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The interplay between self-esteem, expectancy, cognitive control, rumination, and the experience of stress: A network analysis

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Abstract
Research suggests that self-esteem, individuals´ expectancies regarding their ability to deal with future stressors and cognitive control are related and participate in the process of stress regulation. In the current study, 286 participants (51 men and 235 women; ranging from 18 to 89 years old; mean age = 27.53, SD = 10.64) completed online questionnaires to assess self-esteem, expectancy, cognitive control (assessed using measures of attentional and anxiety control), perceived stress, rumination, and symptoms of distress. Network analysis was used to obtain a comprehensive, data-driven view on the complex interplay between these variables. Our analysis shows that high self-esteem is related to more self-efficacy (a measure of expectancy). Self-efficacy, in turn, shows a strong association with more attentional and anxiety control, which are related to lower overall perceived stress during the past month. Moreover, higher perceived stress was related to more symptoms of distress via higher scores in rumination. This study is the first to provide a data-driven test of how individuals with low self-esteem and expectancy, and deficits in cognitive control processes may have difficulties in dealing with daily stressful situations.

Keywords Expectancy · Self-esteem · Cognitive control · Stress · Rumination · Network analysis

Introduction

The ability to handle life stressors plays a central role in the development and clinical course of several mental disorders such as depression, anxiety, and substance abuse (Hankin, 2008; Tafet & Nemeroff, 2016). These stress-related disorders are usually triggered by an accumulation of stressors occurring over time (Monroe & Harkness, 2005). Identifying and understanding resilience and vulnerability factors associated with the exposure to stressors is crucial to comprehend, prevent, and treat stress-related disorders.

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Besides the processes occurring during the actual confrontation with the stressor, the period of anticipation plays a critical role in stress regulation (e.g., Brosschot et al., 2006). Previous research demonstrated that individuals make adaptive behavioral, cognitive, and physiological adjustments when anticipating stressful situations, which may facilitate the process of coping with the upcoming stressor (e.g., Pulopulos, Baeken, et al., 2020; Pulopulos, Vanderhasselt, et al., 2018; Schulkin, 2011). Within this context, individuals´ expectancies regarding their ability to deal with future stressors and cognitive control processes may play a central role during stress anticipation. Individuals with positive expectancies tend to be more persistent in their efforts and motivated to engage in more challenging tasks (Bandura et al., 1982). Moreover, stress regulation can be improved by interventions targeting cognitive control, understood as the collection of mental processes that allow flexible adaptation of information processing and behavior depending on the individual´s current goals (Hoorelbeke et al., 2015). In the Neurocognitive Framework for Regulation Expectation, De Raedt and Hooley (2016) propose that individuals´ expectancies modulate the proactive allocation of cognitive control during stress anticipation. Positive expectancies activate (proactive) cognitive control processes, leading to successful anticipatory stress regulation, resulting in a lower effort needed to regulate stress during the actual confrontation with the stressor. Thus, positive expectancies would lead to better stress regulation via the activation of cognitive control processes. Along this line, Pulopulos, Baeken, et al. (2020) showed that positive expectancy was associated with lower cortisol response to stress via lower anticipatory heart rate variability response, a peripheral index associated with better stress resilience and cognitive control (Thayer et al., 2009). Moreover, increasing left dorsolateral prefrontal cortex activity, an area that plays a critical role in cognitive control (e.g., Pulopulos, Allaert, et al., 2020), reduces the cortisol response to stress (Pulopulos, Schmausser, et al., 2020). Importantly, Vanderhasselt et al. (2015) observed that cognitive effort exerted during anticipation of an emotion eliciting stimulus is related to lower cognitive effort when confronted with that stimulus. Together, these results support the idea that expectancies and cognitive control are critical to understanding how individuals confront stressful situations.

Self-esteem (understood as the individual's evaluation of the current self) is a construct closely related to stress regulation, cognitive control, and expectancy. Neuroimaging studies have shown that lower self-esteem is related to higher activation of brain regions associated with emotion and stress regulation self-referential processing (Eisenberger et al., 2011) and cognitive control under social stressors (Kogler et al., 2017). Lower self-esteem increases the efforts needed to control stressors, which may lead to negative self-related thoughts (Kogler et al, 2017). Moreover, individuals´ expectancies would be determined by both previous coping experiences and self-esteem. Individuals with high self-esteem tend to show positive expectancies regarding their abilities to deal with stressful events (Abel et al., 1996; Judge et al., 2002), and according to De Raedt and Hooley (2016), this would increase proactive regulatory control prior to and during the stressor (e.g., Nasso et al., 2020). Importantly, there is a reciprocal influence between expectancy, stress and self-esteem since positive expectancies, by leading to successful stress regulation, create a positive experience that would, in turn, increase self-esteem (De Raedt & Hooley, 2016).

