sensitivity; "Int" = Intervention; "Sx" = Anxiety and depression symptom composite score. Covariates were gender, ethnicity, and age. "RI" = Random Intercept.

Figure 1. Focal RI-CLPM



Note. SS = Social Support, observed variable; AS = Anxiety Sensitivity, observed variable; cSS = within-person social support; cAS = within-person anxiety sensitivity; RIss = random intercept for social support; RI_{AS} = random intercept for anxiety sensitivity. The four direct paths from perceived social support at Time T to perceived social support at Time T + 2 and those from anxiety sensitivity at Time T to anxiety sensitivity at Time T + 2 are not depicted to reduce complexity of the figure diagram.

Study 2: Adult Attachment Security, Emotion Regulation Tendencies, and Transdiagnostic Symptoms of Depression and Anxiety

Abstract

Experiences in close relationships, including felt security and closeness, influence emotion regulation. Interpersonal influence on two strategies, cognitive reappraisal (which downregulates emotional experiences) and expressive suppression (which inhibits emotional expression) and later symptoms is understudied. This longitudinal study evaluated indirect associations between experiences in close adult relationships—operationalized as adult attachment security (AS)—and transdiagnostic symptoms of anxiety and depression (General Distress; GD) through reappraisal and suppression. Thirty-month longitudinal data from 270 young adults were examined in a cross-lagged panel model. There was a significant unique effect of AS on expressive suppression such that higher AS predicted lower use of subsequent expressive suppression. There were significant unique effects of emotion regulation on symptoms such that higher reappraisal predicted lower subsequent GD and higher suppression predicted higher subsequent GD. The direct effect and both indirect effects of AS on GD were nonsignificant. Results suggest that close relationship experiences may inform how one expresses emotions, and how one regulates emotions may inform transdiagnostic distress as measured by symptoms of depression and anxiety. There was no evidence that AS informed future transdiagnostic symptoms.

Introduction

Close relationships are focal components of resilience research (Luthar, 2006). Throughout development, close relationships and supportive social interactions with family members, friends, romantic partners, and other adults provide emotional security and a way to mitigate stress (Masten & Cicchetti, 2016). The present secondary data analysis aims to clarify how experiences in close adult relationships—as measured by adult attachment security (AS)[3]—relate to later mental health outcomes through distinct emotion regulation strategies.

One approach to studying individual differences in close adult relationship experiences is to examine adult attachment styles, or how adults relate to important people in their lives (Carver, 1997). Originally developed to describe infant expectations concerning caregiver accessibility and responsiveness (Ainsworth et al., 1978), attachment styles are also conceptualized as useful ways to describe adult relationships (Hazan & Shaver, 1994). Considered distinct from infant attachment relationships, adult attachment relationships are reciprocal, represented by beliefs and expectations, and commonly between peers who gradually meet attachment functions (i.e., emotional support; security needs) (Hazan & Shaver, 1994). Adult attachment relationships characterized as *secure* are ones in which individuals experience comfort that results from having a responsive and available attachment figure from whom they are free to explore and to whom they can return (Carver, 1997). Individuals with a secure attachment style characterized their romantic relationships positively (e.g., happy, trusting), endorsed support and acceptance for their partners, and indicated longer relationship durations compared to other attachment styles (Hazan and Shaver, 1987). Secure attachment style is also associated with higher perceived social support (e.g., Priel & Shamai, 1995). As such, adult AS

[3] Abbreviations used in this paper include AS for attachment security and GD for General Distress.

corresponds to more positive close relationship experiences. Separately, self-reported adult AS is associated with lower levels of depression and anxiety in adolescents (Cooper et al., 1998) and adults (e.g., Manning et al., 2017; Priel & Shamai, 1995).

Emotion regulation is a process that may be impacted by interpersonal experiences. Emotion regulation is the process by which individuals control their emotional experience and expression to accomplish one's goals (Gross 1998; Thompson, 1994). Emotion regulation encompasses not only intrapersonal emotion regulation strategies, but also the external influences including the regulation of emotions from close others (Thompson, 1994). The process model of emotion regulation and its extension (Gross, 1998; Gross, 2015b) posit that emotion regulation begins with identification of a difference between one's current and desired states, leading to selection and implementation of strategies at different stages of emotion generation (Lincoln et al., 2022). Emotion regulation strategies are classified across dimensions including adaptivity (adaptive vs. maladaptive) and timing of use (antecedent-focused vs. response-focused) (Lincoln et al., 2022). Cognitive reappraisal ("reappraisal" hereon) is a antecedent-focused cognitive change strategy that involves interpreting a situation in an attempt to change its emotional impact (Gross & John, 2003). In contrast, expressive suppression ("suppression" hereon) is a response-focused strategy that involves inhibition of emotion-expressive behavior, without reducing the experience of negative emotions (Gross & John, 2003). Reappraisal has been categorized as putatively adaptive, and expressive suppression as putatively maladaptive, given negative and positive associations with negative emotions and psychopathology, respectively (Gross & John, 2003).

Adult attachment security relates to reliance on support seeking and constructive means of coping with stress (Mikulincer et al., 2003). It has been posited that the experience of

availability and positive interactions with attachment figures contribute to appraisal of stressors as manageable (Shaver & Mikulincer, 2007) and learning that displaying distress can elicit support from others (Mikulincer et al., 2003). Supporting this literature, more secure individuals report greater self-efficacy in regulating distress and greater effectiveness and comfort with getting support from others (Mikulincer et al., 2003). In the emotion regulation literature, experiences in close relationships have been documented to influence emotion regulation by affecting the interpretation of stressful situations and resources available (Thompson, 1994). As such, someone with higher AS may be more likely to employ reappraisal. In contrast, someone who does not perceive an emotionally safe relationship may not express their emotions to others (Thompson, 1994). Therefore, someone with higher AS may be less likely to employ suppression. In support, cross-sectional research demonstrates that secure attachment is positively associated with reappraisal, and negatively associated with suppression (Karreman & Vingerhoets, 2012).

Emotion regulation is one mechanism through which adult attachment may lead to depression and anxiety, disorders characterized by emotion regulation difficulties (Lincoln et al., 2022). Longitudinal and cross-sectional evidence from adolescent and young adult samples supports the association between adult attachment styles and emotion regulation, which in turn reduces depression and anxiety (e.g., Nielsen et al., 2017; Pascuzzo et al., 2015). Regarding the study of *security* in these associations, work is limited to cross-sectional research. One study found that securely attached undergraduates reported more adaptive emotion regulation (e.g., accepting emotions during distressing times), which coincided with lower symptoms of depression and generalized anxiety (Marganska et al., 2013). Another study in a community adult sample reported results consistent with the effect of AS on self-reported well-being (i.e.,

positive mood, vitality) being partially mediated by cognitive reappraisal, but not expressive suppression (Karreman & Vingerhoets, 2012). However, such a claim is not strongly warranted in the absence of a longitudinal design (Cole & Maxwell, 2003).

To date, there are key limitations to address in studies examining associations among AS, emotion regulation, and psychopathology. The first limitation is the dearth of longitudinal research. Existing cross-sectional evidence of emotion regulation accounting for the adult AS and mental health relationship does not allow for causal claims. A second limitation of extant research is the focus on insecure attachment styles related to emotion regulation and psychopathology (e.g., Nielsen et al., 2017), therefore overlooking study of protective effects of attachment security in adults. Finally, existing research relies on single symptom questionnaires that broadly classify depression and anxiety as opposed to measures that account for overlapping features. Examining transdiagnostic features of depression and anxiety in relation to AS levels and emotion regulation may facilitate identifying intervention principles that would alleviate transdiagnostic symptoms, as opposed to symptoms specific to depression and anxiety.

The present longitudinal study examines indirect effects of AS on symptom distress shared by depression and anxiety (General Distress; GD) through reappraisal or suppression in young adults. Young adulthood is a unique developmental stage marked by uncertainty and instability and a high prevalence of mental health disorders (Arnett et al., 2014). Late adolescence and early adulthood also mark times during which non-caregiver relationships become increasingly important (Steinberg & Morris, 2001). As such, exploring whether close relationships may positively impact emotion regulation and resulting mental health is crucial to study in young adults. We hypothesized that higher levels of AS would predict subsequent

higher average reappraisal use and lower average suppression use, which would in turn predict subsequent lower GD.

Method

Participants

Of the 366 young adults who enrolled in a longitudinal study at the University of California, Los Angeles (UCLA) and Northwestern University (NU) (Brain, Motivation, and Personality Development project; R01 MH100117), 270 completed baseline questionnaires and were included in the present analyses. The sample (Baseline Age: M = 18.63, SD = .55) was 53.3% White and 67% Female. Most participants reported higher gross family incomes and the mean years of education was 12.51 (SD = .63) (see Table 1 for demographic details).

Participants were recruited based on self-reported trait Neuroticism as measured by a 12-item version of the Eysenck Personality Questionnaire-Neuroticism scale[4] (EPQ-N; Eysenck & Eysenck, 1975) and Reward Sensitivity as measured by the Behavioral Activation Sensitivity (BAS) (Carver & White, 1994). Sampling procedures were designed to recruit participants from high/mid/low ranges on both scales, with oversampling from the two diagonals of the bivariate space defined by the quasi-orthogonal EPQ-N and BAS scales (i.e., high EPQ-N/high BAS, low EPQ-N/low BAS, mid EPQ-N/mid BAS, high EPQ-N/low BAS and low EPQ-N/high BAS). This sampling method was employed because the parent study aimed to examine positive and negative valence systems and aimed to understand factors related to psychopathology onset in a non-clinical sample. Other inclusion criteria were between 18-19 years old, right-handed (for neuroimaging purposes), and English fluency. Exclusion criteria were a history of a DSM-5

[4] A modified EPQ-N was used in the present study. We eliminated items to make it briefer and participants responded to items on a 0 (*not at all*) to 3 (*very much*) Likert scale instead of answering Yes/No.

criteria for lifetime diagnosis of bipolar disorder or psychotic disorder, or current, severe substance use disorder. We also excluded participants with a moderate or greater traumatic brain injury/neurological disorder, MRI contraindications, and color-blindness given that the parent study collected neuroimaging data (not reported in this paper).

Although the parent study was designed to use a dimensional approach to investigate broad symptom domains, diagnostic interviews were conducted for sample characterization. Participant diagnoses were assessed using the Structured Clinical Interview for Diagnostic and Statistical Manual of Mental Disorders (5th ed.) (First et al., 2016). 18.9% of participants met for a current clinically significant depressive or anxiety disorder at baseline.

Procedure

During a laboratory baseline assessment (T1), participants provided informed consent and completed self-report measures and other behavioral and biological measures not included in this paper. Procedures were repeated at 10 (T2), 20 (T3), and 30 (T4) months.[5] All study procedures were approved by the UCLA (#13-001606) and NU (#STU00086226) Institutional Review Boards.

Measures

Attachment Security

Three items from the Measure of Attachment Qualities (MAQ; Carver, 1997) were used to measure levels of attachment security. This security subscale captures a "positive sense of benefitting from closeness in relationships" distinct from insecure attachment qualities (Carver, 1997). An example item on this subscale is "When I'm close to someone, it gives me a sense of comfort about life in general." Participants were instructed to "rate the extent to which you

[5] Assessments were separated by 10 months to complete follow-ups within funding period.

believe each statement best describes your feelings about close relationships in general." Items are rated on a 7-point Likert scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). The measure yields a dimensional measure of attachment security, with higher scores corresponding to greater levels of security. This measure has evidence of convergent validity (Carver, 1997; Segal et al., 2009) and acceptable internal reliability (Justo-Núñez et al., 2022; Segal et al., 2009). High interitem reliability was observed in our sample over time ($M_\alpha = .84$).

