



Cognitive Reappraisal and Expressive Suppression Moderate the Association Between Social Anxiety and Depression

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Abstract

Comorbidity of social anxiety disorder and major depressive disorder is common and bears a worse prognosis than either disorder alone. Emotion regulation strategies, such as cognitive reappraisal (CR), expressive suppression (ES), and their interaction may impact the association of social anxiety with depression symptoms. Path analysis was used to examine how CR and ES may interact to predict the association of social anxiety with depression in a large, multi-university sample ($N=9,750$). There was a three-way interaction of CR, ES, and social anxiety predicting depression. CR weakened the association of social anxiety with depression at low levels of ES. ES weakened the social anxiety/depression relation at low CR, and ES strengthened the association at high levels of CR. Compared to low levels of both strategies, high levels of either emotion regulation strategy paired with low levels of the other weakened the social anxiety/depression association. Compared to high or low levels of both strategies, high CR with low ES was associated with a weaker relation between social anxiety and depression. The association of social anxiety and depression symptoms, hence their comorbidity, may depend in part on the interaction of CR and ES. ES may interfere with the resilience to comorbidity provided by CR. Either CR or ES may convey resilience compared to using neither strategy.

Keywords Emotion regulation · Expressive suppression · Reappraisal · Social anxiety · Depression

Social anxiety disorder (SAD) and major depressive disorder (MDD) are among the most common psychiatric problems, having a lifetime morbid risk of about 13% and 30% respectively (Kessler et al., 2012). Comorbidity of SAD and MDD is high. SAD is the most common co-occurring anxiety disorder among depressed individuals (Adams et al., 2016), and persons with SAD have more than four times the risk of developing MDD (Ruscio et al., 2008). Comorbid SAD/MDD is associated with more severe functional

interference, problematic substance use, and suicidal ideation (Dalrymple & Zimmerman, 2007). SAD conveys subsequent risk of MDD (Ohayon & Schatzberg, 2010) and precedes depression in the majority of comorbid SAD/MDD cases (Adams et al., 2016). Whereas SAD most commonly emerges during adolescence, MDD typically begins during early or middle adulthood (Hasin et al., 2018; Kessler et al., 2012; Stein et al., 2017). Examining the association between social anxiety and depressive symptoms in emerging adults may yield better understanding of factors of SAD/MDD comorbidity.

Theories propose that emotion regulation strategies are important in the development of anxiety and mood disorders, including SAD and MDD (Hofmann et al., 2012; Werner & Gross, 2010). Cognitive reappraisal (CR) and expressive suppression (ES) are two strategies for regulating emotion (Gross, 1998) that are emphasized in frameworks of emotion regulation in SAD and MDD. CR involves the re-interpretation of a situation or event in a manner that alters the initial emotional response (Gross, 1998). For example, a school-admissions interview initially appraised as socially threatening can be reappraised as an opportunity to learn

General Scientific Summary This study suggests that risk for comorbid social anxiety disorder and depression depends on emotion regulation strategies. Using cognitive reappraisal or expressive suppression was linked to lower risk compared to using neither strategy. Cognitive reappraisal without expressive suppression was linked to lower risk than using both strategies.

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about the school (Gross & John, 2003). CR is generally considered adaptive, and training clients to reappraise negative situations is a core feature and mechanism of change in cognitive-behavioral therapy for SAD (Goldin et al., 2014) and MDD (Forkmann et al., 2014). ES involves the purposeful inhibition of behaviors that exhibit emotion and has been compared to holding a poker face (Gross, 2014; Gross et al., 2006). For example, a socially anxious person might attempt to hide trembling hands by clenching them (Werner & Gross, 2010). ES is generally considered to be maladaptive (Butler et al., 2003; Richards & Gross, 2000), although that may not be the case when used flexibly in appropriate circumstances (Aldao et al., 2015).

