



Negative affect mediates the relationship between use of emotion regulation strategies and general health in college-aged students

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ARTICLE INFO

Keywords:

Emotion regulation
Negative affect
Health
Individual differences
College-aged

ABSTRACT

Patterns of dysregulated emotions can take a toll on both mental and physical health. Such patterns also put people at risk for affective disorders, including anxiety and depression. Early adulthood is a critical period during which affective disorders first develop, so there is a need to identify individual difference factors that predispose some young adults to develop anxiety and depression. Here, we recruited a sample of college-aged volunteers ($N = 393$) and assessed their use of multiple emotion regulation strategies, depressive and anxiety symptoms, and general health. We hypothesized that cognitive reappraisal would be associated with better health, via fewer reported depressive and anxiety symptoms, whereas expressive suppression would be associated with poorer health, via more depressive and anxiety symptoms. To test these hypotheses, we fit a mediation model with cognitive reappraisal and expressive suppression as predictors, anxiety and depressive symptoms as mediating variables, and a global health measure as the outcome. There were robust direct and indirect associations in support of our hypotheses. These results suggest that targeting emotion regulation abilities in early adulthood may be an effective strategy to reduce the risk of developing affective disorders and improve overall health.

1. Introduction

Negative emotions—whether consisting of feelings of distress and anxiety, or negative, self-directed appraisals and ruminative tendencies—are something many people experience, at least from time to time. When such feelings become more frequent or intense, interfering with daily functioning, they can put people at risk for developing affective disorders, especially anxiety and depressive disorders. Currently, depression affects more than 322 million people worldwide—an 18.4% increase from 2005 (World Health Organization, 2017), and 20% of adults (40 million) in the US alone are diagnosed with at least one anxiety disorder (Harvard Medical School, 2007).

Developmentally, the age of onset for anxiety disorders is, on average, 21.3 years (Lijster et al., 2017), and for major depressive disorder, 26 years (Zisook et al., 2007). Prevalence for a major depressive episode is highest among young adults, aged 18–25 (Center for Behavioral Health Statistics and Quality, 2017), and those who experience earlier-onset depression (e.g., in young adulthood) report lower quality of life and poorer social functioning later in life (Zisook et al., 2007). College-aged individuals (i.e., those 18 to 21 years of age), are therefore an important group to study, given the time period in which these affective disorders often first arise. Further, negative affect

among college-aged students has become increasingly prevalent, with recent estimates indicating that 50.6% of students present with symptoms of anxiety at university counseling and mental health centers, followed by 41.2% of students who present with depressive symptoms (Reetz et al., 2016). Moreover, in a very large ($N \sim 23,000$) sample, 21.9% of college students report anxiety interfering with their academic performance, and 15.8% are diagnosed with or treated for anxiety (American College Health Association, 2014).

Patterns of negative affect, especially when experienced chronically, have the potential of leading to a clinical diagnosis of an affective disorder. These emotions not only take a serious toll on psychological health, but on physical health as well. Indeed, prior work has shown that negative affect, especially feelings of anxiety and distress, can influence endocrine and immune system functioning, resulting in increased risk for various health conditions later in life (Brosschot, Gerin, & Thayer, 2006; Brosschot, Verkuil, & Thayer, 2017; Fagundes, Glaser, & Kiecolt-Glaser, 2013), including cardiovascular disease, certain cancers, and type 2 diabetes, to name a few (for a review, see Fagundes & Way, 2014). Given the time in development when affective disorders first appear, the increasingly high prevalence of anxiety and depression among college-aged individuals, and the effects of negative emotions on mental and physical health, identifying factors that predispose some

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<https://doi.org/10.1016/j.paid.2019.109529>

Received 23 March 2019; Received in revised form 5 June 2019; Accepted 18 July 2019

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(and not others) to experience pre-clinical levels of anxiety and depressive symptoms in the first place represents an important and timely goal for research linking mental health to physical health.

