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Permalink
https://escholarship.org/uc/item/0m41x352

Journal
Psychology and Health, 30(10)

ISSN
0887-0446

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Publication Date
2015-10-03

DOI
10.1080/08870446.2015.1026904

Peer reviewed

Psychology & Health

Rumination is independently associated with poor psychological health: Comparing emotion regulation strategies

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Rumination is independently associated with poor psychological health: Comparing emotion regulation strategies

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Objective: Emotion regulation (ER) strategies are related to psychological health, with most work examining reappraisal and suppression. Yet, emerging findings suggest that rumination may have stronger relationships with psychological health, namely depression, than other ER strategies. This paper replicated and extended this work by testing whether rumination was independently associated with a range of poor psychological health risk indicators and outcomes. In addition, it explored whether the reason why rumination is so deleterious to health is because it underlies the stress–health relationship.
Design: Participants (*n* = 218) completed measures online.
Main outcome measures: Surveys assessed ER strategies (reappraisal, suppression, proactive coping, emotion support seeking, and rumination), health risk indicators (hostility, optimism, self-esteem), health outcomes (depression, poor sleep quality, anxiety) and perceived chronic stress.
Results: Multivariate regression analyses revealed rumination as the only ER strategy with a consistent independent effect on all the health risk indicators and outcomes. Bootstrapping analyses revealed indirect effects of perceived chronic stress on all the health variables via rumination.
Conclusion: Rumination had a deleterious relationship with psychological health, perhaps because rumination underlies the relationship between stress and psychological health. Results have implications for interventions, particularly emphasizing the need to target ruminative thinking after stressful experiences.

Keywords: rumination; emotion regulation; psychological health; stress

Emotion regulation (ER) strategies have been consistently shown to be related to mental health (Gross & Muñoz, 1995). For example, reappraisal is associated with greater levels of self-esteem, optimism, and subjective well-being and less depression, than suppression, which demonstrates the opposite pattern (Gross & John, 2003). Likewise, deficits in ER predict depression, borderline personality, substance abuse, eating and somatoform disorders (Berking & Wupperman, 2012). Although consistent relationships have been found between ER and psychological health, a majority of the research has focused on reappraisal and suppression. A recent meta-analysis, however, suggested that ruminative ER strategies may have the strongest relationship with psychopathology

compared to other ER strategies, including reappraisal and suppression (Aldao, Nolen-Hoeksema, & Schweizer, 2010). The purpose of this paper is to compare rumination with four common ER strategies (i.e. reappraisal, suppression, proactive coping and emotional support seeking) on a wide range of psychological health risk indicators (i.e. hostility, self-esteem and optimism) and outcomes (i.e. depression, poor sleep quality and anxiety), to determine which ER strategies, if any, have an independent relationships with psychological health. Subsequently, this paper explores whether one reason rumination may have such strong relationships with psychological health is due to its association with stress.

Defining ER

ER can be defined as a set of processes that people engage in, consciously or not, that redirect the spontaneous flow of any emotionally charged state (Koole, 2009). One well-cited model for conceptualizing the different types of ER strategies has been the process model of ER (Gross, 1998b). This model suggests that there are different classes of ER depending on whether the ER occurs before an emotional response (antecedent-focused) or after (response-focused), and whether the ER focuses on selecting or modifying the situation, deploying attention to certain aspects of it, shaping its meaning or modulating responses. Generally, it has been argued that those processes occurring early in this time sequence (e.g. situation modification and attentional deployment) should have a differential, and perhaps stronger, impact on the emotional response than those occurring later (e.g. emotion suppression) (e.g. Gross, 1998b).

Other ER classifications exist, such as those classifying ER strategies based on whether they are automatic versus controlled processes (Mauss, Bunge, & Gross, 2007), or classifying ER strategies based on their targets (i.e. attention, knowledge and bodily responses) or functions (i.e. satisfying hedonic needs, supporting global pursuits and facilitating the global personality system) (Koole, 2009). Although no consensus exists, the process model appears to be most common in the literature; moreover, there is some overlap across the different classifications. As such, the different ER strategies are discussed below in terms of the process model, yet would also fit within other models.

The current paper explores five types of ER strategies. In terms of antecedent-focused strategies, proactive coping, rumination and reappraisal are assessed. Proactive coping involves cognitions and behaviours aimed at attaining one's goals (Greenglass, Schwarzer, & Taubert, 1999), and involves situation selection or modification in which the person regulates themselves and their environments to prevent negative emotions from occurring (Koole, 2009). Rumination involves cognitive representations of any stressor, real or imagined, that are typically negative and unconstructive (Smyth, Zawadzki, & Gerin, 2013), and includes maladaptive, preservative focus on the experience of emotion, its causes and consequences (Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008). Thus, rumination reflects the inability to deploy attentional resources away from stressful thoughts (Webb, Miles, & Sheeran, 2012). Finally, reappraisal is the process of construing a potentially emotion-eliciting situation in a way that changes its emotional impact (Gross & John, 2003), thus representing a form of cognitive change. In terms of response-focused strategies, suppression and emotion support seeking are examined. Suppression is a response modulation that involves inhibiting ongoing emotion-expressive behaviour (Gross & John, 2003), and thus looks to control

emotion by inhibiting its experience and expression. Emotion support seeking involves regulating emotional distress by disclosing one's feeling to others, aiming to evoke empathy and seeking companionship (Greenglass et al., 1999). In sum, these ER strategies provide a wide range of classes of ER strategies, including both presumed positive and negative ER strategies, and antecedent-focused and response-focused ER strategies.

Comparing ER strategies

Building from the process model, reappraisal and suppression have often been studied as prototypical examples of ER strategies (Gross, 1998a), with reappraisal typically having positive effects and suppression negative effects (Gross & John, 2003). Yet, emerging evidence suggests other ER strategies may exist that are important to examine, notably attentional ER strategies. Supporting this contention, a meta-analysis of experimental studies was conducted comparing the effect of ER strategies on experienced emotion, assessed via experiential, behavioural and physiological means (Webb et al., 2012). To conduct the analysis, the researchers coded the experimental manipulations of ER in each study into a taxonomy of ER strategies based on the process model of ER. Manipulations suggesting rumination (i.e. concentration strategies of attentional deployment) had a consistent small- to medium-sized effect on emotion across the experiential, behavioural and physiological measures (Webb et al., 2012). Rumination was the only strategy to consistently impact all forms of ER, with reappraisal affecting experiential and behavioural outcomes but not physiological, and suppression affecting behavioural and physiological outcomes but not experiential.