Emotion Regulation

The Emotion Regulation Questionnaire (ERQ; Gross & John, 2003) contains 10 items assessing one's tendency to use reappraisal (6 items) and suppression (4 items). Items are rated on a 7-point Likert scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). Higher scores correspond to greater use of the strategy. Acceptable to high interitem reliability was observed in our sample over time (reappraisal: $M_\alpha = .85$; suppression: $M_\alpha = .74$).

Symptoms of Anxiety and Depression

Transdiagnostic symptoms of anxiety and depression were measured in a dimensional framework, using factor analytic methods to generate factor score estimates across distinct dimensions of symptoms from self-report measure items. Factor scores were developed using Confirmatory Factor Analysis in Mplus version 5 (Muthén & Muthén, 1998-2007). This analysis identified a "broad" factor, General Distress (GD), which taps symptoms common to all depressive and anxiety disorders (Naragon-Gainey et al., 2016; Prenoveau et al., 2010). Model specification details, including how the items loaded onto factors, can be found in Prenoveau et al. (2010). Self-report depression and anxiety symptom measure items included three subscales of the Fear Survey Schedule-II (FSS; Geer, 1965) to assess specific fears, the Albany Panic and Phobia Questionnaire (APPQ; Rapee et al., 1994) to assess interoceptive and agoraphobic fears,

the Self-Consciousness subscale of the Social Phobia Scale (SPS; Mattick & Clarke, 1998; Zinbarg & Barlow, 1996) to assess social fears, the Inventory to Diagnose Depression (IDD; Zimmerman et al., 1986) to assess anhedonia, hopelessness, dysphoria, and self-deprecation, and the Mood and Anxiety Symptom Questionnaire (Watson et al., 1995) assessed anxiety symptoms (e.g., generalized anxiety, panic) as well as symptoms of depression. Scalar invariant factor scores were used in the present analyses for follow-up timepoints.

Data Analysis

We examined associations among AS, reappraisal, suppression, and GD across four timepoints in a cross-lagged panel model (CLPM; Campbell, 1963; Kenny, 1975) estimated in MPlus version 8 (Muthén & Muthén, 1998-2017). CLPM is recognized as an approach to conducting mediation analyses in longitudinal data (Selig & Preacher, 2009) and allows for modeling prospective relationships and maintaining temporal precedence. To examine (1) the effect of AS on GD through reappraisal and (2) the effect of AS on GD through suppression simultaneously, multiple mediation analyses were performed to examine one indirect effect conditional on the presence of another mediator in the model (Preacher & Hayes, 2008).

Model selection was performed in a series of steps (see Figure 1 for model and Table 2 for fit statistics of tested models). First, we estimated saturated models (i.e., all possible paths, freely estimated). Next, we assumed stationarity in 20 relationships across time because it is believed that the degree to which one construct relates to another construct remains the same over time (Cole & Maxwell, 2003). The regression coefficients constrained to the same value at each wave were: autoregressive paths within each construct from T to T+1, paths from AS (T) to other constructs (T+1), paths from reappraisal (T) to other constructs (T+1), paths from suppression (T) to other constructs (T+1), paths from the GD (T) to other constructs (T+1), and

ethnicity effects. Residual covariances were also constrained. The stationarity assumption was not violated (Table 2). We then removed lagged paths between different constructs until introduction of misfit. We examined Chi-square tests of model fit and fit indices using conventional cut-offs (RMSEA $\leq$ 0.06, SRMR $\leq$ .08, CFI $\geq$ 0.95; Hooper et al., 2008).

The indirect effects of AS (T) predicting GD (T+2) were calculated using MODEL INDIRECT. The bootstrapped method (1,000 iterations) was employed (Cheung et al., 2008). Full information maximum likelihood addressed missing follow-up data (T2: 8.9%, T3: 12.6%, T4: 44.1%).[6] We examined associations with focal variables at baseline, sex, ethnicity, and race with a missing data variable (computed by dichotomously coding focal variable data at each follow-up). Logistic regression analyses tested Missing at Random in which aforementioned variables were regressed on the missing data variable. The significance level for all analyses was $p < .05$.

Results

Descriptive Statistics

There was a small, positive effect of attachment security on reappraisal (T1-T3 only) and a small-to-moderate, negative effect of attachment security on suppression (T1-T4). Attachment security was not significantly correlated with GD (T1-T4). There was a negative, small-to-moderate effect of reappraisal on GD (T1-T4) and a small, positive effect of suppression on GD (T1-T4) (Table 3).

Missing Data Analysis

[6] Substantial T4 missingness was because measures were administered with the T4 neuroimaging session (parent study), which was completed by a sample subset.

Race, sex, baseline reappraisal, and baseline suppression did not predict missingness (all *p*s > .11). Ethnicity predicted missingness of Time 4 GD, baseline AS predicted missingness of Time 2 GD, and baseline GD predicted missingness of Time 4 AS and Time 4 GD (all *p*s < .05). Given that baseline GD and AS were already incorporated into the CLPM, the effect of ethnicity was added to make the assumption of Missing at Random more plausible.

Test of Mediation

The effect of AS on reappraisal (a_1) was nonsignificant (Table 4). There was a medium significant negative effect of AS on suppression (a_2). There was a medium significant negative effect of reappraisal (b_1) and a medium significant positive effect of suppression (b_2) on GD. The direct effect of AS on GD was nonsignificant (c'). Indirect effects of AS on GD through reappraisal (c_1) and suppression (c_2) were nonsignificant (Figure 2).

Discussion

Results of our 30-month longitudinal study indicated that higher attachment security predicted lower subsequent suppression. In addition, both higher reappraisal and lower suppression predicted lower subsequent transdiagnostic symptoms of depression and anxiety. As such, tendency to suppress emotional expression seems to be impacted by experiences in close relationships as well as a predictor of higher future transdiagnostic symptomology. Also, how one tends to employ cognitive change to change their emotional experience predicts lower future transdiagnostic symptomology despite not being informed by adult attachment security.

First, our findings suggest that higher attachment security in close relationships is associated emotion regulation, providing evidence to support interpersonal influence within adult attachment relationships on emotion regulation tendencies (Mikulincer et al., 2003; Thompson, 1994). The pattern of results regarding suppression is also consistent with cross-sectional

research demonstrating that higher attachment security related to lower suppression (Karreman & Vingerhoets, 2012). These findings add to previous research by demonstrating that the effect of attachment security on suppression persists when examined longitudinally, underscoring the predictive ability of attachment security in terms of how one may inhibit emotional expression. In addition, given that we accounted for variance of reappraisal in the same model, our finding is unique to suppression. However, we did not find support for a longitudinal association between adult attachment security and reappraisal, which is out of line with findings from previous cross-sectional research (Karreman & Vingerhoets, 2012). This pattern of results may be due to employing a more rigorous analytic approach (i.e., prospective associations; accounting for suppression and symptom variance). It is also possible that adult attachment security relates to other effective intrapersonal emotion regulation strategies or interpersonal emotion regulation. Nevertheless, our findings add more nuance to existing research such that the influence of adult attachment security may be more specific to how individuals tend to express their emotional experience.

In addition, our findings demonstrate prospective relationships between emotion regulation tendencies and transdiagnostic symptoms of depression and anxiety. As such, we add to existing cross-sectional (e.g., Tran & Rimes, 2017; Mutz et al., 2017) and limited longitudinal (Brewer et al., 2016; Kraaj et al., 2010; Romero et al., 2012) evidence demonstrating that emotion regulation strategies predict symptoms and diagnoses. Our findings suggesting that emotion regulation tendencies predict transdiagnostic symptoms of depression and anxiety provide support for predictors of broad distress, which expands the relevance of emotion regulation tendencies beyond a given set of symptoms or diagnoses. Given the high co-occurrence of depression and anxiety (Kessler et al., 2012), taking a dimensional approach

affords advantages in the study and treatment of these disorders (Kircanski et al., 2017). In sum, our results improve understanding regarding prospective associations between emotion regulation tendencies and distress associated with both depression and anxiety.

We failed to find evidence for direct or indirect effects of attachment security on symptoms of depression and anxiety. As such, how comfortable one is in their current relationships seems to have little bearing on one's future broader distress. Previous cross-sectional evidence indicated that undergraduates who had higher levels of attachment security experienced less severe depression and anxiety symptoms, which coincided with less emotion dysregulation (Marganska et al., 2013). However, our results suggest that adult attachment security's effect on transdiagnostic distress may not be causal. It is also possible that we were underpowered to detect this particular association. As such, more longitudinal work with a bigger sample and lower attrition is necessary. Apart from the fact that our analysis was a more rigorous test of prospective relationships, our results may also be due to our measure of adult attachment security, which was selected because it measures the presence of secure attachment, as opposed to conceptualizing attachment security as a lack of attachment anxiety and avoidance (Carver, 1997). Nevertheless, future research should incorporate more comprehensive measures of this complex construct.

The present findings have potential clinical implications. Whereas many cognitive behavioral therapies incorporate reappraisal strategies, our results further suggest that attending to suppression as a response to one's emotions may also be important to lessening symptoms shared by depression and anxiety. Emphasis could be given to psychoeducation on consequences of inhibiting emotional expression and practicing emotional expression in vivo to in order to lessen symptom severity. In addition to the symptom consequences of suppression, there are also

notable social consequences (e.g., lack of comfort and closeness in interactions; Dryman & Heimberg, 2018; Gross & John, 2003). Consequently, individuals who suppress emotions may be less likely to engage their social resources and experience the benefits from social support. As such, the notable consequences of suppression render it a meaningful clinical target that could have a broader functional impact. In addition, interventions that enhance perceptions of relationship security may decrease inhibiting emotional experiences. Importantly, these clinical implications should be tested given the small effect sizes.

Our findings should be considered with several limitations in mind. First, we relied on self-report measurement to assess our constructs and common method variance may inflate these associations as a result (Klein et al., 2011). Future work should examine these associations using different measurement types. We also studied these associations in a nonclinical young adult sample who were sampled based on neuroticism and reward sensitivity levels, had a narrow age range, and higher family incomes on average. As such, it is unclear how these results may generalize to clinical samples, other age groups, non-clinical samples without unique sampling procedures, or lower socioeconomic status samples. In addition, we examined general distress shared by depression and anxiety as an outcome, because of interest in transdiagnostic risk associated with these associations. Nevertheless, despite evidence demonstrating strong effects of suppression in social anxiety (Dryman & Heimberg, 2018), our dimensional tri-level model does not allow for comparison of specific diagnoses. Notably, we considered tendencies to use emotion regulation strategies in the present study, which is distinct from one's capacity to implement such strategies (Gross et al., 2015; Lewis et al., 2010). As such, the pattern of our findings may not inform associations among adult attachment security, emotion regulation strategy implementation, and subsequent transdiagnostic symptoms. Lastly, the tendency to

engage in regulatory strategies are simplistically viewed as maladaptive or adaptive, overlooking the influence of context (e.g., life stress) and the idea that there are some contexts in which suppression may be useful and some situations in which reappraisal may be less efficacious (Bonanno & Burton, 2013). Relatedly, we were not adequately powered to create subgroups (e.g., Asian vs. other racial groups; collectivist vs. individualistic cultural values), nor did we collect measures to appropriately address the question of cultural differences in these associations. However, there is research demonstrating suppression may be normative for individuals of Asian descent due to values of interdependence and harmony (Sun & Lau, 2018). Future work on close relationship experiences influencing emotion regulation should consider the roles of contextual factors and culture.

Conclusions

In sum, our findings suggest that the more security individuals experience in close adult relationships, the more individuals tend to respond to their emotions in a way that encourages their expression. In addition, responding to emotions to reduce negative impact or encourage expression predicts less severe transdiagnostic depression and anxiety symptoms prospectively.