CR and ES are implicated in theories of SAD (Goldin et al., 2014), which describe negative self-appraisal (Hofmann, 2007) and attempts to conceal expressions of emotion (Heimberg et al., 2014). Researchers have proposed that CR and ES in particular play a role in SAD/MDD comorbidity (Dryman & Heimberg, 2018) on the basis of self-report, behavioral, and physiological evidence that both SAD and MDD are associated with less frequent use of CR and more frequent use of ES compared to healthy controls (Blalock et al., 2016; D'Avanzato et al., 2013; Jazaieri et al., 2017; Kinney et al., 2019; Kivity & Huppert, 2018). Comorbidity of SAD and MDD may depend on the use of CR and ES. Low CR conveys stronger risk for depression in individuals with SAD than in healthy controls (D'Avanzato et al., 2013). The combination of ES with social anxiety has been linked to subsequent low positive affect (Farmer & Kashdan, 2012; Kashdan & Breen, 2008), a key feature of depression. On the basis of such evidence, Dryman & Heimberg (2018) proposed that SAD/MDD comorbidity may result from less CR and more ES. Thus, there is a need to test the hypothesis that the association of social anxiety with depression may be greater at low levels of CR and high levels of ES.

In addition to understanding how SAD/MDD comorbidity may depend on CR and ES, there is a need to understand how CR and ES interact with one another. Two hypotheses have been offered regarding the interaction of adaptive and maladaptive emotion regulation strategies (Aldao & Nolen-Hoeksema, 2012). The notion that maladaptive emotion regulation (e.g., ES) interferes with the use of adaptive emotion regulation (e.g., CR) is known as the interference hypothesis. The compensatory hypothesis, on the other hand, posits that adaptive emotion regulation is most protective in the context of a high degree of maladaptive emotion regulation. In support of the latter hypothesis, Aldao & Nolen-Hoeksema (2012) found that adaptive emotion regulation strategies were negatively associated with symptoms only when maladaptive emotion regulation strategies were high as well. In further support, a daily diary study found that occasions of using both CR and ES were associated

with slightly less depression than occasions in which only CR was used (McMahon & Naragon-Gainey, 2018). It is possible that SAD/MDD comorbidity is moderated by the interaction of CR and ES. But we know of no studies that have yet tested this hypothesis. Further, there is a need to test whether the role of CR and ES in SAD/MDD comorbidity differs by demographic factors, such as gender and ethnicity/race, which have been shown to differ in SAD/MDD comorbidity and emotion regulation (Adams et al., 2016; Masumoto et al., 2016; Soto et al., 2011).

The goal of the current study was to examine how emotion regulation processes, specifically CR and ES, may predict the association of social anxiety with depression. CR and ES were examined as moderators of the association between symptoms of social anxiety and depression in a large sample of emerging adults. In addition to examining interactions of CR and ES with social anxiety, we also examined the three-way interaction of CR, ES, and social anxiety on depression. Based on theory and past studies, we hypothesized that that social anxiety and depression would be most closely related in cases of high ES combined with low CR. Based on research indicating gender and ethnicity/race as factors in SAD/MDD comorbidity and emotion regulation (Adams et al., 2016; Masumoto et al., 2016; Soto et al., 2011), we also explored path invariance as a function of these demographic variables.

Method

Participants

The present study is a secondary analysis of cross-sectional data from the Multi-Site University Study of Identity and Culture (MUSIC; see Castillo & Schwartz 2013). All participants were included except those missing data on all variables used in the analyses ($n=330$). Because participants are nested within data collection site, participants with missing data on their university ($n=241$) were also dropped from the study. The final sample consisted of 9,750 undergraduate students, of whom 7,069 (72.5%) were female. The sample was diverse, with 61.6% primarily identifying as White, 15.0% as Hispanic, 9.9% as East Asian, 9.1% as Black, 3.1% as South Asian, and 1.3% as Middle Eastern. The mean age of the sample was 20.3 years ($SD=3.4$).

Procedure

Undergraduate students from 30 universities in the United States were recruited via email, printed advertisements, and in-class announcements. For this study, the only inclusionary criterion was that participants needed to be currently

enrolled in one of the 30 participating institutions. Interested participants were provided a link to an online informed consent document and, after confirming their participation, a link to the online survey. Data were collected between September 2008 and October 2009. Participants received course credit or research participation credit upon completing the survey. All measures and procedures were approved by the institutional review board at the participating universities.