One individual difference factor that has been well studied is how people experience, and, importantly, manage their emotions. Formally, emotion regulation refers to the processes by which people influence which emotions they experience, when they experience them, and how they are expressed (Gross, 1998, 2002). The process model of emotion (Gross, 2002) makes a helpful distinction in the kinds of emotion regulation strategies people can employ, namely: antecedent-focused strategies, which can be implemented before emotions run their full course and are completely expressed and experienced (e.g., physiologically and behaviorally), versus response-focused strategies, which occur after an emotion has already been experienced. Cognitive reappraisal, which involves changing one's appraisal of an emotion-eliciting stimulus to alter its emotional impact, is an example of an antecedent-focused strategy. Conversely, expressive suppression, whereby one actively inhibits outward expression of an inner, emotional state (e.g., hiding feelings of excitement and triumph upon discovering a winning poker hand) is a response-focused strategy. Empirical work has shown that rather than decreasing distress and discomfort, response-focused strategies, namely suppression, can result in increased emotional distress (Lavy & van den Hout, 1994). Generally, expressive suppression has been linked to dysregulated patterns of emotional response, increased autonomic arousal (Richards & Gross, 2000) and negative health indicators more broadly (Denson, Grisham, & Moulds, 2011; Gross, 2014; Gross & John, 2003; John & Gross, 2004; Otto, Sin, Almeida, & Sloan, 2018; Webb, Miles, & Sheeran, 2012). Additionally, studies have identified expressive suppression in the context of affective disorders, especially anxiety and mood disorders, as a relatively ineffective and maladaptive strategy—specifically as a co-occurring feature of these disorders (e.g., Campbell-Sills, Barlow, Brown, & Hofmann, 2006a; Roemer, Litz, Orsillo, & Wagner, 2001) and with negative downstream consequences on peripheral physiology (e.g., heart rate; Campbell-Sills, Barlow, Brown, & Hofmann, 2006b).

Conversely, growing evidence suggests that for those seeking to down-regulate negative emotion, cognitive reappraisal is often an adaptive emotion regulation strategy, as measured by subjective reports and physiological (e.g., brain imaging) measures (Denny, Inhoff, Zerubavel, Davachi, & Ochsner, 2015; Gross, 1998, 2014; McRae et al., 2010; Ochsner et al., 2004; Ray, McRae, Ochsner, & Gross, 2010; Urry, 2010). In addition, some studies have directly compared relationships between the tendency to use different emotion regulation strategies (i.e., expressive suppression versus cognitive reappraisal) and various health indicators. For example, Appleton, Loucks, Buka, and Kubzansky (2014) found that suppression was associated with increased risk for developing cardiovascular disease, whereas reappraisal was associated with lower risk of cardiovascular disease (Appleton et al., 2014). Another study revealed that use of emotion regulation strategies was associated with either higher or lower inflammation, with reappraisal linked to lower inflammation and suppression linked to higher inflammation—even after controlling for the influence of other factors known to co-vary with inflammation (Appleton, Buka, Loucks, Gilman, & Kubzansky, 2013). Also, individuals reporting general difficulties with emotion regulation also tend to have lower heart rate variability (Williams et al., 2015), a physiological marker of resilience associated with self-regulatory processes that confer benefits on health across several domains (McCraty & Zayas, 2014; Quintana, Guastella, McGregor, Hickie, & Kemp, 2013; Reynard, Gevirtz, Berlow, Brown, & Boutelle, 2011).

Given these previous lines of research demonstrating links between (1) negative affect and health; (2) emotion regulation and negative affect; and (3) emotion regulation and important health indicators, a key, unaddressed question is *how* these variables are associated with one another—specifically, the role of emotion regulation strategies impacting both mental and physical health and the psychological mechanisms that underlie these links. This is especially important to examine among the college-aged, given the age of onset for affective

disorders and high prevalence of college students reporting anxiety and depressive symptoms that interfere with their daily lives. Indeed, recent theorizing has proposed that use of frequently adaptive (e.g., cognitive reappraisal) and less adaptive (e.g., expressive suppression) emotion regulation strategies directly act on positive and negative affective states, which then have downstream impacts on health, especially cardiometabolic health and stress-related biomarkers (Trudel-Fitzgerald, Qureshi, Appleton, & Kubzansky, 2017). Thus, in the current study we addressed the question: is the relationship between college students' use of emotion regulation strategies and general health mediated by experience of negative emotions—namely anxiety and depressive symptomatology? We did so by performing a novel, multiple mediation model that simultaneously took into account college students' use of multiple emotion regulation strategies, patterns of negative affect, and a measure indexing overall health and wellbeing.