Following from this meta-analysis, some studies have provided direct comparisons of different ER strategies. For example, the associations of nine ER strategies (i.e. rumination, catastrophising, self-blame, other-blame, acceptance, positive reappraisal, putting into perspective, positive refocusing and planning) with depression was examined across five samples (i.e. early adolescents, late adolescents, an adult general population, elderly people and psychiatric patients); results suggested rumination, catastrophising and reappraisal as the only ER strategies consistently related to depression (Garnefski & Kraaij, 2006). Among juveniles with a chronic disease, the same nine ER strategies were compared; only rumination and catastrophizing were found to have independent associations with internalising problems, and only rumination to have an association with of quality of life (Garnefski, Koopman, Kraaij, & ten Cate, 2009). Among college students, the associations of rumination, thought suppression, reappraisal and problem-solving were compared on depression, anxiety and eating disorder (Aldao & Nolen-Hoeksema, 2010). The independent effect of each strategy was not examined, however, bivariate correlations again suggested rumination to have the strongest relationship to each of the psychopathologies (with small- to medium-sized effects), followed by suppression, reappraisal and problem-solving which generally had small effects. Finally, composites of adaptive (i.e. acceptance and positive reframing) and maladaptive (i.e. behavioural disengagement, denial, suppression and rumination) ER strategies were compared in predicting a composite psychopathology score (i.e. depression, anxiety and alcohol use) both cross-sectionally and longitudinally over a year (Aldao & Nolen-Hoeksema, 2012). Only the maladaptive strategies independently predicted the composite psychopathology score.

Summarising these comparisons, consistent evidence suggests rumination to have independent and/or stronger associations with poor psychological health compared to other ER strategies. Nevertheless, these studies typically only examined a limited range of psychological health outcomes (most often depression); it is unclear whether the effects of rumination were so strong because of a particularly potent relationship with depression, or whether rumination would have a more general effect on poor psychological health. In addition, independent effects of each type of ER have not always been explored; given that each of the ER strategies likely shares variance (e.g. due to a personality characteristic or certain life circumstance), it is important to partial out this shared component to see if a general propensity to ER is driving effects or whether a specific strategy is more strongly associated with better health. Thus, the first aim of this study is to compare rumination with reappraisal, suppression, proactive coping and emotional support seeking on a range of psychological health risk indicators (i.e. hostility, self-esteem and optimism) and outcomes (i.e. depression, poor sleep quality and anxiety), to determine which ER strategies, if any, have independent associations with psychological health.

Why would rumination be so deleterious?

Although some limitations exist regarding how to interpret these prior studies, they seem to suggest that rumination may stick out as a particularly potent, and particularly negative, ER strategy. Yet, work comparing ER strategies has typically not addressed why one ER strategy might have more (or less) impact on psychological health compared to another. The second aim of this study is to explore a potential reason why rumination may have such deleterious effects on psychological health. This paper proposes that rumination's connection with stress can account these effects.

A long line of work has suggested that stress leads to poor health (Cohen, Janicki-Deverts, & Miller, 2007). In attempting to explain this relationship, one theory that has received considerable empirical support has suggested that the extent to which individuals perceive they have the resources to respond to the stressors they encounter determines the extent to which those stressors will have an impact on the person (Lazarus & Folkman, 1984). This work on coping suggests a potential mechanism for how numerous forms of ER may promote positive health, including proactive coping (e.g. does the person have the resources to avoid stressful situations), reappraisal (e.g. does the person have the resources to see how stressors may be less toxic) and emotion support seeking (e.g. does the person have resources in the form of the support of others).

Yet, rumination may be an additional mechanism that explains whether stress will lead to poor health. Research has found that individuals engage in more rumination when they experience stress (Nolen-Hoeksema & Morrow, 1991; Sontag & Graber, 2010; Verkuil, Brosschot, Meerman, & Thayer, 2012; Zawadzki, Graham, & Gerin, 2013). When individuals ruminate they experience more negative emotional states (e.g. Nolen-Hoeksema, Morrow, & Fredrickson, 1993; Rusting & Nolen-Hoeksema, 1998). Moreover, the mental focus of thinking about stress make it so the individuals have a harder time concentrating and problem-solving (Lyubomirsky & Nolen-Hoeksema, 1995; McLaughlin, Borkovec, & Sibrava, 2007). As such, engaging in rumination may make it more difficult to have adaptive coping responses to stress, and perhaps explains in part why rumination appears to have a stronger effect on psychological health than

other ER strategies. In addition, simply the process of thinking about stress can produce and sustain physiological responding that typically accompanies stress responses (Gerin, Davidson, Christenfeld, Goyal, & Schwartz, 2006; Glynn, Christenfeld, & Gerin, 2007). This repetitive and extended physiological responding is proposed to cause wear-and-tear on the body that over time leads to disease (Brosschot, Gerin, & Thayer, 2006; Smyth et al., 2013). Such an explanation helps to account for why rumination has been found to be associated with a range of poor psychological health outcomes, including depression (Hong, 2007; Thomsen, Mehlsen, Christensen, & Zachariae, 2003; Zawadzki et al., 2013), poor sleep quality (Thomsen et al., 2003; Zawadzki et al., 2013) and anxiety (Nolen-Hoeksema, 2000).

Indeed, some work has found evidence supporting rumination as explaining, at least in part, the association between perceived stress and depression (Sontag & Graber, 2010), perceived discrimination and depressive symptoms (Borders & Liang, 2011), loneliness and depressed mood and poor sleep quality (Zawadzki et al., 2013). Although promising, this work has largely examined the association of rumination with a limited range of psychological health outcomes. Moreover, the potential impact of other ER strategies has not been concurrently examined. Although limited by a cross-sectional design that cannot directly speak to causality, the present study builds from this prior work to test whether the associations typically observed between stress and health can be accounted for by the ER strategies. Although many interventions exist to reduce stress and its impact on health, few interventions are aimed directly are reducing ruminative thinking (exceptions include cognitive behavioural therapy; Meichenbaum, 1977). If it was found that associations between stress and psychological health are no longer significant when rumination and other ER strategies are statistically controlled for, but that the ER strategies remained significantly associated with health, these results would suggest that greater efforts might be warranted in designing interventions to improve one's ER ability. Thus, the present study tested whether there were indirect effects of stress on a broad range of psychological health indicators and outcomes via the five ER strategies.

The current study

The relationship between ER strategies and health was tested on a young adult sample. Health was measured both in the form of health outcomes, including depression, poor sleep quality and anxiety, and health risk indicators, including hostility, optimism and self-esteem. Depression (Mackenzie et al., 2011), sleep problems (Buboltz, Brown, & Soper, 2001) and anxiety (Wittchen, Nelson, & Lachner, 1998) are common for young adults. Moreover, early instances of depression (Gopinath, Katon, Russo, & Ludman, 2007), poor sleep quality (Krueger & Friedman, 2009) and anxiety (Woodward & Fergusson, 2001), predict both later relapse and worse long-term health. Likewise, the health risk indicators – hostility (Chida & Steptoe, 2009; Leiker & Hailey, 1988), optimism (Achat, Kawachi, Spiro, DeMolles, & Sparrow, 2000; Scheier & Carver, 1992), and self-esteem (McGee & Williams, 2000; Trzesniewski et al., 2006) – also have been shown to predict poor future health. Thus, a broad range of psychological health was assessed that are both highly present in the sample studied and predict poor future health.