Table 1. Sample Demographics and Diagnoses at Baseline

	N	*%*
Gender		
Female	181	67
Male	88	32.6
Transgender	1	0.4
Race		
White	144	53.3
Black or African American	23	8.5
Asian	76	28.1
American Indian or Alaska Native	4	1.5
Multiracial	22	8.1
None by choice	1	0.4
Ethnicity		
Hispanic or Latine	73	28.1
Family Income		
<$19,999	9	3.9
$20,000-99,000	93	40.6
$100,000-199,999	79	34.5
>$200,000	48	21.0
Current Diagnoses		
Anxiety Disorder	37	13.7
Depressive Disorder	4	1.5
Depressive and Anxiety Disorder	10	3.7

Note. Depressive and anxiety disorders reported here include those that met for full diagnostic criteria or otherwise specified criteria for a given disorder and received a rating ≥ 4 (clinically significant) on the Clinical Severity Rating scale (Di Nardo & Barlow, 1988). 8.9% of participants had missing family income data. 6.3% of participants had "not applicable" coded for family income.

Table 2. Model Fit Information

	χ^2	df	*p*	CFI	SRMR	RMSEA
Saturated	0	0	<.001	1.00	.00	.00
Constrained	72.72	56	.07	.99	.05	.03
Remove different construct lagged paths T-3→T	**79.25**	**68**	**.17**	**.99**	**.05**	**.03**
Remove different construct lagged paths T-2→T	118.00	92	.035	.98	.06	.03

Note. The bolded row represents the selected model. Saturated = models with estimate all paths estimated. Constrained = models constrain select paths to equality. Remove different construct lagged paths = models without different construct paths at T-3/T-2 predicting other constructs at T.

Table 3. Bivariate Correlations and Descriptive Statistics of Study Variables

	1	2	3	4	*M* (*SD*)
T1 (*N*=268)					
1. AS	--				18.03 (2.91)
2. Reappraisal	.21*	--			30.16 (6.40)
3. Suppression	-.33*	-.27*	--		14.53 (4.41)
4. GD	-.13	-.33*	.22*	--	.05 (.91)
T2 (*N*=251)					
1. AS	--				17.68 (3.16)
2. Reappraisal	.16*	--			28.78 (7.38)
3. Suppression	-.29*	.00	--		13.97 (4.73)
4. GD	-.05	-.33*	.17*	--	.16 (.93)
T3 (*N*=238)					
1. AS	--				17.50 (3.49)
2. Reappraisal	.17*	--			29.31 (5.94)
3. Suppression	-.41*	-.07	--		14.38 (4.74)
4. GD	-.08	-.33*	.24*	--	.06 (.97)
T4 (*N*=159)					
1. AS	--				18.13 (2.94)
2. Reappraisal	.15	--			30.42 (5.72)
3. Suppression	-.40*	-.15	--		13.53 (4.68)
4. GD	-.03	-.39*	.26*	--	-.20 (.89)

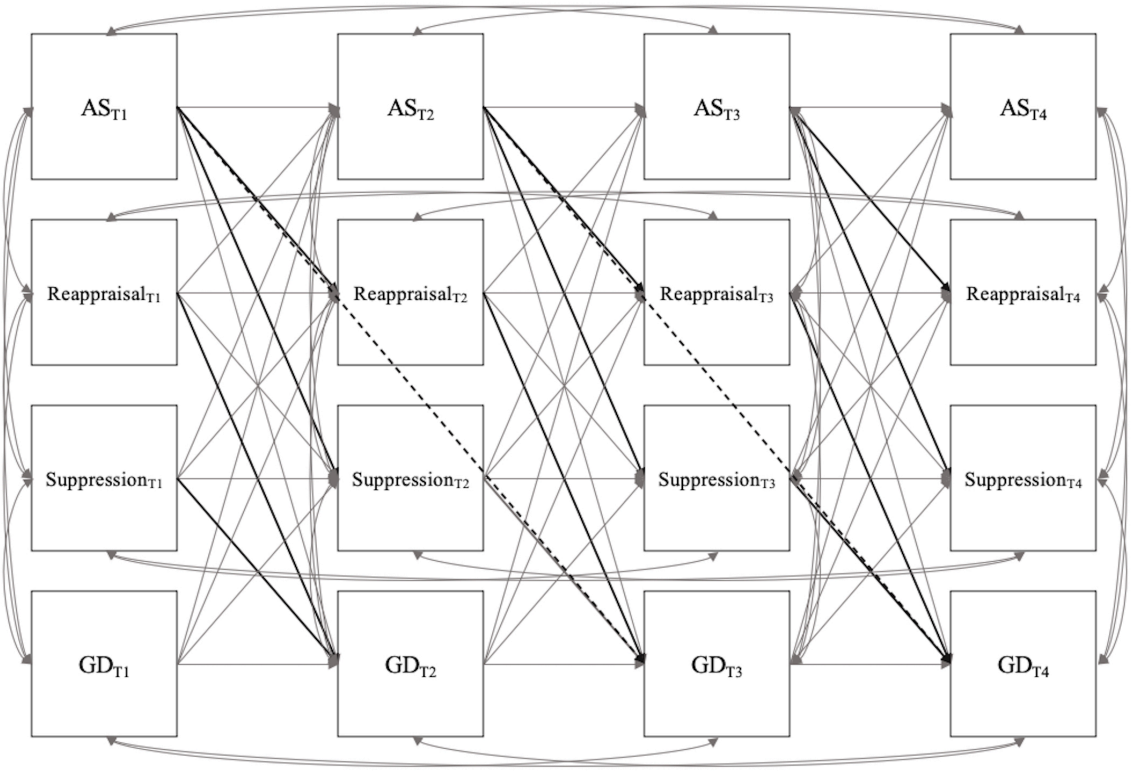
Note. AS = Attachment Security. GD = General Distress. *$p < .05$

Table 4. Mediation Model Path Results from Cross-lagged Panel Models

Path	Std. Est.	Est. (*SE*)	Est. 95% CI
a_1: $AS_{(T-1)} \rightarrow Reappraisal_{(T)}$	.02	.04 (.08)	-.13, .19
b_1: $Reappraisal_{(T-1)} \rightarrow GD_{(T)}$	-.10**	-.01 (.005)**	-.02, -.004
a_2: $AS_{(T-1)} \rightarrow Suppression_{(T)}$	-.09*	-.14 (.06)*	-.24, -.03
b_2: $Suppression_{(T-1)} \rightarrow GD_{(T)}$	.09**	.02 (.01)**	.004, .03
c': $AS_{(T-2)} \rightarrow GD_{(T)}$	.08	.03 (.02)	-.01, .06
c_1: $AS_{(T-2)} \rightarrow Reappraisal_{(T-1)} \rightarrow GD_{(T)}$	-.002	-.001 (.001)	-.003, .002
c_2: $AS_{(T-2)} \rightarrow Suppression_{(T-1)} \rightarrow GD_{(T)}$	-.007	-.002 (.001)	-.005, .00

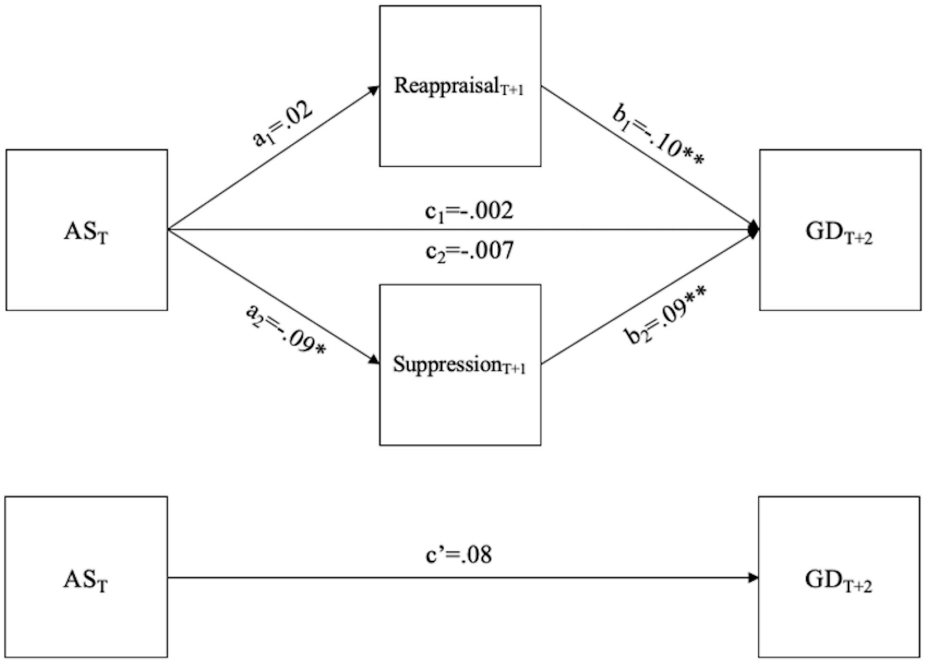
Note. AS = Attachment Security; GD = General Distress; Std. Est = Standardized estimate. Est. = Unstandardized estimate. $^{**}p < .01$, $^{*}p < .05$

Figure 1. Tested Cross-lagged Panel Model



Note. Black lines informed direct and indirect effects in the mediation test. Ethnicity paths and paths between different constructs (T→T+2) are not included other than AS_T→GD_{T+2} for simplicity purposes.

Figure 2. Results Summary



Note. Standardized estimates are displayed.

Study 3: Influence of Social Support on Cognitive Reappraisal in Young Adults at Risk for Depression and Anxiety

Abstract

Social support offers protection from depression and anxiety, possibly through its beneficial effects upon cognitive reappraisal. The present study evaluates potential mechanisms of social support, utilizing a reappraisal task in 121 undergraduates at risk for depression and anxiety. Participants were instructed to reinterpret stressful images with (Social Condition) and without (Solo Condition) the reminder of a social support figure. Aversiveness, negative affect, and positive affect ratings, as well as written reappraisal responses, were collected trial-by-trial. Results indicated that participants reported lower aversiveness, lower negative affect, and higher positive affect when reinterpreting images in the Social Condition compared to the Solo Condition. Analyses of adherence ratings of written reappraisals revealed that participants generated reinterpretations more in the Social Condition than in the Solo Condition. Results suggest that social support may enhance cognitive reappraisal, and thus may be a suitable target for interventions for depression and anxiety.

Introduction

Social support has a robust and broad impact upon positive mental health outcomes (e.g., Alegría et al., 2018; Sarason et al., 2001), including lower depression and anxiety (Auerbach et al., 2011; Metts et al., 2021; Metts et al., 2022; Zimmerman et al., 2020). Specifically, more social support reduces risk for depression, whereas less social support increases risk for depression (e.g., Auerbach et al., 2011; Metts et al., 2021; Metts et al., 2022). Social support is less studied in the context of anxiety but there is evidence for social support curbing anxiety onset (Bolger & Eckenrode, 1991; Metts et al., 2021; Metts et al., 2022; Reinelt et al., 2014; Zimmermann et al., 2020). Yet, little work has been dedicated to the mechanisms associated with social support that could account for lower depression and anxiety. One potential mechanism is cognitive reappraisal of stressors. The present study aims to evaluate the influence of social support upon instructed reappraisal of stressful situations.

Cognitive Reappraisal

Cognitive reappraisal, re-evaluation of a stressful situation or one's ability to handle the situation in an attempt to modify one's emotional response (Gross, 1998), has been widely studied. Cognitive reappraisal decreases the emotional relevance of an emotional cue, which lessens subjective, physiological, and expressive negative emotional experiences (Gross, 1998). Given that cognitive reappraisal lends itself well to experimental manipulation (Gross, 2002), many paradigms have tested the extent to which instructed cognitive reappraisal changes emotional responses. In such paradigms, participants are typically given an instructional cue (e.g., reappraise) and shown an emotional stimulus (e.g., negatively-valenced image) before providing an account of their subjective emotional experience (e.g., negative affect).