The present approach is distinct from past work that examined similar constructs and also used mediation modeling in that we set out to predict overall health and wellbeing—with multiple emotion regulation strategies in a relatively healthy sample—versus predicting only mental health (stress and psychopathology) in a trauma-exposed community sample (Moore, Zoellner, & Mollenholt, 2008). Additionally, we were focused on participants' use of cognitive reappraisal and expressive suppression specifically, versus more domain-general constructs that have been associated with different aspects of mental and physical health via mediation modeling, such as psychological resilience (Tugade & Fredrickson, 2004).

Specifically, based on the patterns of effects and associations observed in prior work, as discussed above, in the current study we tested directional hypotheses about this mediated relationship, namely that: (1) greater cognitive reappraisal frequency would be associated with *better* overall health, via *fewer* reported anxiety and depressive symptoms; and (2) greater expressive suppression frequency would be associated with *poorer* health, via more frequently experienced anxiety and depressive symptoms. To these hypotheses, we used multiple mediation modeling with multiple predictors (i.e., college students' tendency to employ cognitive reappraisal and expressive suppression, respectively) and multiple mediators (i.e., experience of anxiety and depressive symptoms) to characterize a composite measure of general health, while controlling for participants' age and gender.

2. Method

2.1. Participants

Given our hypotheses about mediation effects involving indirect paths from emotion regulation to health, via negative emotions, we followed sample size recommendations by Fritz and MacKinnon (2007) for mediation effects; specifically, to achieve 80% power to detect at least small to medium sized effects in any α and β paths making up an indirect effect, using percentile bootstrap estimation (Shrout & Bolger, 2002), the required sample size was 404–406 (see Table 3 in Fritz & MacKinnon, 2007). Accordingly, we sought to recruit approximately 400 participants for the study by drawing from a large pool of undergraduate students receiving course credit for participating in psychology research. Prospective participants were told they would complete an online survey study. Before beginning the survey, all participants provided informed consent in accordance with the Rice University's Institutional Review Board. Measures collected in the final sample of respondents ($N = 393$; 253 Females; $M_{\text{age}} = 19.36$ years, $SD_{\text{age}} = 1.12$ years) were used in all subsequent analyses.

2.2. Measures

2.2.1. Emotion regulation

A previously validated, 10-item Emotion Regulation Questionnaire (Gross & John, 2003) was used to measure participants' trait-level

Table 1

Zero-order, pairwise correlations between all measures of interest and all measures' means and standard deviation.

Measure	1	2	3	4	M	SD
1. Cognitive reappraisal					27.92	5.94
2. Expressive suppression	−0.02 [−0.12, 0.08]				14.65	4.64
3. Anxiety symptoms	−0.31*** [−0.39, −0.21]	0.17*** [0.07, 0.26]			9.50	3.54
4. Depressive symptoms	−0.31*** [−0.40, −0.22]	0.27*** [0.18, 0.36]	0.80*** [0.76, 0.83]		8.36	3.67
5. General health	0.26** [0.17, 0.35]	−0.26** [−0.35, −0.17]	−0.52** [−0.59, −0.44]	−0.57** [−0.63, −0.50]	10.68	2.32

Note. *M* and *SD* are used to represent mean and standard deviation, respectively. Values in square brackets indicate the 95% confidence interval for each correlation.