The study tested two set of hypotheses. First, it examined whether there were independent associations of the ER strategies on each of the psychological health indicators.

It was predicted that rumination would have independent associations across all outcomes. Second, the study explored whether any of the ER strategies could account for the relationship between perceived chronic stress and poor psychological health. It was predicted that there would be significant indirect effects of stress on the health risk indicators and outcomes via rumination.

Method

Participants

In exchange for course credit, 218 undergraduates from introductory biobehavioural health and psychology classes participated in the study (165 women, 53 men; aged 18–32, $M = 20.31$). Although race and ethnicity were not collected from participants, the sample was selected from a large north-eastern university with students who predominantly identify as non-Hispanic Caucasian.

Materials and procedure

Emotion regulation

All measures were completed online in one session. Reappraisal and suppression were measured with the ER Questionnaire (Gross & John, 2003). For reappraisal, six items assessed the extent to which potentially emotion-eliciting situation was construed in a way that changes its emotional impact ($\alpha = .88$; e.g. 'I control my emotions by changing the way I think about the situation I'm in'). For suppression, four items assessed response modulation that involved inhibiting ongoing emotion-expressive behaviour ($\alpha = .81$; 'I control my emotions by not expressing them'). Proactive coping and emotion support seeking were measured with the Proactive Coping Inventory (Greenglass et al., 1999). For proactive coping, 14 items assessed self-regulatory goal attainment cognitions and behaviour ($\alpha = .60$; e.g. 'When I experience a problem, I take the initiative in resolving it'). For emotion support seeking, five items assessed regulating emotional distress by disclosing to others and seeking companionship ($\alpha = .78$; e.g. 'When I'm depressed I get out and talk to others'). Finally, rumination was measured with the Ruminative Response Scale, a subscale of the Response Styles Questionnaire (Nolen-Hoeksema & Morrow, 1991), which uses 22 items to assess ruminative coping responses to negative mood ($\alpha = .95$; e.g. 'How often do you think about a recent situation, wishing it had gone better?'). All ER scales were answered on 1 (*Disagree Strongly* or *Not at All True* or *Never*) to 4 (*Agree Strongly* or *Completely True* or *Always*) scales. Scale means were computed with higher scores indicating greater reappraisal, suppression, proactive coping, emotion support seeking and rumination.

Health risk indicators

Hostility was measured with the Cook Medley Hostility Scale (Cook & Medley, 1954). The cognitive, affective and behavioural elements associated with hostility are assessed with 50 true or false statements ($\alpha = 88$; 'When someone does me wrong, I feel I should pay him back if I can, just for the principle of the thing'). Optimism was measured with the revised Life Orientation Test (Scheier, Carver, & Bridges, 1994).

Generalised expectancies for positive versus negative outcomes were assessed with six items (α = .83; 'In uncertain times, I usually expect the best'). Self-esteem was measured with the Rosenberg Self-Esteem Scale (Rosenberg, 1979). Evaluation of one's overall self-worth was assessed with 10 items (α = .93; 'On the whole, I am satisfied with myself.'). Optimism was measured on a 1 (*Strongly Disagree*) to 5 (*Strongly Agree*) scale, whereas self-esteem was measured on a 1 (*Strongly Agree*) to 4 (*Strongly Disagree*) scale. Scale means were computed such that higher numbers indicated greater hostility, optimism and self-esteem.

Health outcomes

Depression was measured with the Center for Epidemiological Studies of Depression Scale (Radloff, 1977). Depressive symptoms and behaviours over the past month were assessed with 20 items (α = .92; 'I felt that I couldn't shake off the blues, even with help from family & friends'). Poor sleep quality was measured with the Pittsburgh Sleep Quality Index (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989). Sleep quality over the past month was assessed with 24 items that form component scores related to subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication and daytime dysfunction. Scores are combined, per standardised instructions, to yield a global score of self-reported sleep quality. Although scale reliability information is not typically computed, the global score has been shown to have good test–retest reliability and to have high sensitivity and specificity in distinguishing good and poor sleepers (Buysse et al., 1989). Anxiety was measured with the Spielberger Trait Anxiety Scale (Spielberger, Gorsuch, & Lushene, 1970). The frequency with which respondents generally feel symptoms of anxiety was assessed with 20 items (α = .93; 'I feel nervous and restless'). Depression and anxiety were measured on 1 (*Rarely or None of the Time* or *Not at All*) to 4 (*Most or All of the Time* or *Very Much So*) scales. Scale means were computed such that higher numbers indicated greater depression, worse sleep quality and greater anxiety.

Chronic stress

Chronic stress was measured with the Trier Inventory for the Assessment of Chronic Stress (Schulz & Schlotz, 1999). Perceived stress over the past month was assessed with 30 items (α = .92; 'I do not have enough time to perform my daily tasks'). Items were assessed using a 1 (*Never*) to 5 (*Very Often*) scale, and a scale mean was computed such that higher numbers indicated greater stress.

Analytic plan

Hypothesis 1 compares the associations of each of the ER strategies on the psychological health indicators and outcomes. To test this hypothesis, a series of multivariate regression models were run in which the five ER strategies were entered as predictors of the health risk indicators and outcomes (for Hypotheses 1 and 2, each health variable was tested in a separate model). By simultaneously examining each of the ER strategies in the same model, these results reveal the independent associations of each ER strategy above that of the other strategies. Hypothesis 2 explored whether any of the ER

strategies can account for the relationship between perceived chronic stress and the psychological health variables. To test this hypothesis, a bootstrapping procedure was used (MacKinnon, Lockwood, & Williams, 2004), which tested indirect effects of perceived chronic stress on the psychological health variables via the ER strategies. Bootstrapping allows for the testing of multiple mediators in a single model, avoiding issues such as the omitted variable problem that can lead to biased parameter estimates when separate tests for each mediator are used, and provides an assessment of the relative magnitude of the effect of each mediator (Preacher & Hayes, 2008). Bootstrapping was tested using PROCESS (Hayes, 2013), specifying 5000 resamples and 95% bias-corrected confidence intervals. For the present paper, the confidence intervals of each indirect effect are explored; confidence intervals that include zero indicate a null effect (Mooney & Duval, 1993).

Results

Preliminary analyses

Correlations across the five ER strategies, the health risk indicators and outcomes, and perceived stress were initially explored. Aside from a moderate relationship between proactive coping and emotional support seeking, correlations between the ER strategies were small- to non-significant suggesting the ER strategies represented distinct constructs. As expected each of the ER strategies was correlated with the health risk indicators and outcomes, with the exception of sleep that was only significantly related to suppression and rumination. All relationships were in the expected direction with reappraisal, proactive coping and emotional support having salubrious relationships with the psychological health-related variables (e.g. greater optimism, lower depression), and suppression, rumination and perceived chronic stress having deleterious relationships (e.g. lower self-esteem, greater anxiety) (Table 1).