Measures

Center for Epidemiological Studies Depression Scale (CES-D; Radloff 1977)

The CES-D consists of 20 items that assess depressive symptomatology (e.g., “I felt that everything I did was an effort”) over the most recent one-week period. To be consistent with other MUSIC study questionnaires, the response scale was modified to range from 1 (Strongly Disagree) to 5 (Strongly Agree). Internal consistency was excellent ($\alpha = 0.92$).

Social Interaction Anxiety Scale (SIAS; Mattick & Clark, 1998)

Social anxiety was assessed with the SIAS, a 19-item measure that assesses fear of social interactions (e.g., “I find myself worrying I won’t know what to say in social situations”). Respondents endorse the extent to which each item is characteristic or true of them. For consistency with other measures in the MUSIC study, a modified response scale was used that ranged from 1 (Strongly Disagree) to 5 (Strongly Agree). Internal consistency was excellent ($\alpha = 0.94$).

Emotion Regulation Questionnaire (ERQ; Gross & John 2003)

The ERQ is a 10-item scale that assesses emotion regulation strategies. It consists of two subscales. The 6-item reappraisal subscale describes cognitive reappraisal strategies (e.g., “I control my emotions by changing the way I think about the situation I’m in”). The 4-item expressive suppression subscale describes regulatory strategies involving inhibition of emotional expression (e.g., “When I am feeling negative emotions, I make sure not to express them”). Response options range from 1 (*strongly disagree*) to 7 (*strongly agree*). Internal consistency was good for both reappraisal ($\alpha = 0.89$) and expressive suppression ($\alpha = 0.79$).

Analytic Strategy

The analytic process proceeded in three steps and were conducted in *Mplus* v8.1 (Muthén & Muthén, 2017) using a robust maximum likelihood estimator (MLR), which produces standard errors robust to non-normality. Little’s MCAR Test was non-significant indicating [$\chi^2(20) = 23.559$, $p = .262$], indicating that results were not biased as a result of missing values. As a result, missing data was handled utilizing Full Information Maximum Likelihood (FIML). Additionally, we adjusted standard errors for model parameters to account for potential nesting of participants within data collection sites (Kauermann & Carroll, 2001). According to Little’s (2013) suggested values good fit is represented as $CFI \geq 0.95$, $RMSEA \leq 0.06$, and $SRMR \leq 0.061$; adequate fit as $CFI = 0.90-0.95$, $RMSEA = 0.06-0.08$, and $SRMR = 0.06-0.08$; and mediocre fit as $CFI = 0.85-0.90$, $RMSEA = 0.08-0.10$, and $SRMR = 0.08-0.10$.

In the first step, we estimated our initial path model utilizing observed total scores. Towards that end, depression was regressed onto social anxiety, CR, and ES as well as their interaction terms and gender and age. Because this path model represented a fully saturated or just-identified model, to obtain model fit indices, we tested a more parsimonious model by removing any nonsignificant paths. Age was not a significant predictor of depression, so it was removed as a predictor but allowed to correlate with the other predictors, allowing for estimation of model fit. Although the two-way interactions between social anxiety and emotion reappraisal and suppression were non-significant, given that there was a significant three-way interaction, these predictors were retained in the final model. Second, we interpreted all significant effects and probed any significant interactions using a procedure described by Dawson and Richter (2006). Slopes were calculated at high (+1SD) and low (-1SD) levels of CR and ES (Aiken & West, 1991). The slope difference and standard error of the slope difference between each pair of slopes were calculated. The ratio of each slope difference to the standard error of the slope difference was tested to determine if it differed from zero. Third, and finally, we sought to determine whether the effects were invariant across ethnic/racial groups (i.e., White, Black, East Asian, Hispanic, and South Asian) and gender (i.e., male and female). Towards this end, we utilized multi-group path modeling and estimated a fully unconstrained model (with all paths free to vary across groups). Because this was a fully saturated model, once again, nonsignificant covariates were trimmed from the model to obtain model fit indices. Next, we estimated a model in which paths were constrained to be equal across groups. Models were compared using Satorra-Bentler scaled χ^2 difference test as well as the ΔCFI (> 0.010) and $\Delta RMSEA$ (> 0.010). If findings