** Indicates $p < .01$.

*** Indicates $p < .001$.

tendencies to employ two emotion regulation strategies: cognitive reappraisal (example item: “I control my emotions by changing the way I think about the situation I’m in”) and expressive suppression (example item: “I keep my emotions to myself.”) (Gross & John, 2003). Participants endorsed each scale item using 7-point likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). Scores from each subscale (6 items for cognitive reappraisal; 4 items for expressive suppression) were summed to derive a total score for each strategy (possible range: 6–42 for reappraisal; 4–28 for suppression), with higher scores indicating greater use of the respective strategy. Internal consistency was sufficient for both the reappraisal subscale ($\alpha = 0.84$) and the suppression subscale ($\alpha = 0.75$).

2.2.2. Negative affect (anxiety and depressive symptoms)

Items assessing pre-clinical levels of anxiety and depressive symptoms were taken from the Patient-Reported Outcomes Measurement Information System (PROMIS®) battery, which has been developed and validated for use in adult populations with support from a National Institutes of Health initiative (Cella et al., 2007, 2010). Specifically, we administered PROMIS® items assessing anxiety, as well as depressive symptoms. For anxiety, participants responded to the prompt “In the past 7 days...” by endorsing the following four items on a 1 to 5, frequency-based Likert scale: “I felt fearful,” “I found it hard to focus on anything other than my anxiety,” “My worries overwhelmed me,” and “I felt uneasy.” Similarly, for depressive symptoms, participants responded to “In the past 7 days...” by endorsing these four items, again on a 1 to 5, frequency based Likert scale: “I felt worthless,” “I felt helpless,” “I felt depressed,” and “I felt hopeless.” For both sets of items, we summed item-level values to create an aggregate score (possible range: 5–20) that reflected the frequency of reported anxiety and depressive symptoms, respectively. Reliability analysis indicated that items had good internal consistency for both anxiety ($\alpha = 0.86$) and depression ($\alpha = 0.90$) scores.

2.2.3. General health measure

To assess general health and well-being, we administered items from the PROMIS® Global Health survey, which reliably captures multiple facets of health and wellbeing (Hays, Bjorner, Revicki, Spritzer, & Cella, 2009) and is predictive of future health outcomes (Cella et al., 2010). Participants gave ratings on a 1 to 5 Likert scale, with options “Poor,” “Fair,” “Good,” “Very Good,” and “Excellent,” in response to the following four questions: (1) “In general, would you say your health is;” (2) “In general, would you say your quality of life is;” and (3) “In general, how would you rate your satisfaction with your social activities and relationships?” We summed scores for these three items to create a composite score (possible range: 3–15) that reflected general health and wellbeing across domains. Items that went into this composite score achieved sufficient internal reliability, $\alpha = 0.74$.

2.3. Mediation model specification

Following our hypotheses, which necessitated incorporating all variables of interest, we specified a multiple predictor, multiple mediator (mPred-mMed) model¹ in which emotion regulation tendencies (specifically cognitive reappraisal and expressive suppression) were predictor variables (X1 and X2), overall health as the outcome variable (Y), and scores on the anxiety and depressive scales as the intervening (mediating) variables (M1 and M2). Additionally, we included age and gender as covariates of no interest in all paths of the mPred-mMed model. We also included a covariance term for the two mediators to account for the fact that they were highly correlated with each other (Preacher & Hayes, 2008). We tested for the following four indirect associations: (1) the association between cognitive reappraisal and health, via experienced anxiety symptoms; (2) the association between cognitive reappraisal and health, via experienced depressive symptoms; (3) the association between expressive suppression and health, via experienced anxiety symptoms; and (4) the association between expressive suppression on health, via experienced depressive symptoms.

We also computed four primary contrasts of these indirect associations, within and between the reappraisal–health path and the suppression–health paths, respectively. These contrasts allowed us to specifically address the following questions: (1) is the path between cognitive reappraisal and health mediated (relatively) more by anxiety as compared to depressive symptoms; (2) is the path between expressive suppression and health mediated (relatively) more by anxiety as compared to depressive symptoms; (3) is the indirect path to health, via depression, stronger for reappraisal versus suppression; and (4) is the indirect path to health, via anxiety, stronger for reappraisal versus suppression?