H1. Comparing ER strategies

In multivariate regression models, the five ER strategies were entered as predictors of the health risk indicators and outcomes. Preliminary analyses tested for multicollinearity among the ER strategies, with no such issues detected (i.e. tolerance levels > .48; VIFs < 2.05). Overall model statistics and standardised beta estimates for each ER strategy can be found in Table 2. Rumination emerged as the strongest and most consistent predictor of psychological health, such that those prone to greater rumination were those with greater hostility, lower self-esteem, lower optimism, greater depression, poorer sleep quality and greater anxiety. Small effects were observed for reappraisal predicting self-esteem, optimism and anxiety, and suppression marginally predicting hostility and depression, and significantly predicting self-esteem, optimism and anxiety. Proactive coping and emotion support seeking were unrelated to all psychological health risk indicators and outcomes.

H2. Indirect effects

Next, bootstrapping was used to test whether there were indirect effects of perceived chronic stress on psychological health via the ER strategies. As can be seen in Table 3,

Table 1. Correlations, ranges, means and standard deviations across ER strategies, health risk indicators, health outcomes and perceived chronic stress.

	1	2	3	4	5	6	7	8	9	10	11	12
1. Reappraisal	–											
2. Suppression	.01	–										
3. Pro. coping	.24***	-.32***	–									
4. Supp. seek.	.30***	-.15*	.67***	–								
5. Rumination	-.26***	.37***	-.10	-.13+	–							
6. Hostility	-.14*	.34***	-.19**	-.16*	.54***	–						
7. Self-esteem	.31***	-.34***	.17*	.19**	-.61***	-.38***	–					
8. Optimism	.31***	-.38***	.24***	.26***	-.53***	-.45***	.63***	–				
9. Depression	-.26***	.37***	-.17*	-.15*	.73***	.49***	-.69***	-.59***	–			
10. Poor sleep	-.13+	.20**	.03	-.01	.46***	.27***	-.39***	-.37***	.49***	–		
11. Anxiety	-.38***	.39***	-.23***	-.25***	.75***	.54***	-.78***	-.73***	.79***	.47***	–	
12. Stress	-.27***	.39***	-.26***	-.22**	.56***	.45***	-.43***	-.42***	.52***	.32***	.58***	–
Range	1–4	1–4	1–4	1–4	1–4	1–2	1–4	1–5	1–4	0–21	1–4	1–5
M	2.90	2.27	2.67	2.78	1.73	1.40	3.25	3.54	1.62	5.08	1.93	2.58
SD	.55	.68	.30	.53	.52	.18	.57	.73	.45	2.68	.52	.50

Notes: Reappraisal and suppression are the reappraisal and suppression subscales from the ER Questionnaire. Pro. coping and Supp. seek. are the proactive coping and emotional support seeking subscales of the Proactive Coping Inventory. Rumination is the Ruminative Response subscale of the Response Styles Questionnaire.
+$p < .10$; *$p < .05$; **$p < .01$; ***$p < .001$.

Table 2. Standardised beta estimates of the ER strategies predicting the health risk indicators and outcomes.

	Health risk indicators			Health outcomes		
	Hostility	Self-esteem	Optimism	Depression	Poor sleep	Anxiety
Reappraisal	.01	.16**	.18**	−.08	−.04	−.19***
Suppression	.13[+]	−.15*	−.21***	.10[+]	.07	.14**
Proactive coping	−.09	−.02	.02	−.06	.11	−.02
Support seeking	−.02	.07	.11	.02	−.004	−.08
Rumination	.48***	−.51***	−.39***	.67***	.43***	.64***
$F(5, 211)$	19.46	30.27	24.71	52.116	11.87	70.54
r^2	.32	.42	.37	.55	.22	.63

$^+p < .10$; $^*p < .05$; $^{**}p < .01$; $^{***}p < .001$.

Table 3. Unstandardised betas (standard errors) of the indirect effects of perceived chronic stress on the health risk indicators and outcomes via the ER strategies.
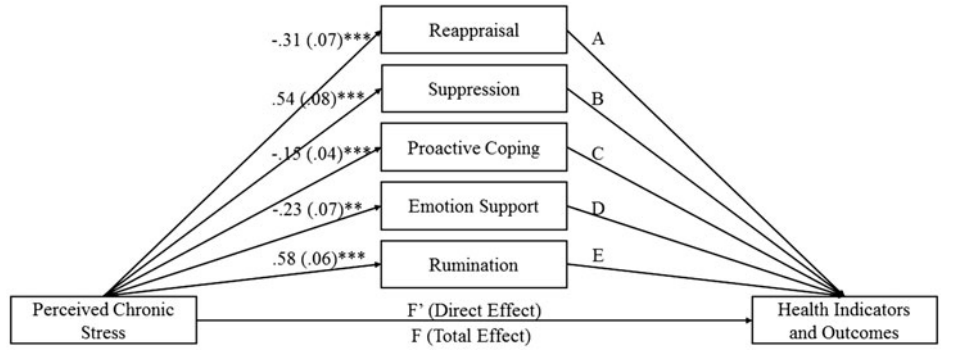
	Health risk indicators			Health outcomes		
Predictors	Hostility	Self-esteem	Optimism	Depression	Poor sleep	Anxiety
A: Reappraisal	.01	.16**	.22**	−.05	−.13	−.16***
	(.02)	(.06)	(.08)	(.04)	(.34)	(.04)
B: Suppression	.02	−.12*	−.21**	.05	.20	.08*
	(.02)	(.05)	(.07)	(.04)	(.29)	(.04)
C: Proactive coping	−.04	−.05	.04	−.08	1.04	−.01
	(.05)	(.14)	(.19)	(.10)	(.77)	(.10)
D: Support seeking	−.01	.07	.15	.02	−.004	−.08
	(.03)	(.08)	(.10)	(.05)	(.43)	(.06)
E: Rumination	.14***	−.54***	−.51***	.54***	2.00***	.58***
	(.02)	(.07)	(.10)	(.05)	(.40)	(.05)
F′: Chronic stress (direct effect)	.07*	−.06	−.09	.11*	.57	.16**
	(.03)	(.08)	(.10)	(.05)	(.42)	(.06)
F: Chronic stress (total effect)	.16***	−.50***	−.61***	.47***	1.72***	.61***
	(.02)	(.07)	(.09)	(.05)	(.34)	(.06)

$^*p < .05$; $^{**}p < .01$; $^{***}p < .001$.

Table 4. Indirect effects (and 95% confidence intervals) of perceived chronic stress on the health risk indicators and outcomes via the ER strategies.