Experimental studies have consistently found that cognitive reappraisal downregulates negative affect (e.g., Ochsner et al., 2002, 2004; Ray et al., 2010; Shafir et al., 2015).

Cognitive Reappraisal, Depression, and Anxiety

Cognitive reappraisal has been posited to be adaptive and have positive impacts on depression and anxiety. A consistent finding from cross-sectional research in healthy samples is that cognitive reappraisal is related to less depressive and anxiety symptoms; however, the associations are small-to-medium in strength and are not always observed (Riepenhausen et al., 2022). In addition, relationships between cognitive reappraisal and outcomes are stronger when stress is taken into account (Riepenhausen et al., 2022). Findings from longitudinal studies are less compelling, as most fail to support prospective predictions of cognitive reappraisal tendency upon depression and anxiety (Riepenhausen et al., 2022). On the other hand, studies that actively train cognitive reappraisal over time report decreases in depression and anxiety-related outcomes (Riepenhausen et al., 2022). Most studies relate cognitive reappraisal tendency to clinical outcomes, which is distinct from implementation of cognitive reappraisal (Gross, 2015a). As such, more mechanistic work in relation to clinical outcomes is needed.

Augmenting Cognitive Reappraisal with Social Support

Interpersonal factors may augment cognitive reappraisal as an emotion regulation strategy. The buffering role of social support in response to stress upon depression and anxiety is well established (e.g., Crockett et al., 2007; Gore & Aseltine, 1995; Raffaelli et al., 2013; Shahar & Henrich, 2016; Wills & Cleary, 1996). The interpersonal emotion regulation model (Zaki & Williams, 2013) posits that social support can intervene by helping individuals regulate their emotional responses through ‘social reappraisal,’ or offering an alternative interpretation of a negative stimulus or stressor, that in turn reduces emotional responses to stressful situations

(Reeck et al., 2016; Williams et al., 2018). In support, social reappraisal, operationalized as listening to a friend's reinterpretation of a negative image, was found in one study to associate with greater reductions in negative affect than solo reappraisal (i.e., reappraisal without interpersonal influence) (Sahi et al., 2021).

Gaps to Address

Because the concept of cognitive reappraisal as an emotion regulation strategy assumes an emotional impact from cognitive change (Gross et al., 2006), the instructional prompts typically ask participants to reappraise in order to feel no emotion (e.g., Gross, 1998) or to decrease negative emotions (e.g., Ochsner et al., 2004; Sahi et al., 2021). As such, the roles of cognitive reappraisal and emotional response are confounded. Hence, it is not clear whether the benefits of social versus solo reappraisal reported by Sahi et al. (2021) are specifically a function of instructions to reappraise versus instructions to change emotional state. Neutral instructional cues that ask participants to reappraise without specifying emotional change (e.g., Koval et al., 2015) enable more precise investigation of the effects of social support upon reappraisal.

Cognitive change is traditionally assumed rather than measured within instructed reappraisal paradigms. As such, the extent to which instructed reappraisal produces actual reappraisal, whether in social or solo paradigms, is unknown. In order to understand how social support strengthens emotion regulation, it is essential to measure the extent of cognitive change (i.e., analyze participant's verbal or written reappraisals). Quantification of cognitive change is especially relevant for individuals who experience depression and anxiety, since their cognitive biases (Marroquín, 2011; Reeck et al., 2016; Salters-Pedneault et al., 2006; Werner et al., 2011) may mitigate against instructed reappraisals, leading to weakened actual reappraisals.

The effect of instructed reappraisal on positive affect has been measured in studies of solo reappraisal (e.g., McRae et al., 2012; Song et al., 2018), but not yet in studies of social reappraisal. Yet, depression and anxiety are characterized not only by elevated negative affect, but also by lowered positive affect (Dejonckheere et al., 2018; Eisner et al., 2009; Kashdan, 2007; Watson et al., 1988). Thus, to fully understand the influence of social support, it is essential to measure both positive and negative affect outcomes from instructed reappraisal. Lastly, social reappraisal has been experimentally tested only in a healthy female sample (Sahi et al., 2021). Clearly, there is a need for more direct investigation of the effects of how social support may impact emotion regulation in individuals at risk for and who experience depression and anxiety.

The Present Study

Experimental designs are needed to investigate how social support influences emotion regulation (Thoits, 2011). As such, the present study examines whether having a reminder of a social support figure (i.e., social reappraisal) is more effective than not having a reminder (i.e., solo reappraisal) when asked to reinterpret negatively-valenced images. We build upon previous solo and social reappraisal research by providing a neutral reappraisal instruction, directly assessing cognitive change, and collecting aversiveness, negative affect, and positive affect outcomes in an at-risk sample (see Figure 1). Undergraduates elevated on neuroticism (a risk factor for depression and anxiety) completed a task with two conditions, one in which they were prompted to think about what a social support figure would say to help think about a negative image differently (Social Condition) and a second in which they were prompted to think about the negative image differently by themselves (Solo Condition). First, it was hypothesized that the Social Condition would lead to more effective reappraisal (as measured by reductions in

aversiveness) than the Solo Condition. Second, it was hypothesized that the Social Condition would more effectively reduce negative affect and increase positive affect than the Solo Condition. Third, we explored whether adherence to the reinterpret cue would be associated with greater reductions in aversiveness and negative affect or greater increases in positive affect.

Method

Participants

UCLA undergraduates ($N = 229$) recruited through the UCLA Department of Psychology Subject pool were screened for eligibility, of whom 136 met eligibility criteria and signed consent to participate. Eligible participants were $\geq$ 18 years old, fluent in English, and elevated on neuroticism according to the 12-item Eysenck Personality Questionnaire-Neuroticism scale[7] (EPQ-N; Eysenck & Eysenck, 1975). Elevation on this measure is defined as a score greater than or equal to 22, based on pilot data from young adults from another project (Craske, Bookheimer, Zinbarg, and Nusslock, R01 MH100117). Because of task non-completion due to technical and scheduling difficulties, only 121 individuals were considered completers. The mean age of this sample was 19.42 ($SD = 1.69$) years. The gender distribution of the sample was 81.8% female, 16.5% male, and 1.7% non-binary. Participants were 38.8% Asian, 38% White, 7.4% Black/African American, 2.5% Native American or Alaskan Native, and 25.6% Hispanic/Latine (13.2% did not disclose race). Participants had subclinical symptoms of depression and anxiety (see Table 1 for full characteristics).

Power Analysis

[7] A modified EPQ-N was used in the present study such that participants responded to items on a 0 (Not at all) to 3 (Very much) Likert scale instead of answering Yes or No.

We computed that 74 participants were needed to observe a small effect size of (f = .15) with 80% power (statistical test: ANOVA: Repeated measures, within factors, one group, three measurements, calculated using G*Power 3.1.9.3).

Task Development

Visual stimuli for the Social Condition and Solo Condition were drawn from the International Affective Picture System (Lang et al., 2005). A total of 90 images were selected: 60 negative and 30 neutral. Negative images were selected by the first author if they depicted an interpersonal (e.g., people mourning) or non-interpersonal (e.g., building destruction) stressful scenario and were tested with undergraduate research assistants to ensure that they were able to generate reinterpretations in response to the selected negative images. If a research assistant judged the image as being too difficult to reinterpret, the image was removed and replaced until all images could be successfully reinterpreted. Four sets of 15 negative images were created such that the average valence ratings did not significantly differ between sets. Negative and neutral image sets were matched on valence ratings (negative sets: $M_{valence}$ = 2.73, SD = .53; neutral sets: $M_{valence}$ = 5.01, SD = .12), with lower ratings indicating more negative valence on a 1-9 scale. Four versions of each condition were created that counterbalanced image sets across Social and Solo Conditions (e.g., Solo Version 1: negative image set 1 = reinterpret, negative image set 4 = look, neutral image set 1 = look; Social Version 1: negative image set 2 = reinterpret, negative image set 3 = look, neutral image set 2 = look). The order of the three within-task trial types (negative–reinterpret, negative–look, neutral–look) and rating scales (aversiveness; negative affect, positive affect) were also counterbalanced within the task.

Procedure

All consent and experimental procedures were approved by the UCLA IRB (IRB #21-001738). The study had two parts that occurred 1-7 days apart (M = 1.92, SD = 1.29): (1) an online screening session and (2) an online experimental session. Participants first completed a screening session to determine if they were eligible to participate in the experimental session. During the screening session, participants completed an EPQ-N (Eysenck & Eysenck, 1975). If they scored 22 or higher on the EPQ-N and met inclusion criteria (at least 18 years old, fluent in English), they were eligible for the experimental session. If not eligible, participants were excused from the rest of the experiment and provided a list of mental health referrals if they were elevated on neuroticism. If eligible, participants were provided mental health resources and provided the option of continuing with Part 1 of the study.

All participants completed an online informed consent form before completing Part 1. Participants who agreed to participate completed self-report questionnaires assessing perceived social support (Zimet et al., 1988), emotion regulation tendencies (Gross & John, 2003), adult attachment security (Carver, 1997), and symptoms of depression and anxiety (Lovibond & Lovibond, 1995). Participants were then asked to select "the individual who gives you the most support on a daily basis" from any relationship (e.g., parent, friend, significant other; Hornstein et al., 2017). Participants then rated how much social support this individual gave them every day on a sliding scale ranging from 1 (*very little*) to 10 (*very much*) (Hornstein et al., 2017) and provided the first name of the support figure to be used in the experimental session. The mean level of support from support figures identified by participants in this study was 8.06 (SD = 1.60).

Prior to the experimental session (Part 2), the first author edited Social Condition scripts to include the first name of the support figure provided by the participant in Part 1. For Part 2,

participants reported to a 90-minute virtual experimental session via Zoom. Participants underwent a 15-minute training with a researcher using PowerPoint and were instructed on how to respond to different cues (see Appendix A for instruction text). Participants were also given examples of aversiveness (awful; scary), negative emotions (sad; fearful), and positive emotions (optimistic; hopeful) to assist in responding to aversiveness and affect ratings. The training included two practice trials per condition in PsyToolkit (Stoet, 2010, 2017), using minimally negative images ($M_{valence}$ = 4.21, SD = .18) not used in the experimental task and were oriented to the ratings and writing prompt. Participants then completed their assigned version of the Solo and Social Conditions using PsyToolkit (Stoet, 2010, 2017) in counterbalanced order. The Solo Condition utilized a modified version of a standard reinterpretation paradigm (Ochsner et al., 2004) and the Social Condition utilized a modified version of a social reappraisal task (Sahi et al., 2021).

The Social Condition and Solo Condition each included three trial types: negative–reinterpret, negative–look, and neutral–look. Neutral–reinterpret was not included given that it did not make sense from the participants' perspective (Sahi et al., 2021). Thus, the design was an incomplete 2 (valence: negative vs. neutral) x 2 (instruction: reinterpret vs. look) x 2 (condition: Solo vs. Social) design. The incomplete design was accounted for with statistical modeling choices. There were 15 trials of each trial type within the Social Condition and Solo Condition.

In the Solo Condition, participants were first presented with an instructional cue "look" or "reinterpret by yourself" for 2 s, followed by a negative or neutral image for 8 s. Following the look cue, participants were instructed to look at the picture and think about it like they normally would. Following the reinterpret by yourself cue, participants were instructed to try to think of the image in a different way. Participants were then told they could (1) try to tell

themselves a story about how the scenario in the image will have a positive outcome or (2) focus on a detail or aspect of the situation that is not quite as bad as it first seems. Participants were also provided an example of reinterpretation to ensure understanding of the instructional cue (e.g., “The car broke down, but help came shortly after”). Participants then provided three ratings (aversiveness, negative affect, positive affect; 5 s each) before responding briefly to a writing prompt “What did you think about?” (10 s). Participants then clicked to advance to the next trial (Figure 2).