3. Results

First, before estimating all path coefficients in the mPred-mMed model, we examined pairwise, zero-order correlations between all key variables of interest (i.e., both predictors, both mediators, and the outcome variable) as well as descriptives for each variable (see Table 1 for all statistics). In addition, as an exploratory analysis, we examined overall effects of ethnicity and race across all measures for our

¹ The mPred-mMed model specification we implemented in the present work has been used previously to test specific hypotheses, in tandem, about multiple direct and indirect paths between predictor and outcome variables, via mediating variables (Dalley, Toffanin, & Pollet, 2012). To estimate all path coefficients and compute associated statistics, we used the *lavaan* package in R (Rosseel, 2012), as this package allows for versatile model specification and also the ability to specify contrasts for paths in directional models, including contrasts of indirect effects (in the case of mediation).

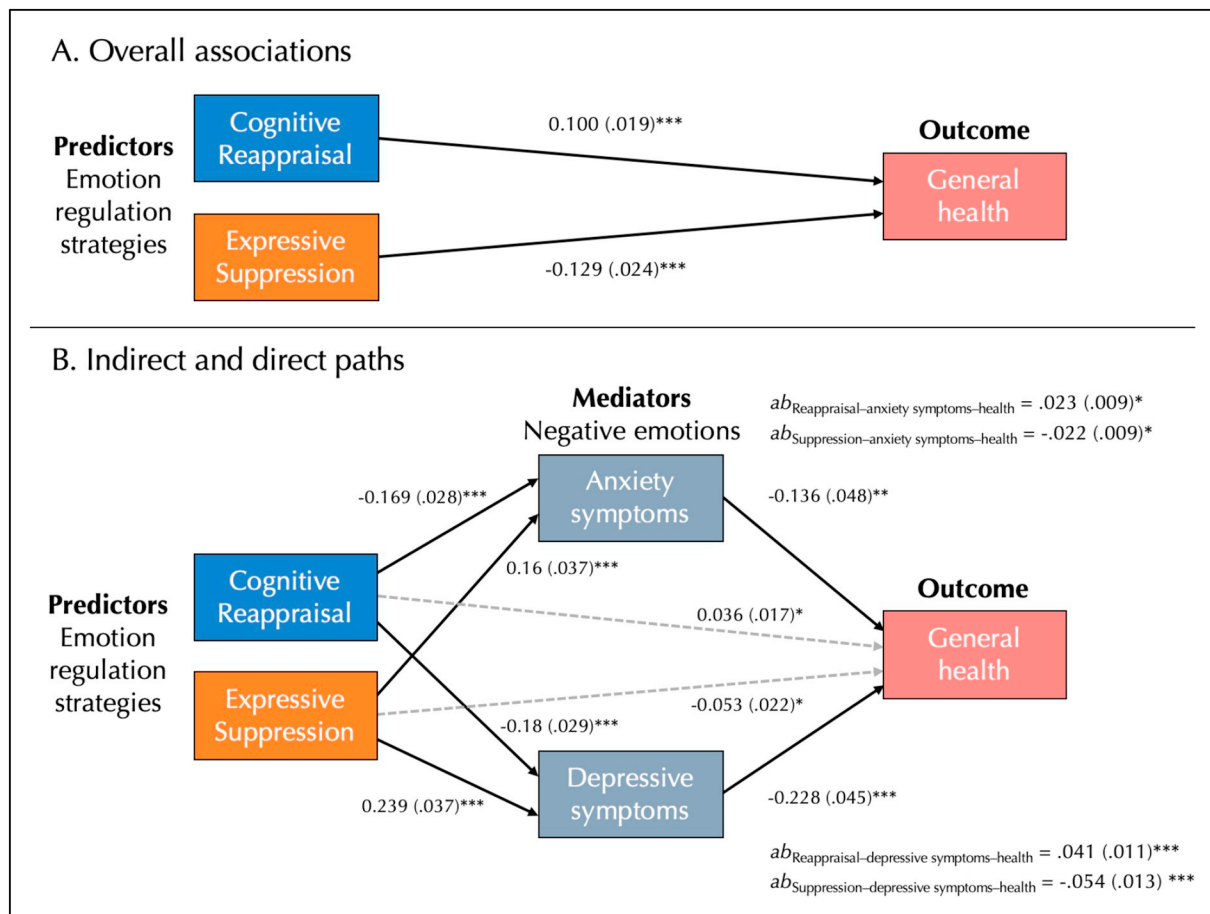


Fig. 1. A: Path diagram depicting overall associations between cognitive reappraisal and health, and expressive suppression and health, respectively. B: Path diagram depicting all direct and indirect paths in the mPred-mMed model, with emotion regulation strategies (cognitive reappraisal and expressive suppression) as predictors, negative affect (feelings of anxiety and depressive symptoms) specified as mediators, and general health as the outcome. Estimates of indirect associations are designated by *ab*. Dashed gray lines indicate direct paths between the predictors and the outcome. Potential influences of age and gender (not shown) are controlled for in all paths. All numbers indicate unstandardized path coefficients, with estimates of standard error in parentheses. * indicates $p < .05$; *** indicates $p < .001$.

undergraduate sample; no significant differences across ethnic and racial categories were observed for any study measure (see Tables S1–S4 in Supplementary materials).

Overall, there were significant associations between most of the variables, and all relationships were in hypothesized directions, as shown below and in Table 1. For example, cognitive reappraisal was associated with overall better health, $r = 0.264$, (95% CI: 0.169, 0.353), $t(391) = 5.41$, $p < .001$, whereas expressive suppression was associated with overall poorer health, $r = -0.262$ (95% CI: -0.352 , -0.168), $t(391) = 5.37$, $p < .001$. Anxiety and depressive symptoms were also highly correlated with one another, $r = 0.798$ (95% CI: 0.760, 0.832), $t(391) = 26.225$, $p < .001$. There was no association between cognitive reappraisal and expressive suppression, $r = -0.022$, (95% CI: -0.121 , 0.077), $t(391) = -0.444$, $p = .657$, which is consistent with prior work (e.g., Gross & John, 2003).