	Health risk indicators			Health outcomes		
	Hostility	Self-esteem	Optimism	Depression	Poor sleep	Anxiety
Reappraisal	−.004	**−.05**	**−.07**	.02	.04	**.05**
	[−.02, .01]	**[−.10, −.02]**	**[−.14, −.02]**	[−.003, .05]	[−.17, .27]	**[.02, .09]**
Suppression	.01	**−.06**	**−.12**	.03	.11	**.04**
	[−.005, .04]	**[−.13, −.02]**	**[−.20, −.04]**	[−.01, .07]	[−.20, .46]	**[.004, .09]**
Proactive coping	.01	.01	−.01	.01	−.16	.001
	[−.01, .03]	[−.03, .06]	[−.07, .05]	[−.01, .04]	[−.47, .04]	[−.03, .03]
Support seeking	.001	−.02	−.03	−.005	.001	.02
	[−.01, .02]	[−.06, .02]	[−.10, .01]	[−.03, .02]	[−.21, .23]	[−.01, .05]
Rumination	**.08**	**−.31**	**−.30**	**.31**	**1.16**	**.34**
	[.05, .11]	**[−.43, −.22]**	**[−.43, −.18]**	**[.23, .41]**	**[.68, 1.69]**	**[.26, .43]**

Note: Items in bold indicate that the 95% confidence interval does not include zero.

perceived chronic stress predicted each of the ER strategies, and also predicted each of the health risk indicators and outcomes (see path F). In turn, reappraisal and suppression predicted self-esteem, optimism and anxiety, while rumination consistently predicted all the health variables. When the ER strategies were included, chronic stress was no longer a significant predictor of self-esteem, optimism and poor sleep quality, whereas its effects were significant but greatly reduced for hostility, depression and anxiety (see path F′). Finally, as can be seen in Table 4, there were significant indirect effects for rumination on all the psychological health outcomes, for reappraisal on self-esteem, optimism and anxiety, and for suppression on self-esteem, optimism and anxiety.

Exploratory analyses

Given that potential gender differences may exist in the use of rumination (Broderick, 1998; Nolen-Hoeksema & Jackson, 2001), the above analyses were rerun while controlling for participant gender. The observed patterns reported in Tables 2–4, remained relatively unchanged when participant gender was included in the analyses.

Discussion

Deficits in ER predict poor psychological health (e.g. Berking & Wupperman, 2012; Gross & John, 2003; Gross & Muñoz, 1995). A recent meta-analysis suggested that rumination may have the strongest associations with psychopathology compared to other ER strategies (e.g. Aldao et al., 2010). Supporting and extending previous work, this study found rumination to have the strongest and only consistent independent association with the health risk indicators and outcomes compared to reappraisal, suppression, proactive coping and emotion support seeking. As expected, rumination had a deleterious relationship with psychological health, including greater hostility, lower optimism, lower self-esteem, greater depression, greater sleep problems and greater anxiety. These results fall in line with other work that has also compared ER strategies and

likewise found rumination to have strong deleterious associations with health (e.g. Aldao & Nolen-Hoeksema, 2010, 2012; Garnefski & Kraaij, 2006; Garnefski et al., 2009). Importantly, these results extend prior work in two ways. First, all the ER strategies were examined concurrently thus revealing the independent associations of each ER strategy. Second, this study tested a wide range of psychological health variables, including both health risk indicators and outcomes. The health outcomes studied – depression, poor sleep quality and anxiety – are those that are highly prevalent in the sample studied (Buboltz et al., 2001; Mackenzie et al., 2011; Wittchen et al., 1998). Moreover, both the health risk indicators and outcomes predict future poor health (Achat et al., 2000; Chida & Steptoe, 2009; Gopinath et al., 2007; Krueger & Friedman, 2009; Leiker & Hailey, 1988; McGee & Williams, 2000; Scheier & Carver, 1992; Trzesniewski et al., 2006; Woodward & Fergusson, 2001). Therefore, the observed pattern of results suggests the importance of rumination not only on current, but also future, health.

In addition to rumination, and replicating previous work (Gross & John, 2003), reappraisal and suppression were also associated with some of the health risk indicators and outcomes, albeit with smaller relationships than rumination. Specifically, reappraisal had a small positive relationship with self-esteem, optimism and anxiety, but no associations were observed for hostility, depression and sleep quality. In contrast, suppression had a small negative relationship with self-esteem, optimism and anxiety, and marginally was associated with hostility and depression; no associations were observed for sleep quality. Surprisingly, neither proactive coping nor emotion support seeking was independently related to the health risk indicators or outcomes, although small relationships were observed in the bivariate correlational analyses. These null results notwithstanding, a large portion of the variance in the psychological health risk indicators and outcomes was explained by the ER strategies, with r^2 ranging from .32 to .63. These results suggest the importance of multiple forms of ER, especially rumination, for understanding psychological health, but also that many processes may be simultaneously occurring that can both promote or prevent positive health.

In addition to identifying a relationship between rumination and poor health, results from the bootstrapping analyses suggested that rumination accounted for much of the relationship between stress and poor health. Although the results of this cross-sectional study cannot suggest causal relationships, these results are in line with theory and research that has purported such a relationship. The negative impact that stress has on health has a long documented history (Cohen et al., 2007), yet the psychological mechanisms underlying this relationship are not well understood (for exceptions see, for example, Brosschot et al., 2006; Segerstrom, Tsao, Alden, & Craske, 2000; Smyth et al., 2013). In line with work on coping (Lazarus & Folkman, 1984), this study found that one's thoughts are of vital importance in understanding stress' pejorative effects. Namely, and replicating prior work (e.g. Nolen-Hoeksema & Morrow, 1991; Sontag & Graber, 2010; Verkuil et al., 2012; Zawadzki et al., 2013), greater perceived stress or stressful situations predict greater rumination. In turn, engaging in rumination can create and extend stress responding (e.g. Gerin et al., 2006; Glynn et al., 2007), which induces negative emotional states (Nolen-Hoeksema et al., 1993; Rusting & Nolen-Hoeksema, 1998) and increases difficulty in concentrating and problem-solving (Lyubomirsky & Nolen-Hoeksema, 1995; McLaughlin et al., 2007). When this stress responding is repeated over time, it can create wear-and-tear on the body that is proposed to lead to

disease (Brosschot et al., 2006; Smyth et al., 2013). Thus, while the experience of stress may be unavoidable, the extent to which one engages in rumination as a result of the stressful situation may go a long way in explaining why stress leads to disease.