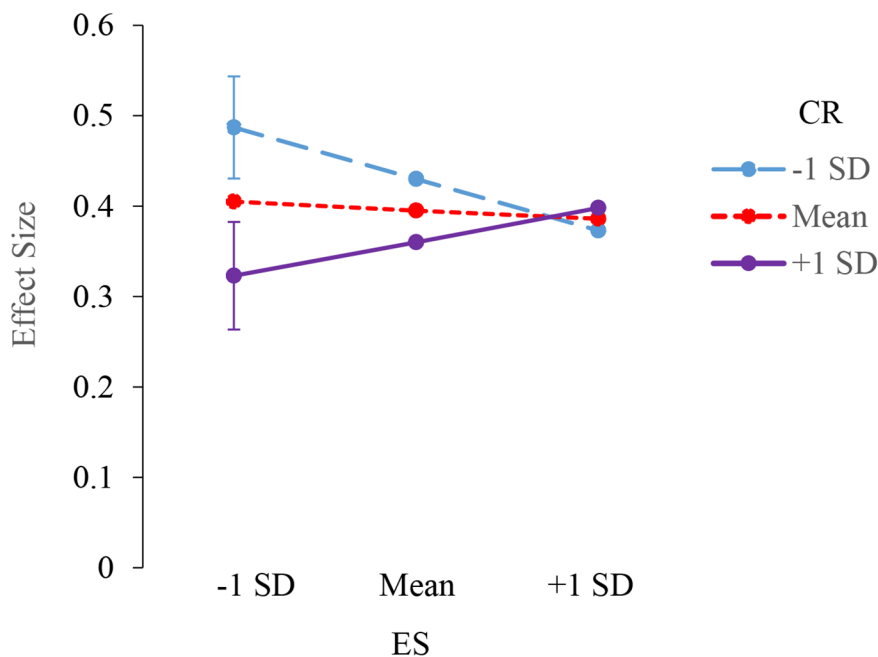


Fig. 1 Effect of Social Anxiety on Depression Moderated by Cognitive Reappraisal (CR) and Expressive Suppression (ES)

indicated a significant difference between the constrained and unconstrained model, follow-up analyses were conducted to determine which paths violated the assumption of invariance utilizing the Satorra-Bentler scaled χ^2 difference test as well as the ΔCFI (>0.010) and $\Delta RMSEA$ (>0.010).

Results

Step 1 – Model Specification

Because age was not a significant predictor of depression, it was removed as a predictor but allowed to correlate with the other predictors, allowing for estimation of model fit. Although the two-way interactions between social anxiety and emotion reappraisal and suppression were non-significant, given that there was a significant three-way interaction, these predictors were retained in the final model. The revised model provided good fit, $RMSEA=0.044$, $CFI=0.989$, $SRMR=0.005$.

Step 2 – Generalized Model Effects

Standardized coefficients with 95% confidence intervals are reported below (see Table 1). Increased social anxiety predicted depression, $\beta=0.395$ [0.360 0.429], as did decreased CR, $\beta = -0.056$ [-0.098 -0.015], and increased ES, $\beta=0.132$ [0.086 0.178]. There was a three-way interaction of social anxiety, CR, and ES, $\beta=0.106$ [0.062 0.151].