Given these overall robust patterns of covariance, in addition to the fact that there were associations between the hypothesized predictors, mediators, and outcome that satisfied initial steps for establishing mediation (as per Baron & Kenny, 1986),² we proceeded to fit the mPred-mMed model to the data. As described in the Method section

above, we specified cognitive reappraisal and expressive suppression as the two predictor variables, anxiety symptoms and depressive symptoms as the two mediating variables, and general health as the outcome variable. See Fig. 1A for overall (i.e., unmediated) associations between cognitive reappraisal and health and expressive suppression and health, respectively, and Fig. 1B for a complete path diagram of model estimates for all indirect and direct links between the two predictors, two mediators, and general health.

The mPred-mMed model accounted for 33.7%³ of the variance in participants' reported general health scores, and reappraisal and suppression collectively accounted for 17.6% variance in anxiety and 20.3% variance in depressive symptoms, respectively. First, as far as total effects, there was a robust positive association between cognitive reappraisal and general health, $b = 0.100$ (95% bootstrapped⁴ CI: 0.063, 0.138), $z = 5.23$, $p < .001$, and there was also a significant negative association between expressive suppression and general health, $b = -0.129$ (95% bootstrapped CI: -0.177 , -0.082), $z = -5.308$, $p < .001$ (see Fig. 1A).

Regarding indirect effects (i.e., mediation), there was a significant indirect path between cognitive reappraisal and health, via less frequently reported anxiety symptoms, $b = 0.023$ (95% bootstrapped CI: 0.007, 0.042), $z = 2.517$, $p = .012$, 23% mediation, as well as a

² I.e., Step 1: the predictor variables (cognitive reappraisal and expressive suppression) were both associated with the outcome (general health); Step 2: both predictor variables were associated with the hypothesized mediating variables (anxiety and depressive symptoms); Step 3: the mediating variables were both associated with outcome, controlling for the predictor variables.

³ Adjusted R-squared value.