The Social Condition followed a similar procedure, except that instead of seeing a cue to “reinterpret by yourself” they saw a cue to “reinterpret with [social support figure’s first name].” Following the reinterpret with [social support figure’s first name] cue, participants were instructed to think of what their support figure might say to help them think differently about the image. Participants were then told they could (1) try to think of how their support figure might help them come up with a story about how the scenario in the image will have a positive outcome or (2) think of how their support figure might help them focus on a detail or aspect of the situation so that it is not quite as bad as it first seems. Participants were provided an additional example reinterpretation from a hypothetical support figure’s perspective to ensure understanding of the instructional cue.

Within each condition, participants were given two 1-minute breaks after 15 trials during which they listened to a non-emotional music clip (https://stock.adobe.com/search/audio?k=462873381). In between the two conditions, participants took a 3-minute break to watch a video meant to provide a brief non-emotional distraction

(https://www.youtube.com/watch?v=EajLVkEpXeE&list=PL39_ud5aKSvnYDhKdB7wTDUZRiE8RaJat&index=158). Each condition lasted approximately 30 minutes.

At the end of the procedures, participants were asked about their perceptions of the study. The researcher debriefed participants on the details of the study and provided them an option of watching one of three pleasant video clips shown to improve mood in previous research (see Appendix B for video clip links). Participants received course credit upon completion.

Materials/Apparatus

Aversiveness and Affect Ratings

To measure aversiveness, participants were asked "How bad does this image seem?" on a 5-point scale ranging from 1 (*not bad at all*) to 5 (*extremely bad*). To measure negative affect, participants were asked "How negative do you feel?" on a 5-point scale ranging from 1 (*not negative at all*) to 5 (*extremely negative*). To measure positive affect, participants were asked "How positive do you feel?" on a 5-point scale ranging from 1 (*not positive at all*) to 5 (*extremely positive*).

Adherence Ratings

To examine participant adherence to the reinterpret cue, two undergraduate research assistants independently rated participant written responses on the following scale: 1 (*not at all*), 2 (*somewhat*), 3 (*fully*). For example, a written response that indicated a reinterpretation of the image (i.e., the participant was judged to have thought of the image in a different way) received a rating indicating higher adherence to the reinterpret cue. Interrater reliability was good for ratings in the Social Condition (ICC = .83) and the Solo Condition (ICC = .85). Ratings from the two raters were averaged as a variable to include in analyses.

Exploratory Self-Report Measures

Exploratory measures in Part 1 included measures of perceived social support (Multidimensional Scale of Perceived Social Support; Zimet et al., 1988), secure attachment (Measure of Attachment Qualities – Security Subscale; Carver, 1997), emotion regulation tendencies (Emotion Regulation Questionnaire; Gross & John, 2003), and depression and anxiety symptoms (Depression, Anxiety and Stress Scale - 21 Items; Lovibond & Lovibond, 1995). These measures are not analyzed in the current paper.

Data Analysis

Data were analyzed in RStudio 2022.07.0.548 (RStudio Team, 2022). We examined mean ratings of adherence from written responses for the reinterpret cue in the Social Condition and the Solo Condition and compared means using a paired sample *t*-test.

Linear mixed-effects model analyses were conducted using the 'lme4' package ('lmer' function). For each self-reported outcome (aversiveness, negative affect, positive affect), linear mixed-effects model analyses were conducted. This analytic approach accounts for non-independence of errors due to the repeated-measures design and better accommodates missing data compared to other common analytic approaches (e.g., repeated measures ANOVA). The data were analyzed in two stages given the incomplete design (Sahi et al., 2021).

First, the data was filtered for look trials only. Linear mixed-effects models were conducted with valence of the images (negative vs. neutral) as the predictor variable, self-rated aversiveness, negative affect, and positive affect (trial-level) as the outcome variables, and participant ID as the group-level random variable. These models served as manipulation checks and ensured that participants had greater aversiveness, greater negative affect, and lower positive affect in response to the negative images than the neutral images.

Next, the dataset was filtered for negative image trials only. A linear mixed-effects model was run with instruction type (reinterpret vs. look) and condition (Solo vs. Social) as the predictor variables, self-rated aversiveness, negative affect, and positive affect as the outcome variables, and participant ID as the group-level random variable. Since the primary comparison of interest was between the solo-reinterpret and social-reinterpret conditions, an interaction term between instruction and condition was included and followed up with Tukey-adjusted pairwise comparisons to specifically compare solo-reinterpret versus social-reinterpret. Gender identity, order, and version (1-4) were tested as covariates but were removed from models because they were nonsignificant.

To examine effects of ratings of adherence, we re-ran linear mixed-effects models examining negative image trials with ratings of adherence to the reinterpret cue in both Solo and Social Conditions as covariates. Lastly, we calculated Pearson correlations between ratings of adherence to the reinterpret cue and reappraisal efficacy in each task.

Results

Ratings of Adherence

Adherence ratings of written scripts for the reinterpret cue were higher in the Social Condition (M = 2.47, SD = .70) than the Solo Condition (M = 2.20, SD = .83), $t(120) = 3.47$, $p < .001$.

Aversiveness

As evidence for difference between negative and neutral images, linear mixed-effects model analyses of "look" trials indicated a significant effect of valence (i.e., neutral vs. negative) on aversiveness, b = -2.06, $t(6934) = -94.24$, $p < .001$, 95% CI = [-2.11, -2.02], such that participants reported higher aversiveness on negative–look trials (M = 3.37, SD = .57) than neutral–look trials (M = 1.31, SD = .24) across Social and Solo conditions.

The analysis of "negative" trials revealed a significant interaction between condition and instruction, $b = .32$, $t(6904) = 6.13$, $p < .001$, 95% CI = [.22, .43], such that participants reported greater aversiveness during solo–reinterpret trials ($M = 2.87$, $SD = .76$) than social–reinterpret trials ($M = 2.54$, $SD = .69$), $t(6905) = 8.57$, $p < .001$ (Figure 3). By contrast, there was no difference between the solo–look trials ($M = 3.38$, $SD = .06$) and social–look trials ($M = 3.38$, $SD = .06$), $t(6904) = -.10$, $p > .99$. The analysis of "negative" trials revealed that the interaction between condition and instruction remained significant when accounting for adherence ratings for the reinterpret cue ($b = .32$, $t(6904) = 6.13$, $p < .001$, 95% CI = [.22, .43]).

Negative Affect

Linear mixed-effects model analyses of "look" trials indicated a significant effect of valence on negative affect, $b = -1.82$, $t(6899) = -83.99$, $p < .001$, 95% CI = [-1.86, -1.76], such that participants reported higher negative affect on negative–look trials ($M = 3.22$, $SD = .66$) than neutral–look trials ($M = 1.40$, $SD = .30$) across Social and Solo conditions.

The analysis of "negative" trials revealed a significant interaction between condition and instruction, $b = .25$, $t(6857) = 5.01$, $p < .001$, 95% CI = [.15, .35], such that participants reported greater negative affect during solo–reinterpret trials ($M = 2.66$, $SD = .79$) than social–reinterpret trials ($M = 2.35$, $SD = .65$), $t(6858) = 8.84$, $p < .001$ (Figure 3). By contrast, there was no difference between the solo–look trials ($M = 3.25$, $SD = .07$) and social–look trials ($M = 3.19$, $SD = .06$), $t(6857) = 1.77$, $p = .29$). The analysis of "negative" trials revealed that the interaction between task and instruction remained significant when accounting for adherence ratings for the reinterpret cue ($b = .25$, $t(6857) = 5.01$, $p < .001$, 95% CI = [.15, .35]).

Positive Affect

Linear mixed-effects model analyses of "look" trials indicated a significant effect of valence on positive affect, $b = .69$, $t(6883) = 36.11$, $p < .001$, 95% CI = [.65, .72], such that participants reported lower positive affect on negative–look trials ($M = 1.32$, $SD = .27$) than neutral–look trials ($M = 2.01$, $SD = .68$) across Social and Solo conditions.

The analysis of "negative" trials revealed a significant interaction between condition and instruction, $b = -.19$, $t(6884) = -5.22$, $p < .001$, 95% CI = [-.26, -.12], such that participants reported lower positive affect during solo–reinterpret trials ($M = 1.77$, $SD = .55$) than social–reinterpret trials ($M = 1.96$, $SD = .60$), $t(6884) = -7.59$, $p < .001$ (Figure 3). By contrast, there was no difference between the solo–look trials ($M = 1.32$, $SD = .03$) and social–look trials ($M = 1.32$, $SD = .03$), $t(6884) = -.21$, $p > .99$. The analysis of "negative" trials revealed that the interaction between task and instruction remained significant when accounting for adherence ratings for the reinterpret cue ($b = -.19$, $t(6884) = -5.22$, $p < .001$, 95% CI = [-.26, -.12]).

Association between Reappraisal Efficacy and Ratings of Adherence

Solo reappraisal efficacy (as measured by outcomes of aversiveness, negative affect, positive affect) was moderately correlated with ratings of adherence (of written reappraisals by independent raters) in the Solo Condition (aversiveness: $r = .51$, $p < .001$; negative affect: $r = .53$, $p < .001$; positive affect: $r = -.56$, $p < .001$). Similarly, social reappraisal efficacy was moderately correlated with rated generation of a reappraisal in the Social Condition (aversiveness: $r = .36$, $p < .001$; negative affect: $r = .36$, $p < .001$; positive affect: $r = -.44$, $p < .001$).

Discussion

The present study tested whether having a reminder of a social support figure is more effective than not having a reminder when reappraising stressful images and examined the

influence of such instructed reappraisals on aversiveness, negative affect, and positive affect. In line with our hypotheses, our findings indicate that compared to when reappraising alone, young adults at risk for depression and anxiety experience larger decreases in aversiveness and negative affect as well as a larger increase in positive affect when they are reminded of the individual who provides them the most daily support during reappraisal. We also found that higher adherence ratings to the reinterpretation cue were associated with more beneficial outcomes (aversiveness, negative affect, and positive affect) in both Social and Solo conditions. We contribute to a growing literature using advanced methodology by demonstrating the benefit of social support on distinct reappraisal and affect outcomes in a clinically relevant sample.

Individuals who develop depression and anxiety tend to have cognitive biases and difficulty reinterpreting stressful situations effectively (Marroquín, 2011; Mineka & Sutton, 1992; Reeck et al., 2016; Salters-Pedneault et al., 2006; Werner et al., 2011). In addition, these clinical populations experience excesses in negative affect and deficits in positive affect as well as more negative appraisals of situations, biased judgements of aversive outcomes, and tendencies to catastrophize (Craske & Pontillo, 2005; Craske et al., 2016; Gotlib & Joorman, 2010; Mineka & Sutton, 1992). As such, we fill an important gap in the literature by exploring the extent of cognitive change in a clinically relevant sample, the impact of cognitive change on affect and perceived negativity of situations, and how that impact may be augmented by social support, a well-supported factor contributing to positive mental health outcomes (e.g., Auerbach et al., 2011; Metts et al., 2021; Metts et al., 2022). Importantly, our pattern of results in this at-risk sample provides confirmatory evidence that social support may be a resilience factor that leads to positive mental health outcomes in the face of stress because of assistance with emotion regulation (Kalisch et al., 2015).

First, we found that reappraisal led individuals to perceive negative images as less aversive when reminded of a social support figure compared to when not reminded of the social support figure, providing evidence for the benefit of social support's influence on an underexplored, clinically relevant outcome. These findings are in line with the idea that social support may buffer the effects of stress by assisting individuals to change the meaning of the situation (Thoits, 1986) or lessening how aversive a situation seems by changing people's perceptions regarding their abilities to cope with an aversive situation (Hornstein et al., 2022). The finding may also reflect increased safety associated with social support (Bowlby, 1969/1982).