These results have important implications for interventions aiming to improve psychological health. Namely, while much work has been dedicated to reducing stress, an alternative or supplement to these approaches may be to prevent individuals from engaging in unconstructive rumination after stress is experienced. For example, in one study, participants were instructed to write about their life goals, which reduced ruminative thinking and also reduced cortisol awakening responses, suggesting a reduction in the impact of stress on health (Teismann, Het, Grillenberger, Willutzki, & Wolf, 2014). Presumably, this intervention was effective for its ability to replace negative, repetitive and unconstructive cognitions typical of rumination with more positive and adaptive cognitions. The reduction in the unconstructive component of these cognitions may have been the crucial component to the observed effects. A review by Watkins (2008) concluded that although the consequences of unconstructive repetitive thought are depression, anxiety and difficulties in physical health, when that repetitive thought is constructive positive consequences ensue, including recovery from traumatic events and depression, adaptive planning and an uptake in health-promoting behaviours. In other words, and in line with other similar lines of work (e.g. Feldman, Joormann, & Johnson, 2008), rumination, worry and other forms of perseverative cognitions may not be inherently negative, but rather what determines consequences is the ability of these thoughts to evolve and produce new meaning beyond the often initial negative thought. As such, a more formal intervention like cognitive behavioural therapy that aims to help individuals identify when they are engaging in maladaptive thought patterns, and replace those excessively negative thoughts with more positive and adaptive cognitions may help reduce rumination and produce positive benefits on psychological health (see Meichenbaum, 1977). Indeed, cognitive behavioural therapy focused on reducing rumination reduced depressive symptoms compared to treatment as usual (Watkins et al., 2007), although no attentional control group was included, so it is not possible to link effects directly to rumination. In sum, research has suggested that reducing rumination may be possible, and the results of the present study suggest that such a reduction might have an impact on improving a broad constellation of psychological health.

Limitations and future directions

The sample involved college students, of whom roughly three-quarters were female. As such, results may have limited generalisability to non-student samples of differing demographics. Yet, exploratory analyses in which participant sex was controlled for suggested that gender did not impact results. This makes sense as although women may report more rumination than men (Broderick, 1998; Nolen-Hoeksema & Jackson, 2001), the negative effects of rumination appear general across the sexes (Nolen-Hoeksema & Harrell, 2002). Moreover, the effect of rumination, and other ER strategies, on depressive symptoms was similar across five diverse samples, including early adolescents, late adolescents, general adult, the elderly and psychiatric patients (Garnefski & Kraaij, 2006). Nevertheless, future work would benefit by replicating the results reported here with a more diverse population. Particularly, it would be important to test these results on an older population, as it would allow the testing of whether the

observed relationships between stress, rumination and psychological health also hold for poor physical health, which typically develops later in life.

In addition, the sample size may not have been adequate to detect very small relationships that may have existed between some of the ER strategies and the psychological health risk indicators and outcomes. For example, a series of power analyses was run using GPower 3.0 in which the required sample size was estimated to determine the change in r^2 for each predictor in a regression model with five predictors, and with α set at .05. Results suggest that the sample size of this study was acceptable to detect up to small- to medium-sized effects, but may have been underpowered to detect small effects. Thus, some of the non-significant relationships observed in the regression analyses may in fact represent small but potentially identifiable effects. Future research would benefit from attempting to replicate these findings with larger sample sizes.

Although the well-validated and widely used Proactive Coping Inventory (Greenglass et al., 1999) was used to assess proactive coping, this subscale had relatively average reliability. The added variability due to measurement error as a result of the average levels of reliability may have resulted in reduced relationships observed between proactive coping and the health risk indicators and outcomes. Future work may wish to assess proactive coping using alternative measures, or if average reliability was again observed with the Proactive Coping Inventory, seek to identify a subset of items for this scale that forms a more reliable index of proactive coping.

The data were cross-sectional and thus cannot speak directly to issues of causality. The proposed model was based on prior work testing longitudinal relationships between stress, rumination and health (e.g. Zawadzki et al., 2013), yet more longitudinal data are needed to test rumination as a mediator. In addition, ER is a dynamic process with many types of ER strategies occurring in response to the same emotion (Gross & Thompson, 2007). Yet, rarely has ER been assessed outside the laboratory or beyond survey instruments. Techniques such as ecological momentary assessment (Smyth & Stone, 2003) that can measure real-time associations between stress, ER and cognitive and emotional states may enable a more nuanced approach to assessing ER that could examine the interplay of various ER strategies and their effects on health.

Finally, the present study focused mostly on negative aspects of psychological health for which rumination may be particularly important. Future work may want to also explore positive aspects of psychological health so as to determine whether other strategies, such as proactive coping and emotion support seeking, have more predictive relationships with these types of psychological health outcomes.

Conclusion

Individuals likely engage in some kind of ER for most of their waking life, and such control and management (or lack thereof) of emotion have important health implications. Yet, as the results in the present study suggest, not all forms of ER have equal relationships. One clear implication appears to be that reducing ruminative thinking may improve psychological health. At the same time, the ability to reshape meaning (reappraisal) appears to have potential positive effects, while trying to suppress the expression of emotion has negative effects. These differences suggest complex relationships between ER and psychological health, with much more work needed to understand when and how different forms of ER impact health.

Disclosure statement

No potential conflict of interest was reported by the author.

References

Achat, H., Kawachi, I., Spiro, A., DeMolles, D. A., & Sparrow, D. (2000). Optimism and depression as predictors of physical and mental health functioning: The normative aging study. *Annals of Behavioral Medicine, 22*, 127–130. doi:10.1007/BF02895776

Aldao, A., & Nolen-Hoeksema, S. (2010). Specificity of cognitive emotion regulation strategies: A transdiagnostic examination. *Behaviour Research and Therapy, 48*, 974–983. doi:10.1016/j.brat.2010.06.002

Aldao, A., & Nolen-Hoeksema, S. (2012). When are adaptive strategies most predictive of psychopathology? *Journal of Abnormal Psychology, 121*, 276–281. doi:10.1037/a0023598

Aldao, A., Nolen-Hoeksema, S., & Schweizer, S. (2010). Emotion-regulation strategies across psychopathology: A meta-analytic review. *Clinical Psychology Review, 30*, 217–237. doi:10.1016/j.cpr.2009.11.004

Berking, M., & Wupperman, P. (2012). Emotion regulation and mental health: Recent findings, current challenges, and future directions. *Current Opinion in Psychiatry, 25*, 128–134. doi:10.1097/YCO.0b013e3283503669

Borders, A., & Liang, C. T. H. (2011). Rumination partially mediates the association between perceived ethnic discrimination, emotional distress, and aggression. *Cultural Diversity and Ethnic Minority Psychology, 17*, 125–133. doi:10.1037/a0023357

Broderick, P. C. (1998). Early adolescent gender differences in the use of ruminative and distracting coping strategies. *The Journal of Early Adolescence, 18*, 173–191. doi:10.1177/0272431698018002003

Brosschot, J. F., Gerin, W., & Thayer, J. F. (2006). The perseverative cognition hypothesis: A review of worry, prolonged stress-related physiological activation, and health. *Journal of Psychosomatic Research, 60*, 113–124. doi:10.1016/j.jpsychores.2005.06.074