Table 1 Path analysis of social anxiety and emotion regulation strategies predicting depression

| Predictor | β | S.E. | <i>p</i> | 95% CI |
|--------------------------|---------|-------|----------|------------------|
| Social Anxiety | 0.395 | 0.018 | <0.001 | [0.360, 0.429] |
| CR | -0.056 | 0.021 | 0.008 | [-0.098, -0.015] |
| ES | 0.132 | 0.024 | <0.001 | [0.086, 0.178] |
| CR × ES | -0.010 | 0.013 | 0.458 | [-0.035, 0.016] |
| Social Anxiety × CR | -0.038 | 0.024 | 0.117 | [-0.085, 0.010] |
| Social Anxiety × ES | -0.012 | 0.016 | 0.469 | [-0.044, 0.020] |
| Social Anxiety × CR × ES | 0.106 | 0.023 | <0.001 | [0.062, 0.151] |
| Gender | 0.059 | 0.012 | <0.001 | [0.036, 0.083] |

Note. CR = cognitive reappraisal, ES = expressive suppression

The interaction was probed at low (-1 SD) and high (+ 1 SD) levels of each moderator (see Fig. 1). At low levels of ES, the effect of social anxiety on depression was lower (i.e., confidence intervals did not overlap) when CR was high, $\beta=0.323$ [0.263 0.382] than when it was low, $\beta=0.487$ [0.431 0.544]. At average and high levels of ES, the effect of social anxiety did not differ across levels of CR, as indicated by overlapping confidence intervals. At each level of CR, the effect of social anxiety on depression did not differ as a function of ES.

Based on ± 1 SD, slopes of the effect of social anxiety on depression were calculated for (1) high CR, high ES; (2) high CR, low ES; (3) low CR, high ES; and (4) low

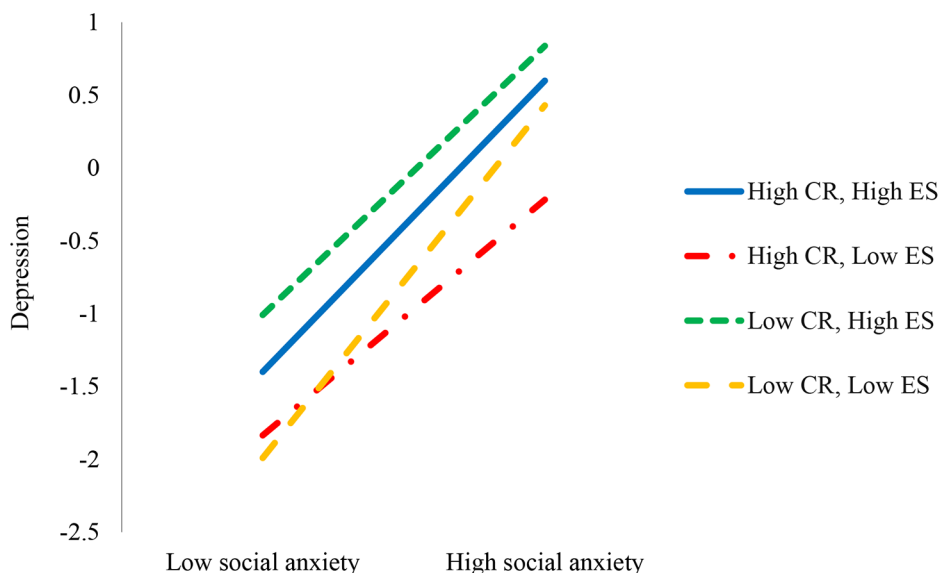


Fig. 2 Interactive Effects of Cognitive Reappraisal (CR) and Expressive Suppression (ES) on the Association of Social Anxiety with Depression

CR, low ES (see Fig. 2; see Table 2). The gradient of each slope was significant, $p < .001$, indicating that social anxiety and depression were related at all levels of CR and ES. The slope of low CR, low ES was significantly greater than the slope of high CR, low ES or the slope of low CR, high ES. The slope of high CR, high ES was greater than the slope of high CR, low ES.