Second, we found that reappraisal led to individuals experiencing less negative affect in response to a negative image when reminded of a social support figure compared to when not reminded of the social support figure. These results are in line with a previous experimental test suggesting that social support can enhance reappraisal in terms of lessening negative affect (Sahi et al., 2021). However, we add to previous work by demonstrating that the reminder of a specific social support figure by using a neutral – as opposed to directive (i.e., cueing emotional change) – reappraisal instruction reduces negative effect, that disambiguates the effects. Secondarily, the reminder of a social support figure during reappraisal has similar effects across all genders and is comparable to a dyad interaction found in only female friends (Sahi et al., 2021). Consequently, we add to previous findings by demonstrating the augmenting effect of social support upon affective change in response to instructed reappraisal.

Third, we found that reappraisal led to individuals experiencing more positive affect in response to negative images when reminded of a social support figure. Whereas findings from solo reappraisal provide evidence for increasing positive affect (e.g., McRae et al., 2012; Song et

al., 2018), this is the first study to our knowledge to demonstrate this benefit for social reappraisal. Our findings lend support to a theory posed by Sahi et al. (2021) that imagining a reinterpretation from a social support figure may be rewarding and comforting. In addition, the broaden-and-build theory of positive emotions posits that positive emotions affect thought patterns and behavioral responses, which makes one's mindset broader than when experiencing negative emotions (Fredrickson et al., 2004). Positive affect has also been found to buffer the impact of stress on symptoms of depression and anxiety (Sewart et al., 2019). As such, the impact of social support upon positive affect in response to negative images suggests that social reappraisal may be a path to experiencing increased positive emotions, which may benefit a person's outlook, coping resources, and stress response.

Further, results indicated that in both tasks, the more adherence to the instructed reinterpretation, the more benefit participants received on each outcome from reappraisal. The analysis of written reinterpretations is a novel addition to cognitive reappraisal paradigms that provides evidence for engagement in a cognitive change strategy. The current data increases our confidence that the generation of reinterpretations within each task contributed to the outcomes beyond just the mere reminder of a social support figure.

This study has several strengths, including methodological advances to the study of social support's influence on cognitive reappraisal. These advances include the use of neutral reappraisal cue instructions that allow for separation of reappraisal and affect, thus enabling greater mechanistic precision. We also collected aversiveness and positive affect ratings, in addition to negative affect ratings, as trial-by-trial outcomes and studied individuals who are elevated on neuroticism, further increasing clinical applicability. Separately, we addressed limitations in previous experimental investigations of solo reappraisal (e.g., Ochsner et al., 2004)

and social reappraisal (e.g., Sahi et al., 2021) that assume cognitive change by including an explicit manipulation check with written responses, a component that is particularly important to assess in individuals at risk for depression and anxiety who may have difficulty generating alternative ways of thinking as a result of cognitive biases (e.g., Marroquín, 2011; Mineka & Sutton, 1992). As such, our results lend more confidence to the idea that capitalizing on the benefits of social support during cognitive reappraisal has potential clinical utility.

However, this study is not without limitations. First, this study was conducted in an undergraduate sample, as opposed to a clinical sample. As such, results should be replicated in a clinical sample to increase confidence in the utility of our findings for clinical populations. We also did not collect socioeconomic status or cultural background information for participants. Because of this, we cannot examine how social support influence on cognitive reappraisal may be affected by these demographic variables. In addition, example reappraisals given along with our reinterpretation instruction suggested that participants could either think of a positive outcome of depicted scenarios or focus on a detail or aspect of the situation that did not seem as bad as it did at first. Despite being in line with instructions from other reappraisal paradigms (e.g., Sahi et al., 2021), we propose two different ways to change cognition (i.e., view the situation more positively or view the situation less negatively), which prevents claims about which method may be more beneficial in reappraisal. Future research should study each approach separately to clarify the potential benefit of each method. Separately, we collected written responses after participants provided aversiveness and affect ratings. This design choice was made to replicate existing methodologies (i.e., collect ratings promptly after instructional cue) without introducing confounds. However, the sequence may have confounded the ratings, and limited the extent to which adherence could be considered as a contributor to changes in

aversiveness or affect. Lastly, we used negative images that were not necessarily personally relevant within a reappraisal paradigm and therefore lacked ecological validity. Future research should examine the impact of social support on cognitive reappraisal in the context of stressful life events that are personally relevant.

Despite these limitations, our findings have important clinical implications. It may be that cognitive interventions for depression and anxiety can benefit from incorporating perspectives of social support figures when collaborating on alternate thought generation as a part of cognitive restructuring to benefit aversiveness, negative affect, and positive affect. Separately, given the demonstrated benefit of social support on cognitive reappraisal in individuals at risk for depression and anxiety, social reappraisal might be included as a prevention strategy for attenuating stress effects on affect and perceptions of aversiveness. These findings also speak to the potential value of including a support figure in interventions to enhance reappraisal. However, randomized controlled clinical and prevention trials are necessary to confirm whether social appraisal may produce additional benefit on mood and anxiety. In addition, the risks of individuals becoming dependent on a social support figure for reappraisal assistance (Dixon-Gordon et al., 2015; Hofmann, 2014) and individuals benefitting only from reappraisal that is state-specific (as opposed to that which can generalize across situations; Sahi et al., 2021) warrant further examination.

Conclusions

Our experimental test evaluating the influence of social support upon instructed reappraisal of stressful situations indicates that the reminder of a social support figure may reduce how aversive a stressful situation seems as well as improve how negative or positive a person feels in response to stress. As such, we provide support for cognitive reappraisal of

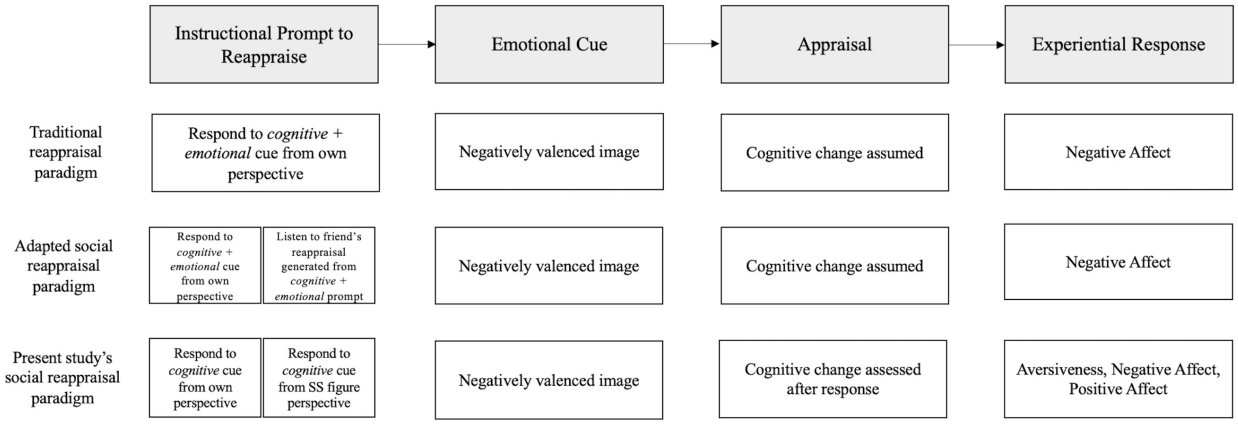
stressors as a mechanism of social support that may lead to lower depression and anxiety. The increased clinical utility of this study lends confidence to the idea that the benefits of social support could be incorporated into clinical interventions and prevention efforts to lessen disorder impact and increase resilience in response to stress.

Table 1. Descriptive Statistics and Pearson Correlations Among Symptoms, and Characteristics

	M (*SD*)	1	2	3	4	5	6	7	8
1. Neuroticism (Sum)	28.60 (4.30)	--							
2. Perceived Social Support (Mean)	5.26 (.98)	.07	--						
3. Attachment Security (Sum)	10.99 (1.30)	.02	.23*	--					
4. Cognitive Reappraisal (Sum)	25.94 (6.86)	-.20*	.12	.11	--				
5. Expressive Suppression (Sum)	15.79 (5.55)	-.03	-.15	-.09	.11	--			
6. Depression Symptoms (Sum)	8.12 (4.89)	.16	-.27**	-.09	-.28**	.16	--		
7. Anxiety Symptoms (Sum)	6.20 (4.10)	.18*	-.06	-.10	-.17	.13	.46**	--	
8. Stress (Sum)	9.62 (4.32)	.33**	-.12	-.04	-.28**	.08	.60**	.59**	--
9. Total Symptoms (Sum)	23.93 (11.12)	.26**	-.19*	-.09	-.30**	.15	.84**	.80**	.87**

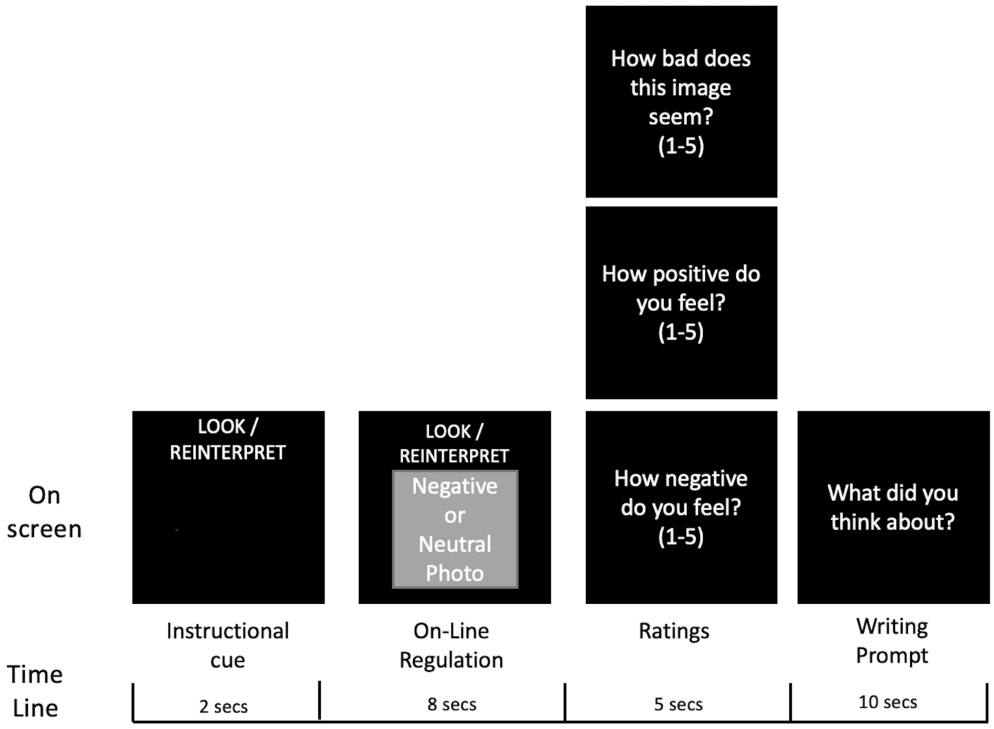
Note. Neuroticism was assessed with the 12-item Eysenck Personality Questionnaire-Neuroticism scale (Eysenck & Eysenck, 1975). Perceived social support was assessed with the Multidimensional Scale of Perceived Social Support; Zimet et al., 1988). Secure attachment was assessed with the Measure of Attachment Qualities – Security Subscale; Carver, 1997). Emotion regulation tendencies were assessed by the Emotion Regulation Questionnaire (Gross & John, 2003). Depression and anxiety symptoms as well as stress were assessed by the Depression, Anxiety and Stress Scale - 21 Items (Lovibond & Lovibond, 1995). * $p < .05$, ** $p < .01$