⁴ All bootstrapped confidence intervals reported here were computed from 10,000 re-samplings of the original data.

significant indirect path between cognitive reappraisal and health, via fewer depressive symptoms, $b = 0.041$ (95% bootstrapped CI: 0.022, 0.063), $z = 3.872$, $p < .001$, 41% mediation (see Fig. 1B for all paths). The contrast of these two indirect paths revealed that neither indirect path coefficient was significantly greater than the other, $b = -0.018$ (95% bootstrapped CI: -0.051 , 0.014), $z = -1.102$, $p = .271$.

For the path between suppression and health, there were two significant indirect paths whereby the negative relationship between suppression and health was partially mediated by more frequently experienced feelings of anxiety, leading to lower overall health scores, $b = -0.022$ (95% bootstrapped CI: -0.042 , -0.006), $z = -2.388$, $p = .017$, 17.1% mediation, as well as more frequent depressive symptoms, $b = -0.054$ (95% bootstrapped CI: -0.083 , -0.03), $z = -4.04$, $p < .001$, 41.9% mediation. The indirect path via depression was not significantly greater than that of anxiety, $b = 0.033$ (95% bootstrapped CI: -0.002 , 0.069), $z = 1.803$, $p = .071$.

Planned contrasts testing whether indirect paths to health—via depression/anxiety—were stronger for reappraisal versus suppression were not significant: this was the case with anxiety as the mediator, $b = 0.001$ (95% bootstrapped CI: -0.013 , 0.018), $z = 0.172$, $p = .863$, and with depression as the mediator, $b = -0.013$ (95% bootstrapped CI: -0.038 , 0.009), $z = -1.116$, $p = .264$.

4. Discussion

Overall, this study tested for relationships between college students' tendencies to employ emotion regulation strategies and overall health, and whether these relationships are mediated by differential experience of negative emotions, specifically anxiety and depressive symptoms that could potentially put participants at higher risk for developing affective disorders. To estimate these direct and indirect relationships, we specified a novel multiple-predictor, multiple-mediator (mPred–mMed) model. Results from this mPred–mMed model, notably the mediation effects, provided strong support for our hypotheses about the relationships between college students' use of emotion regulation strategies, anxiety and depressive symptoms, and overall health. That is, those participants who more readily engaged in cognitive reappraisal reported better overall health, and this relationship was partially mediated by fewer anxiety and depressive symptoms. A different pattern emerged for expressive suppression, as those individuals who reported more frequently using suppression as an emotion regulation strategy had poorer scores on the general health measure, and this association was partially mediated by increased experience of anxiety and depressive symptoms. When comparing indirect (mediation) effects in the reappraisal–health and suppression–health pathways, respectively, neither emotion regulation strategy exerted stronger effects than the other.

Collectively, in addition to adding to the growing literature on the links between variably effective emotion regulation tendencies and their divergent effects on health outcomes (e.g., Appleton et al., 2013; Appleton et al., 2014), these findings also provide a potential account of how these associations may come about in the first place. For example, those individuals who generally reappraise more often will likely experience fewer negative emotions associated with anxiety and depression symptomatology across various emotion-eliciting situations, and this thereby may result in positive effects in both mental and physical health over time (Dandoy & Goldstein, 1990; Gross & John, 2003; Mauss, Cook, Cheng, & Gross, 2007). Conversely, those who more frequently use expressive suppression are not actively cognitively regulating emotions they face, so any experienced negative emotions and their effects on physiology may go relatively unchecked.

A strength of the current study is that the effects were observed in a large sample, so effect size estimates are more robust. This affords more confidence in the nature of the effects observed, including the partial mediation effects, which were sizeable in their own right (i.e., approximately 20% to 40% mediation). The mPred–mMed model

specification also allowed us to model all direct and indirect effects at the same time; this method provided a way to test a set of hypotheses about multiple, parallel relationships between participants' use of different emotion regulation strategies (cognitive reappraisal and expressive suppression), negative affect (as indexed by feelings of anxiety and depressive symptoms), and general health (as measured by a composite index of health indicators from the PROMIS® battery). The nature and direction of the effects we observed have implications for future emotion regulation research, specifically for intervention studies that involve longitudinal training in emotion regulation, such as training people's ability to engage in cognitive reappraisal (Denny, in press; Denny & Ochsner, 2014). More specifically, the present findings may inform future translational work that incorporates random assignment to various forms of emotion regulation training, such as training to increase cognitive reappraisal tendencies, training to alert participants to the deleterious effects of expressive suppression on mental and physical health, and/or a combination thereof.