Step 3 – Invariance across Ethnicity/Race and Gender

Ethnicity/Race. Because this was a fully saturated model and age was not a significant predictor of depression among Blacks and South East Asians, age was removed as a predictor but allowed to correlate with the other predictors, allowing for estimation of model fit. The revised unconstrained model provided good fit, $\chi^2(2) = 0.265$, $p = .876$, $RMSEA < 0.001$, $CFI = 1.000$, $SRMR = 0.002$. Although the constrained model was associated with good fit, $\chi^2(30) = 54.867$, $p = .811$, $RMSEA = 0.035$, $CFI = 0.979$, $SRMR = 0.030$, there was a significant decline in fit relative

to the unconstrained model, $\Delta\chi^2(28) = 53.751$, $p = .024$, $\Delta RMSEA = 0.035$, $\Delta CFI = 0.021$. Despite the significance difference between the constrained and unconstrained models, there was no singular path that significantly varied between ethnic/racial groups.

Gender. Across gender, age was once again not found to be a significant predictor for either male or female participants. As such, age was removed as a predictor but allowed to correlate with the other predictors, allowing for estimation of model fit. The revised unconstrained model provided good fit, $\chi^2(2) = 1.755$, $p = .416$, $RMSEA < 0.001$, $CFI = 1.000$, $SRMR = 0.006$. There was no significant decline in fit relative to the unconstrained model, $\Delta\chi^2(7) = 8.715$, $p = .274$, $\Delta RMSEA = 0.010$, $\Delta CFI = 0.002$, indicating that paths did not significantly differ between male and female participants.

Table 2 Slope comparisons of Cognitive Reappraisal (CR) and Expressive Suppression (ES) predicting the association of social anxiety and depression

| Slope 1 | | Slope 2 | t | p | 95% CI |
|------------------|-----|-----------------|--------|--------|------------------|
| High CR, Low ES | vs. | Low CR, Low ES | -5.262 | <0.001 | [-0.189, -0.086] |
| Low CR, High ES | vs. | Low CR, Low ES | -4.573 | <0.001 | [-0.141, -0.056] |
| High CR, High ES | vs. | High CR, Low ES | 2.106 | 0.035 | [0.005, 0.126] |
| High CR, High ES | vs. | Low CR, Low ES | -1.758 | 0.079 | [-0.153, 0.008] |
| High CR, Low ES | vs. | Low CR, High ES | -1.037 | 0.300 | [-0.114, 0.035] |
| High CR, High ES | vs. | Low CR, High ES | 0.640 | 0.522 | [-0.054, 0.106] |

Note. CR = cognitive reappraisal, ES = expressive suppression, High = +1 SD, Low = -1 SD.

Discussion

The interaction of CR and ES with social anxiety in predicting depression indicates that both emotion regulation strategies are important in the comorbidity of social anxiety and depression. We found that the association of social anxiety with depression was weaker if either CR or ES was high than if both were low. This may indicate that engaging in either strategy is superior to engaging in neither one in terms of reducing risk for comorbid SAD/MDD. Our results add support for the benefits of CR in conveying resilience against depression in those with social anxiety (D'Avanzato et al., 2013). The benefit of ES at low levels of CR in our data is unexpected in the context of prior studies that have mostly found ES to be maladaptive, such as studies that have shown ES to strengthen the association of social anxiety with less positive mood (Farmer & Kashdan, 2012; Kashdan & Breen, 2008; Kashdan & Steger, 2006) and lower life satisfaction (Jazaieri et al., 2017). Although our findings do not indicate an adaptive outcome of ES, they do suggest that ES weakens the association of social anxiety and depression when CR is low.

Few studies have examined the interaction of CR and ES in the context of social anxiety and/or depression. Consistent with our findings, Eftekhari and colleagues (2009) found higher depression symptoms in those with low levels of both CR and ES when compared to other combinations of CR and ES usage. They also found that those with high CR and low ES had fewer depression symptoms compared to other combinations of CR and ES. This is similar to our finding that high CR with low ES, compared to being high or low in both, was associated with a weaker association between social anxiety and depression. Yet our findings differ from a recent daily-diary study. At the between-persons level, it found that ES, but neither CR nor the interaction of CR and ES, was associated with social anxiety or depression. At the within-persons level, using both ES and CR on the same occasion was associated with less depression compared to using CR alone (McMahon & Naragon-Gainey, 2018). Our results differ from the between-persons findings in that an interaction of CR, ES, and social anxiety was evident in our study, suggesting that the protective effect of high CR on SAD/MDD comorbidity is reduced when ES is high. With respect to the within-person findings, our results differ in that CR alone was more adaptive than using both ES and CR. Our results indicate a need to better understand individuals high in both CR and ES, a combination that is common and associated with moderately severe symptoms (Eftekhari et al., 2009).