Buboltz, W. C., Brown, F., & Soper, B. (2001). Sleep habits and patterns of college students: A preliminary study. *Journal of American College Health, 50*, 131–135. doi:10.1080/07448480109596017

Buysse, D. J., Reynolds, C. F., Monk, T. H., Berman, S. R., & Kupfer, D. J. (1989). The Pittsburgh sleep quality index: A new instrument for psychiatric practice and research. *Psychiatry Research, 28*, 193–213. doi:10.1016/0165-1781(89)90047-4

Chida, Y., & Steptoe, A. (2009). The association of anger and hostility with future coronary heart disease. *Journal of the American College of Cardiology, 53*, 936–946. doi:10.1016/j.jacc.2008.11.044

Cohen, S., Janicki-Deverts, D., & Miller, G. E. (2007). Psychological stress and disease. *JAMA, 298*, 1685–1687. doi:10.1001/jama.298.14.1685

Cook, W. W., & Medley, D. M. (1954). Proposed hostility and pharisaic-virtue scales for the MMPI. *Journal of Applied Psychology, 38*, 414–418. doi:10.1037/h0060667

Feldman, G. C., Joormann, J., & Johnson, S. L. (2008). Responses to positive affect: A self-report measure of rumination and dampening. *Cognitive Therapy Research, 32*, 507–525. doi:10.1007/s10608-006-9083-0

Garnefski, N., Koopman, H., Kraaij, V., & ten Cate, R. (2009). Brief report: Cognitive emotion regulation strategies and psychological adjustment in adolescents with a chronic disease. *Journal of Adolescence, 32*, 449–454. doi:10.1016/j.adolescence.2008.01.003

Garnefski, N., & Kraaij, V. (2006). Relationships between cognitive emotion regulation strategies and depressive symptoms: A comparative study of five specific samples. *Personality and Individual Differences, 40*, 1659–1669. doi:10.1016/j.paid.2005.12.009

Gerin, W., Davidson, K. W., Christenfeld, N. J., Goyal, T., & Schwartz, J. E. (2006). The role of angry rumination and distraction in blood pressure recovery from emotional arousal. *Psychosomatic Medicine, 68*, 64–72. doi:10.1097/01.psy.0000195747.12404.aa

Glynn, L. M., Christenfeld, N., & Gerin, W. (2007). Recreating cardiovascular responses with rumination: The effects of a delay between harassment and its recall. *International Journal of Psychophysiology, 66*, 135–140. doi:10.1016/j.ijpsycho.2007.03.018

Gopinath, S., Katon, W. J., Russo, J. E., & Ludman, E. J. (2007). Clinical factors associated with relapse in primary care patients with chronic or recurrent depression. *Journal of Affective Disorders, 101*, 57–63. doi:10.1016/j.jad.2006.10.023

Greenglass, E. R., Schwarzer, R., & Taubert, S. (1999). The Proactive Coping Inventory (PCI): A multidimensional research instrument [Online publication]. Retrieved from http://www.psych.yorku.ca/greenglass/

Gross, J. J. (1998a). Antecedent- and response-focused emotion regulation: Divergent consequences for experience, expression, and physiology. *Journal of Personality and Social Psychology, 74*, 224–237. doi:10.1037/0022-3514.74.1.224

Gross, J. J. (1998b). The emerging field of emotion regulation: An integrative review. *Review of General Psychology, 2*, 271–299. doi:10.1037/1089-2680.2.3.271

Gross, J. J., & John, O. P. (2003). Individual differences in two emotion regulation processes: Implications for affect, relationships, and well-being. *Journal of Personality and Social Psychology, 85*, 348–362. doi:10.1037/0022-3514.85.2.348

Gross, J. J., & Muñoz, R. F. (1995). Emotion regulation and mental health. *Clinical Psychology: Science and Practice, 2*, 151–164. doi:10.1111/j.1468-2850.1995.tb00036.x

Gross, J. J., & Thompson, R. A. (2007). Emotion regulation: Conceptual foundations. In J. J. Gross (Ed.), *Handbook of emotion regulation* (pp. 3–24). New York, NY: Guilford Press.

Hayes, A. F. (2013). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. New York, NY: Guilford Press.

Hong, R. Y. (2007). Worry and rumination: Differential associations with anxious and depressive symptoms and coping behavior. *Behaviour Research and Therapy, 45*, 277–290. doi:10.1016/j.brat.2006.03.006

Krueger, P., & Friedman, E. (2009). Sleep duration in the United States: A cross-sectional population-based study. *American Journal of Epidemiology, 169*, 1052–1063. doi:10.1093/aje/kwp023

Koole, S. L. (2009). The psychology of emotion regulation: An integrative review. *Cognition and Emotion, 23*, 4–41. doi:10.1080/02699930802619031

Lazarus, R. S., & Folkman, S. (1984). *Stress, appraisal, and coping*. New York, NY: Springer.

Leiker, M., & Hailey, B. J. (1988). A link between hostility and disease: Poor health habits? *Behavioral Medicine, 14*, 129–133. doi:10.1080/08964289.1988.9935136

Lyubomirsky, S., & Nolen-Hoeksema, S. (1995). Effects of self-focused rumination on negative thinking and interpersonal problem solving. *Journal of Personality and Social Psychology, 69*, 176–190. doi:10.1037/0022-3514.69.1.176

Mackenzie, S., Wiegel, J. R., Mundt, M., Brown, D., Saewyc, E., Heiligenstein, E., … Fleming, M. (2011). Depression and suicide ideation among students accessing campus health care. *American Journal of Orthopsychiatry, 81*, 101–107. doi:10.1111/j.1939-0025.2010.01077.x

MacKinnon, D. P., Lockwood, C. M., & Williams, J. (2004). Confidence limits for the indirect effect: Distribution of the product and resampling methods. *Multivariate Behavioral Research, 39*, 99–128. doi:10.1207/s15327906mbr3901_4

McLaughlin, K. A., Borkovec, T. D., & Sibrava, N. J. (2007). The effects of worry and rumination on affect states and cognitive activity. *Behavior Therapy, 38*, 23–38. doi:10.1016/j.beth.2006.03.003

Mauss, I. B., Bunge, S. A., & Gross, J. J. (2007). Automatic emotion regulation. *Social and Personality Psychology Compass, 1*, 146–167. doi:10.1111/j.1751-9004.2007.00005.x

McGee, R., & Williams, S. (2000). Does low self-esteem predict health compromising behaviours among adolescents? *Journal of Adolescence, 23*, 569–582. doi:10.1006/jado.2000.0344

Meichenbaum, D. (1977). Cognitive behaviour modification. *Scandinavian Journal of Behaviour Therapy, 6*, 185–192. doi:10.1080/16506073.1977.9626708

Mooney, C. Z., & Duval, R. D. (1993). *Bootstrapping: A nonparametric approach to statistical inference* (pp. 94–95). Newbury Park, CA: Sage.