Figure 1. Comparison of Experimental Paradigms Testing the Process Model of Emotion Regulation



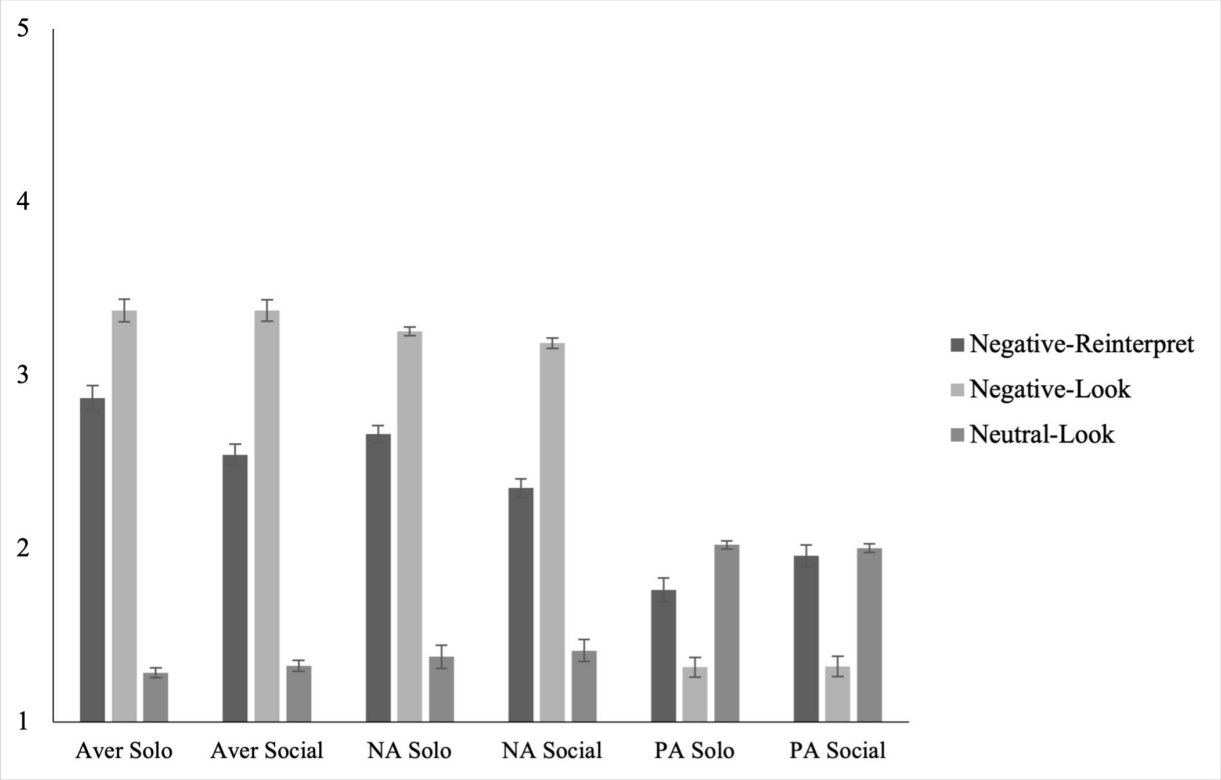
Note. Depiction of how emotion regulation is tested in traditional reappraisal paradigms (e.g., Ochsner et al., 2004), social reappraisal paradigms (Sahi et al., 2021) and in the present study. Notable changes include how cognitive change and experiential responses are assessed in the present study.

Figure 2. Timeline for Events on Each Trial in Reappraisal Tasks



Note. An initial cue instructs participants to look or reinterpret (Solo Condition: "reinterpret by yourself"; Social Condition: "reinterpret with [social support figure's first name]"), which is followed by a photo presentation during which participants follow the instruction that is prompted. Participants then provide a rating of their current negative and positive affect as well as aversiveness of the depicted scenario and respond briefly to a writing prompt before the onset of the next trial.

Figure 3. Aversiveness, Negative Affect, and Positive Affect Across Conditions



Note. Aver = Aversiveness. NA = Negative Affect. PA = Positive Affect. "Solo" refers to the Solo Condition. "Social" refers to the Social Condition.

General Discussion

Social support is associated with reduced risk for depression and anxiety onset and lower depression and anxiety symptom severity. Despite abundant evidence to support this association, less research has been done on *how* social support confers benefit. The three studies in this dissertation assessed the pathway linking social support to depression and anxiety outcomes through emotion regulation in clinical and non-clinical samples. This pathway was examined within the context of evidence-based intervention for anxiety disorders in which I explored the bidirectional associations between perceived social support and anxiety sensitivity – with changes from high to low levels of anxiety sensitivity being a proxy for reappraisal of somatic symptoms – and how these bidirectional associations are affected by cognitive behavioral therapy (Study 1). I also examined how adult attachment security – a proxy for perceived social support – related to subsequent tendencies to use cognitive reappraisal and expressive suppression and shared symptoms of depression and anxiety (Study 2). Finally, I experimentally manipulated the influence of social support on reappraisal of stressful images to examine benefit regarding, aversiveness, negative affect, and positive affect outcomes (Study 3). This series of studies further elucidates a mechanism associated with social support and enhances the clinical utility of attending to social support as it relates to emotion regulation.

In line with hypotheses, Study 1 found some evidence to indicate that increases in perceived social support were associated with decreases in anxiety sensitivity, and vice versa. Further, cognitive behavioral therapy led to anxiety sensitivity decreases through perceived social support increases. In addition, cognitive behavioral therapy led to perceived social support increases through anxiety sensitivity decreases. These associations seemed to be explained in part by depression and anxiety symptoms. Study 2 found that, in partial support of hypotheses,

higher adult attachment security was significantly associated with subsequent lower expressive suppression tendency. In addition, higher cognitive reappraisal tendency and lower expressive suppression tendency were associated with lower subsequent shared symptoms of depression and anxiety. However, there was no evidence that higher attachment security led to lower subsequent shared symptoms of depression and anxiety indirectly through emotion regulation tendencies. Study 3 results indicated that, in line with hypotheses, cognitive reappraisal with the influence of social support was more effective at decreasing aversiveness of a stressor, decreasing negative affect, and increasing positive affect compared to cognitive reappraisal without the influence of social support. In addition, analysis of written reappraisals indicated that the extent to which participants reappraised was higher with the influence of social support.

Support for the specific model tested by this dissertation – in which social support relates to lower depression and anxiety through positive impact on reappraisal – was supported by Study 3 only. This is unsurprising given that the experiment in Study 3 was designed explicitly to test the model whereas Studies 1 and 2 tested the model with pre-collected data that was available from studies with different overarching aims. Study 2, in contrast, did not find that adult attachment security prospectively predicted symptoms through emotion regulation tendencies. Apart from the fact that Studies 1 and 2 were conducted in pre-collected data, the discrepancy in support for the tested model may also be due to measurement. Study 2 operationalized emotion regulation as self-reported tendencies to use emotion regulation strategies in general, whereas Study 3 operationalized emotion regulation as a task-based measure of capacity to reappraise stressful images. Differences in associations as a result of measuring emotion regulation tendency through self-report measures versus capacity assessed by task performance are well-documented in emotion regulation research (e.g., Guassi Moreira et al., 2022; Lincoln et al.,

2022; McRae et al., 2012; Silvers & Guassi Moreira, 2019). The difference in associations using performance-based measures of capacity versus self-reported perceptions of emotion regulation tendency may be due to biases inherent in self-report measurement that contribute to disconnect between one's perceived affective experience and objective reappraisal performance (Guassi Moreira et al., 2022). Separately, task-based measures of reappraisal may not generalize to how reappraisal is implemented in the real world (Guassi Moreira et al., 2022). In addition, social support was operationalized differently in Studies 2 and 3. Study 2 used adult attachment security within close relationships in general as a proxy for social support, whereas Study 3 operationalized this construct as the reminder of a social support figure who provided participants with the most daily support. The specificity entailed with bringing a single close relationship to mind may have strengthened the effects of social support on emotion regulation compared to a proxy for social support captured by a generic self-report measure of trait-like experiences in close relationships.

Study 1 did not directly test the overarching model given a lack of mediational test of perceived social support on anxiety and depression symptoms through anxiety sensitivity. This model was not the focus of Study 1 given the interest in whether evidence-based treatment may impact the relationship between social support and reappraisal. Nevertheless, Study 1 demonstrated evidence of reciprocal associations between perceived social support and a proxy for reappraisal related to somatic symptoms of anxiety and the influence of evidence-based intervention on these associations.

The positive influence of social support on emotion regulation was evidenced by Studies 1, 2, and 3. Specifically, increases in perceived social support were associated with reductions in harmful appraisals of symptom stressors; experiences in close relationships influenced

tendencies to express emotions; and social support enhanced reappraisal capacities. The positive influence of perceived social support on anxiety sensitivity (Study 1) expanded the understanding of social support's benefit on stress response. This line of theoretical work typically focuses on how social support may benefit individuals in response to life stressors (Cohen & McKay, 1984; Taylor, 2011; Thoits, 1986) and therefore overlooks stress that may result from symptoms. Further, evidence to suggest that higher perceived social support may relate to lower expressive suppression tendency (Study 2) contributed to a broader understanding of how social support may benefit emotion regulation. Most research examining the influence of social support on emotion regulation focuses on social-emotional behaviors in live interactions, including seeking companionship, discussing stressors, or asking for support in terms of reappraisal (Reeck et al., 2016; Williams et al., 2018), and focuses less on intrapersonal constructs related to social support. Study 3's findings provided experimental support for a commonly theorized benefit of social support on reappraisal of stressors. Study 3 added to this body of research by demonstrating effects of the reminder of a social support figure on reappraisal capacity and addressing the conflation of reappraisal and emotion change in instructions, thereby strengthening evidence for social support's influence on cognitive reappraisal.

Social support's positive influence on depression and anxiety outcomes was supported by Studies 1 and 3. Although the association between social support and symptoms of depression and anxiety was not the focus of analyses in Studies 1 and 3, correlational evidence included in these studies supported weak negative relationships between perceived social support and symptoms of depression and anxiety. These associations are in line with the large body of evidence relating social support to lower depression and anxiety (e.g., Auerbach et al., 2011;

Bolger & Eckenrode, 1991; Colarossi & Eccles, 2003; Metts et al., 2021; Metts et al., 2022; Reinelt et al., 2014; Zimmermann et al., 2020). Study 2 failed to find an association between adult attachment security and symptom distress shared by depression and anxiety. Although attachment security is related to perceived social support (Florian et al., 1995; Moreira et al., 2003; Priel & Shamai, 1995; Sarason et al., 1986), a measure of perceived social support may have been preferable given the pattern of results found in Studies 1 and 3 and evidence for perceived social support's associations with mental health and resilience outcomes (Auerbach et al., 2011; Dour et al., 2014; Kalisch et al., 2015).

Together, results from Studies 1, 2, and 3 highlight the value of attending to the interpersonal influence on intrinsic intrapersonal emotion regulation tendency and capacity and resulting depression and anxiety outcomes, in addition to the potential for intervention to impact these associations. These associations were demonstrated in the absence of (Study 2) and presence of stressors (Study 1: somatic symptoms; Study 3: stressful images). These associations were also examined in clinical (Study 1), non-clinical (Study 2), and at-risk (Study 3) samples of adults, increasing the generalizability of these associations and their resulting implications for both prevention and intervention approaches.