The current study has implications for competing hypotheses about the interaction of CR and ES. Our findings are more consistent with the interference hypothesis,

which holds that maladaptive emotion regulation strategies block the benefits of adaptive strategies, than they are with the compensatory hypothesis, which holds that adaptive emotion regulation compensates for maladaptive emotion regulation (Aldao & Nolen-Hoeksema, 2012). In contrast to the compensatory hypothesis, we found that CR was beneficial only at low levels of ES. This is more consistent with the idea that ES interferes with the benefits of CR, as per the interference hypothesis. More research is needed to test both hypotheses further while considering emotion regulation tendencies and moment-to-moment dynamics of emotion regulation.

The study has several implications relevant to clinical interventions. Data suggest that interventions, such as cognitive-behavioral therapy (CBT), can increase reappraisal in individuals with SAD (Brozovich et al., 2015; Goldin et al., 2014; Jazaieri et al., 2017; Kivity et al., 2020) and those with depression (Forkmann et al., 2014). Even after treatment, reliance on ES may be high (Kivity & Huppert, 2016) and less responsive to CBT (Goldin et al., 2014; Forkmann et al., 2014; Jazaieri et al., 2017; Mathewson et al., 2013). Our findings indicate this may increase risk for SAD/MDD comorbidity, even among individuals who also rely on CR to regulate emotions. ES may be a relatively neglected treatment target important to treatment outcomes (Hosogoshi et al., 2020). The connection between ES and beliefs (e.g., that expressing emotion is a sign of weakness; Spokas et al., 2009) indicates that it could be targeted by CBT. Our findings support other researchers' recommendation to develop and test interventions that target ES, such as psychoeducation about the function of expressing emotions and exposure exercises (Dryman & Heimberg, 2018) as well as social skills training focused on expressing affect. In addition to alleviating social anxiety, such interventions may reduce risk of co-occurring depressive symptoms.

Our conclusions are limited by the study design and sample. The use of a between-subjects design precludes conclusions about momentary emotion regulation dynamics, but it complements literature that has focused on emotion regulation tendencies, which are clinically important (McMahon & Naragon-Gainey, 2018). The cross-sectional design does not allow for conclusions about causal associations. The use of an undergraduate sample of emerging adults yields insight into a population susceptible to SAD/MDD comorbidity, but using this sample without diagnostic assessment limits generalizability to clinical populations. The emotion regulation measure used in this study assesses, but does not distinguish between, attempts to upregulate and downregulate or negative and positive emotional reactions. It will be important for future studies to examine how emotion regulation is used to increase and decrease both positive and negative emotional responses in the context of SAD/MDD

comorbidity. Consequences of emotion regulation strategies are known to vary to some extent across cultures (Soto et al., 2011). Although we did not investigate the role of culture extensively, we found that no particular path differed as a function of ethnicity/race. Additional studies using experimental and longitudinal designs, other emotion regulation strategies, and clinical samples are needed to further advance the understanding of emotion regulation in SAD/MDD comorbidity.

In summary, our study suggests that CR and ES interactively predict the association of social anxiety with depression. The findings indicate that either emotion regulation strategy may provide resilience to SAD/MDD comorbidity. Moreover, high CR with low ES conveys resilience relative to low or high levels of both strategies. These findings demonstrate a synergistic role of emotion regulation strategies in affective disorder comorbidity.

Declarations

Conflict of Interest The authors declare no conflicts of interest or funding for this research. This secondary data analysis was deemed exempt by the University of Arkansas IRB (#2012306592). The data have not been published or presented previously. The authors would like to acknowledge Linda Castillo, Seth Schwartz, and the many other researchers of the Multi-Site University Study of Identity and Culture, which provided data used in this manuscript.

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