Nolen-Hoeksema, S. (2000). The role of rumination in depressive disorders and mixed anxiety/depressive symptoms. *Journal of Abnormal Psychology, 109*, 504–511. doi:10.1037/0021-843X.109.3.504

Nolen-Hoeksema, S., & Jackson, B. (2001). Mediators of the gender difference in rumination. *Psychology of Women Quarterly, 25*, 37–47. doi:10.1111/1471-6402.00005

Nolen-Hoeksema, S., & Harrell, Z. A. (2002). Rumination, depression, and alcohol use: Tests of gender differences. *Journal of Cognitive Psychotherapy, 16*, 391–403. doi:10.1891/jcop.16.4.391.52526

Nolen-Hoeksema, S., & Morrow, J. (1991). A prospective study of depression and posttraumatic stress symptoms after a natural disaster: The 1989 Loma Prieta earthquake. *Journal of Personality and Social Psychology, 61*, 115–121. doi:10.1037/0022-3514.61.1.115

Nolen-Hoeksema, S., Morrow, J., & Fredrickson, B. L. (1993). Response styles and the duration of episodes of depressed mood. *Journal of Abnormal Psychology, 102*, 20–28. doi:10.1037/0021-843X.102.1.20

Nolen-Hoeksema, S., Wisco, B. E., & Lyubomirsky, S. (2008). Rethinking rumination. *Perspectives on Psychological Science, 3*, 400–424. doi:10.1111/j.1745-6924-2008-00088.x

Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods, 40*, 879–891. doi:10.3758/BRM.40.3.879

Radloff, L. S. (1977). The CES-D Scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement, 1*, 385–401. doi:10.1177/014662167700100306

Rosenberg, M. (1979). *Conceiving the self*. New York, NY: Basic Books.

Rusting, C. L., & Nolen-Hoeksema, S. (1998). Regulating responses to anger: Effects of rumination and distraction on angry mood. *Journal of Personality and Social Psychology, 74*, 790–803. doi:10.1037/0022-3514.74.3.790

Scheier, M. F., & Carver, C. S. (1992). Effects of optimism on psychological and physical well-being: Theoretical overview and empirical update. *Cognitive Therapy and Research, 16*, 201–228. doi:10.1007/BF01173489

Scheier, M. F., Carver, C. S., & Bridges, M. W. (1994). Distinguishing optimism from neuroticism (and trait anxiety, self-mastery, and self-esteem): A reevaluation of the life orientation test. *Journal of Personality and Social Psychology, 67*, 1063–1078. doi:10.1037/0022-3514.67.6.1063

Schulz, P., & Schlotz, W. (1999). Trierer Inventar zur Erfassung von chronischem Streß (TICS): Skalenkonstruktion, teststatistische Überprüfung und Validierung der Skala Arbeitsüberlastung [The trier inventory for the assessments of chronic stress (TICS): Scale construction, statistical testing, and validation of the scale work overload]. *Diagnostica, 45*, 8–19. doi:10.1026/0012-1924.45.1.8

Segerstrom, S. C., Tsao, J. C. I., Alden, L. E., & Craske, M. G. (2000). Worry and rumination: Repetitive thought as a concomitant and predictor of negative mood. *Cognitive Therapy and Research, 24*, 671–688. doi:10.1023/A:1005587311498

Smyth, J. M., Zawadzki, M. J., & Gerin, W. (2013). Stress and disease: A structural and functional analysis. *Social and Personality Psychology Compass, 7*, 217–227. doi:10.1111/spc3.12020

Sontag, L. M., & Graber, J. A. (2010). Coping with perceived peer stress: Gender-specific and common pathways to symptoms of psychopathology. *Developmental Psychology, 46*, 1605–1620. doi:10.1037/a0020617

Spielberger, C. D., Gorsuch, R. L., & Lushene, R. E. (1970). *Manual for the State-Trait Anxiety Inventory (self-evaluation questionnaire)*. Palo Alto, CA: Consulting Psychologists Press.

Smyth, J. M., & Stone, A. A. (2003). Ecological momentary assessment research in behavioral medicine. *Journal of Happiness Studies, 4*, 35–52. doi:10.1023/A:1023657221954

Teismann, T., Het, S., Grillenberger, Willutzki, U., & Wolf, O. T. (2014). Writing about life goals: Effects on rumination, mood and the cortisol awakening response. *Journal of Health Psychology, 19*, 1410–1419. doi:10.1177/1359105313490774

Thomsen, D. K., Mehlsen, M. Y., Christensen, S., & Zachariae, R. (2003). Rumination – relationship with negative mood and sleep quality. *Personality and Individual Differences, 34*, 1293–1301. doi:10.1016/S0191-8869(02)00120-4

Trzesniewski, K. H., Donnellan, M. B., Moffitt, T. E., Robins, R. W., Poulton, R., & Caspi, A. (2006). Low self-esteem during adolescence predicts poor health, criminal behavior, and limited economic prospects during adulthood. *Developmental Psychology, 42*, 381–390. doi:10.1037/0012-1649.42.2.381

Verkuil, B., Brosschot, J. F., Meerman, E. E., & Thayer, J. F. (2012). Effects of momentary assessed stressful events and worry episodes on somatic health complaints. *Psychology & Health, 27*, 141–158. doi:10.1080/08870441003653470

Watkins, E. R. (2008). Constructive and unconstructive repetitive thought. *Psychological Bulletin, 134*, 163–206. doi:10.1037/0033-29009.134.2.163

Watkins, E., Scott, J., Wingrove, J., Rimes, K., Bathurst, N., Steiner, H., … Malliaris, Y. (2007). Rumination-focused cognitive behaviour therapy for residual depression: A case series. *Behaviour Research and Therapy, 45*, 2144–2154. doi:10.1192/bjp.bp.110.090282

Webb, T. L., Miles, E., & Sheeran, P. (2012). Dealing with feeling: A meta-analysis of the effectiveness of strategies derived from the process model of emotion regulation. *Psychological Bulletin, 138*, 775–808. doi:10.1037/a0027600

Wittchen, H. U., Nelson, C. B., & Lachner, G. (1998). Prevalence of mental disorders and psychosocial impairments in adolescents and young adults. *Psychological Medicine, 28*, 109–126.

Woodward, L. J., & Fergusson, D. M. (2001). Life course outcomes of young people with anxiety disorders in adolescence. *Journal of the American Academy of Child & Adolescent Psychiatry, 40*, 1086–1093. doi:10.1097/00004583-200109000-00018

Zawadzki, M. J., Graham, J. E., & Gerin, W. (2013). Rumination and anxiety mediate the effect of loneliness on depressed mood and sleep quality in college students. *Health Psychology, 32*, 212–222. doi:10.1037/a0029007