In line with one of the overarching aims of this dissertation, the three studies addressed existing limitations in the literature on social support, emotion regulation, and depression and anxiety. First, this dissertation focused on both depression and anxiety outcomes, including the influence of depression and anxiety symptoms on specific reciprocal associations and intervention effects (Study 1), the influence of adult attachment security and emotion regulation tendencies on symptom distress shared by depression and anxiety (Study 2), and how the influence of social support on reappraisal impacted affect and aversiveness (Study 3). As such, I

contributed to a dearth of research on anxiety compared to depression regarding social support and emotion regulation and demonstrated the transdiagnostic relevance of these associations. Second, this dissertation addressed existing limitations through methodology and design. Studies 1 and 2 contributed to the lack of longitudinal research on social support, emotion regulation, and depression and anxiety. Results from these studies indicated that perceived social support or a related construct (i.e., attachment security) prospectively predicted reduced misappraisals of somatic stressors (Study 1) and tendency to express emotions (Study 2). Third, Study 3 employed experimental manipulation and collected measures in a reappraisal task that are associated with both depression and anxiety (i.e., affect and aversiveness). As a result, Study 3's findings lend confidence to the idea of social support's influence on reappraisal of stressors as a mechanism that is associated with decreased depression and anxiety outcomes.

In addition, Study 2 contributed to this field of research by examining how adult attachment security and emotion regulation tendencies related to symptoms of depression and anxiety measured in a dimensional framework. As such, results of Study 2 provide more clarity around how tendencies to use cognitive reappraisal or expressive suppression – but not adult attachment security – predict future distress shared by depression and anxiety. The approach of examining these constructs in relation to shared symptom distress combats limitations in the field of studying these associations as they relate to symptoms of one class of disorders or categorical classification (Coghill & Sonuga-Barke, 2012; Kircanski et al., 2017). As a result of this approach, I demonstrated how emotion regulation tendencies predict transdiagnostic symptomology over time, implying that the same principles in treatment may be relevant to treating distress common to anxiety and depression as opposed to specific depressive and anxiety disorder symptoms or diagnoses. Lastly, this dissertation increases the clinical utility of research

linking social support to emotion regulation. I addressed this limitation by exploring the effect of cognitive behavioral therapy on these associations in a clinical sample (Study 1) and used reappraisal instructions that better approximate language found in cognitive interventions in an at-risk sample (Study 3). As such, the dissertation provides more knowledge regarding how the process of social support influencing emotion regulation may be impacted by, and incorporated into, interventions to benefit clinical and at-risk populations.

However, this dissertation is not without limitations. First, I explored the impact of evidence-based intervention on social support and reappraisal of somatic symptoms solely in the context of cognitive behavioral therapy for anxiety disorders (Study 1). As such, it is unknown how these constructs may be affected by other interventions that may change perceptions of social support and reappraisals of symptom stressors (e.g., interpersonal therapy; third wave cognitive behavioral approaches). In addition, despite high comorbidity of depression in the CALM sample, it is unclear how results from the CALM sample may generalize to other clinical samples, including primarily depressed patients or transdiagnostic samples. Separately, I tested the dissertation's model primarily in a unidirectional manner. Specifically, I examined the influence of social support on emotion regulation to influence symptoms as opposed to an alternative model in which emotion regulation influences social support to change symptoms. Results from Study 1 demonstrated a bidirectional influence between perceived social support and anxiety sensitivity. In addition, it has been found that individuals with more adaptive emotion regulation tendencies or capacities are better able to increase the size of their social support networks and have higher quality relationships (Gross & John, 2003; Phillioppot et al., 2004; Reindl et al., 2016). As such, there is evidence to suggest that more adaptive emotion

regulation may increase the likelihood of experiencing social support benefits, which may lead to lower symptoms.

Similarly, the focal emotion regulation strategy throughout this dissertation was cognitive reappraisal. However, as evidenced by the results of Study 2, other emotion regulation strategies – including expressive suppression – are likely impacted by social support and should be the focus of future research. Emotion regulation strategies to prioritize in future research may be those found in clinical interventions, including acceptance and problem solving (Aldao et al., 2010). In studies that considered the influence of stress (Studies 1 and 3), I did not consider life stress that was personally relevant. Future work can incorporate measurement of chronic and episodic stressors (e.g., Hammen et al., 1987; Hammen, 1991) to examine how social support may benefit emotion regulation in response to personally relevant life stressors and have a positive impact on mental health outcomes. Separately, this dissertation focused on symptom distress as the focal outcome throughout studies. Future work could consider incorporating residualization-based resilience outcomes that allow correction for individual differences in levels of stressor exposure and a clear definition of a given time window of stressor exposure relative to mental health outcomes (Kalisch et al., 2021). In addition, this dissertation operationalized constructs of interest differently in each study as a result of available data for Studies 1 and 2. As such, the use of diverse measurement and indicators of the constructs of interest contribute to difficulty with interpretation and application of findings as a whole. Lastly, this dissertation relies heavily on self-report measurement of psychosocial constructs. Future work should prioritize measures including clinician- or interview-rated assessments and explore non-psychosocial levels of analysis relevant to these constructs.

The current studies suggest several important future directions separate from the ideas proposed to address limitations. The clinical implications from each study – including improving misappraisals of somatic symptoms through targeting perceptions social support, encouraging emotional expression through attending to experiences in close adult relationships, and interpreting stressors more adaptively when bringing a social support figure to mind – should be directly tested in randomized controlled trials to confirm suggested benefits. Separately, considerations related to identity, diversity, and culture should also be prioritized in future research on social support, emotion regulation, and depression and anxiety given evidence to suggest variations in social support regarding gender, ethnicity, age, and culture (Taylor, 2011; Vaux, 1985) and emotion regulation regarding gender and culture differences (Kwon et al., 2013; Sun & Lau, 2018). Lastly, given a recent shift in the field to focus on regulatory flexibility and emotion regulation diversity as opposed to the use of single emotion regulation strategies (Aldao et al., 2015; Bonanno & Burton, 2013; Wen et al., 2021), considering context as it relates to social support and emotion regulation is crucial to explore in future work. For example, the influence of social support on emotion regulation could be more effective in some contexts (e.g., assisting with reappraisal of minor life stressor) compared to others (e.g., assisting with reappraisal of major life stressor).

This dissertation also has notable clinical implications. Given the demonstrated benefits of social support, thorough assessment of social support at intake appointments and throughout treatment as a means of evaluating resources and strengths should be prioritized. For clients without adequate social support networks, clinicians may need to help facilitate environmental changes to increase access to adequate support. Psychoeducation on the utility of social support for reappraising harmful beliefs about symptoms or life stressors should also be provided to

clients and any support figures who may be involved in treatment. In addition, through cognitive restructuring techniques, it may be helpful to challenge perceptions of social support and encourage clients to look for evidence to facilitate more realistic conclusions about support availability or de-catastrophize events that lead to faulty conclusions about social support networks. Finally, findings of this dissertation also highlight the potential value of including social support figures in therapy for reappraisal assistance related to life or symptom stressors or to encourage emotional expression. Studies have explored involving partners in interventions including anxiety disorder treatment to address partner accommodation (e.g., Cerny et al., 1987; Craske et al., 1989) and in post-traumatic stress disorder treatment to decrease symptom severity, enhance relationship functioning, and reduce exposure dropout (e.g., Acierno, 2019; Monson & Fredman, 2012). In addition, there is a growing body of research on the inclusion of peer coaching by community members and volunteers to deliver evidence-based treatment strategies (e.g., Andreae et al., 2021; Rosenberg et al., 2022). However, including a social support figure in therapy to benefit emotion regulation, depression, and anxiety has yet to be the focus of research.

The three studies of this dissertation demonstrate the effect of cognitive behavioral therapy on changes in perceptions of social support and misappraisals of anxiety symptoms, the influence of experiences in close relationships on subsequent expression of emotion, and the ability of social support to enhance cognitive reappraisal to benefit affect and perceived aversiveness of stressors. As such, findings from these studies highlight the value of attending to the interpersonal influence on emotion regulation and resulting symptom distress from intervention and prevention standpoints. Future research should explore the influence of social support on other emotion regulation strategies, consider context as it relates to social support's influence on emotion regulation, and examine outcomes that more closely approximate

resilience. Intervention and prevention approaches can account for the implications of this dissertation by incorporating the benefits of social support on emotion regulation into psychoeducation and cognitive techniques as well as exploring the inclusion of social support figures into treatment to enhance emotion regulation.

Appendices

Appendix A: Task Training Instructions from PowerPoint (Study 3)

Slide 1

Instructions

Solo Task

Slide 2

The solo task will start with a word at the top of the screen.

You will see either 'LOOK' or 'REINTERPRET BY YOURSELF'

Next, you'll see a picture …

Slide 3

[example IAPS image 1]

… Like this one

Slide 4

When you see the word 'LOOK,' just look at the picture and think about it like you normally would.

Slide 5

LOOK

[example IAPS image 1]

Slide 6

After you look at the picture, you will make 3 ratings on a series of 5-point scales.

Slide 7

One scale will ask about positive emotions. This could include feeling optimistic or hopeful. On this scale, you can rate that you feel not positive at all, slightly positive, moderately positive, very positive, or extremely positive.

Slide 8

One scale will ask about negative emotions. This could include feeling sad or fearful. On this scale, you can rate that you feel not negative at all, slightly negative, moderately negative, very negative, or extremely negative.

Slide 9

One scale will ask about how bad the image seems. This could include the image seeming awful or scary. On this scale, you can rate that image seems not at all bad, slightly bad, moderately bad, very bad, or extremely bad.

Slide 10

So how positively does the image you saw before make you feel?

Slide 11

So how negatively does the image you saw before make you feel?

Slide 12

So how bad does the image you saw before seem?

Slide 13

After you make 3 ratings, you will write briefly about what you thought about. Keep it short.

Slide 14

So what did you think about as you looked at this image?

Slide 15

When you see the words 'REINTERPRET BY YOURSELF,' try to think of the image in a different way.

For example, try to tell yourself a story about how the scenario in the image will have a positive outcome.

You could also focus on a detail or aspect of the situation that isn't quite as bad as it first seems.

Slide 16

For example, if you don't do as well as you wanted to on an exam, you might tell yourself that it was only one test and that you'll do much better next time.

Slide 17

[example IAPS image 1]

When you think about the picture in the way you just described, how does it make you feel? How does the image seem now?

Slide 18

So how positively does the image you saw before make you feel?

Slide 19

So how negatively does the image you saw before make you feel?

Slide 20

So how bad does the image you saw before seem?

Slide 21

So what did you think about as you tried to change how you felt about this image?

Slide 22

The rating scales will change order throughout. It is important to pay attention!

Slide 23

Let's practice.

Slide 24

Any questions?

Slide 25

Instructions

Social Task

Slide 26

Social Task

The social task will start with a word at the top of the screen.

You will see either 'LOOK' or 'REINTERPRET WITH [Support]'

Next, you'll see a picture …

Slide 27

When you see the word 'LOOK,' just look at the picture and think about it like you normally would.

Slide 28

When you see the words 'REINTERPRET WITH [Support],' try to think of what your support figure might say to help you think about the image differently.

For example, try to think of how your support figure might help you come up with a story about how the scenario in the image will have a positive outcome.

You could also think of how your support figure might help you focus on a detail or aspect of the situation so that it isn't quite as bad as it first seems.

Slide 29

For example, if you fail to get your dream job, your support figure might tell you that there are other great opportunities out there and you will succeed in finding a job eventually.

Slide 30

[example IAPS image 2]

When you think about how your support figure may help you reinterpret the image, how does it make you feel? How does the image seem now?

Slide 31

So how positively does the image you saw before make you feel?

Slide 32

So how negatively does the image you saw before make you feel?

Slide 33

So how bad does the image you saw before seem?

Slide 34

So what came to mind as you thought of what your support figure might say to help you think differently about this image?

Slide 35

The rating scales will change order throughout. It is important to pay attention!

Slide 36

Let's practice!

Slide 37

Any questions?

Appendix B: Pleasant Video Options for Debrief (Study 3)

1. National Geographic Underwater National Park
2. Waterfall mediation
3. What's it like to hear colors? Synesthesia experience

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