Although the effects we report here are suggestive and may help shape future work on the mechanisms by which emotion regulatory processes impact health, there are several important caveats and limitations regarding the present work. First, all observed relationships are correlational (i.e., nothing was experimentally manipulated) and cross-sectional, as all measures were collected at the same point in time. Thus, true directionality and causal influence cannot be established from the present data. For example, those who more frequently engage in cognitive reappraisal may have more favorable health outcomes over time, but the reverse may also be true: those who are in good health to begin with may have the neurocognitive resources and motivation to use cognitive reappraisal, and as a result it becomes a frequent emotion regulation strategy of choice. With regard to expressive suppression, the same logic applies: those who frequently inhibit their emotions may experience worse health, but those who start with poor or compromised health may default to using expressive suppression.

Regardless of the true patterns of directionality between these variables, our design can be adapted in future work that re-administers measures of emotion regulation, anxiety and depressive symptoms, and health measures at several time points, longitudinally. Another experimental approach, as mentioned above, might incorporate longitudinal cognitive reappraisal training coupled with assessment of various mental and physical health indicators, such as cardiovascular and immune functioning, to permit causal inferences regarding the usage and consequences of particular emotion regulation strategies.

A second caveat is that inferences about emotion regulation–negative affect–health relationships in college undergraduates are not necessarily generalizable to all other populations, including racial or ethnic minorities, as these were underrepresented in the current group. This was intentional in the present work, as we set out to examine these relationships in young (i.e., college-aged) adults, given the age of onset for affective disorders and rising prevalence of anxiety and depression among college studies. Even so, follow up studies should further test for boundary conditions of these effects in other populations and contexts, especially those for whom emotion regulation would not only be beneficial but potentially life-saving (e.g., via reductions of cardiovascular disease risk in the case of spousal bereavement; Shahane, Fagundes, & Denny, 2018). Lastly, future research may benefit from assessing additional emotion regulation strategies (i.e., in addition to cognitive reappraisal and expressive suppression) and their differential, downstream impacts on mental and physical health. Indeed, one meta-analysis that focused on associations between multiple strategies and symptoms of various forms of psychopathology found that effect sizes vary by strategy, with some strategies showing small to medium effect sizes (e.g., reappraisal) in predicting fewer negative symptoms and others exerting stronger effects (e.g., suppression and rumination) in predicting greater negative symptoms (Aldao, Nolen-Hoeksema, & Schweizer, 2010).

To conclude, the present study found supporting evidence of

divergent associations between college students' use of emotion regulation strategies and overall health. These associations were mediated by relatively more or less frequently reported negative emotions, specifically feelings of anxiety as well as negative appraisals about oneself that are characteristic of depressive symptomatology. In this way, negative affect served as a key mediator to predict health. Moreover, the influence of cognitive reappraisal and expressive suppression on health, via more or less frequently experienced negative affect, suggests that many individuals might stand to benefit from intervention studies that train (and/or discourage) use of particular emotion regulation strategies. For example, those previously at high risk for experiencing clinically-relevant anxiety and depressive symptoms and poorer health may benefit from an intervention that encourages more use of reappraisal, less use of suppression, or both. Even those with a modest risk of developing anxiety and depressive symptoms and poor health would potentially benefit. This approach may hold particular promise for college-aged individuals, a group entering a time of life that poses many emotional challenges when emotion regulation skills can confer benefits socially, mentally, and physically.

Author contributions

RL and BD designed the study and analysis. RL conducted all analyses and wrote a full draft of the manuscript. BD provided feedback and helped revise the paper to prepare it for submission.

Declaration of Competing Interest

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Acknowledgements

Preparation of this manuscript was supported by a Faculty Initiatives Grant from Rice University.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.paid.2019.109529>.

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