Together, these observations provide support for associations between self-esteem, expectancies, cognitive control, and stress regulation. However, no previous study has investigated the relationship between all these constructs in the same study and explored the unique association between them. Given the complex pattern of intercorrelations, it is important to understand the associations between these constructs while also controlling for all the other variables in the network. Thus, more research is still needed to obtain a more comprehensive view of the interplay between these variables and how they relate to the negative consequences of stress. Within this context, network analysis is an analytical technique that can be used to map the interplay between different constructs in a data-driven manner (Bringmann & Eronen, 2018), and it offers a unique opportunity to investigate complex relationships between several factors (Borsboom & Cramer, 2013; Costantini et al., 2015). Importantly, by providing alternative and insightful ways of illustrating patterns of connectivity between the variables of interest and reflecting the centrality of a given variable within a network (e.g., using the Fruchtermann and Reingold's algorithm; Fruchterman & Reingold, 1991), network analysis enables an intuitive understanding of the complex structure of a model (Bringmann, 2016).

Taking advantage of network analyses, the general aim of this study was to investigate for the first time the complex patterns of relationships between expectancy, self-esteem, and cognitive control (critical constructs for the process of anticipatory stress regulation), and how they relate to measures of stress and its consequences, i.e., rumination and symptoms of distress. Thus, we assessed self-efficacy (understood as the strength of individuals´ belief about their ability to deal with novel and stressful situations), self-esteem, cognitive control, and perceived stress (during the previous month). Regarding cognitive control, previous research has highlighted the importance of considering both hot (emotion-dependent) and cold (emotion-independent) cognitive control processes when investigating stress-related disorders (e.g., Ahern et al., 2019). Therefore, we investigated both hot and cold cognitive control processes in our model. Notably, it has been proposed that low expectancy would lead to more ruminative thinking, and in several studies, decreased stress regulatory control has been related to a tendency to ruminate (for an overview, see Brosschot et al., 2006; Koster et al., 2011). Moreover, experimental studies have revealed that rumination is associated with prolonged emotional and biological responses to stress in depressed individuals (for a conceptual review, see LeMoult & Gotlib, 2019). Therefore, we also measured the tendency to ruminate in our sample. Finally, we assessed general symptoms of distress to investigate whether general distress is related to the other construct included in the model.

Based on the empirical evidence and theoretical models described above (Brosschot et al., 2006; De Raedt & Hooley, 2016; Nasso et al., 2020; Pulopulos, Allaert, et al., 2020; Pulopulos, Baeken, et al., 2020; Vanderhasselt et al., 2015), we expected to find a model depicting associations between expectancy, self-esteem, and cognitive control (attentional and anxiety control). Given the central role of cognitive control (e.g., Ahern et al., 2019; De Raedt & Hooley, 2016), we hypothesized that low self-esteem and expectancy would be related to increased stress perceptions, high tendency to ruminate and more symptoms of distress, via low cognitive control.

Methods

Participants

Participants were recruited through student fora of Ghent University as well as social media (Facebook and Instagram) to complete a questionnaire via LimeSurvey (Schmitz, 2012). Only Dutch-speaking subjects who were older than 18 years were invited to participate in the study (no other inclusion or exclusion criteria were used to recruit the sample). Two hundred and eighty-seven subjects completed the questionnaires. After the exclusion of one participant who was younger than 18 years, the final sample size was 286 participants (51 men and 235 women; ranging from 18 to 89 years old; mean age = 27.53, SD = 10.64). By volunteering to complete the questionnaire, the subjects had the opportunity to win 100€ in a raffle. See Table 1 for a description of the study sample.

The study was approved by the Ethical Committee of the Faculty of Psychology at Ghent University, and all participants provided informed consent prior to completing the survey.

Table 1 *Descriptive statistics (N = 286)*

	Mean/n	*SD*	*Min*	*Max*
Age (years)	27.53	10.64	18	89
Sex				
• Men	51			
• Women	235			
Education				
• Primary education (up to 12 years)	1			
• Lower secondary education (up to 15 years)	5			
• Higher secondary education (up to 18 years)	80			
• Higher education	200			
Marital status				
• Single	102			
• Permanent relationship	95			
• Cohabiting	42			
• Married	40			
• Divorced	5			
• Widow/widower	2			
Rumination	45.55	12.28	22.00	82.00
General Distress	25.56	4.73	10.00	38.00
Self-Efficacy	28.12	4.48	10.00	40.00
Perceived Stress	28.51	7.43	10.00	55.00
Self-Esteem	15.98	4.88	3.00	27.00
Attentional Control	49.65	8.39	29.00	72.00
Anxiety Control	81.81	18.65	25.00	130.00

Measures

Generalized Self-Efficacy Scale The Generalized Self-Efficacy Scale (Schwarzer & Jerusalem, 1995; Dutch translation by Teeuw et al, 1994) is a 10-item scale used to assess the strength of individuals´ belief in their own ability to respond and to deal with novel and difficult situations. Items are rated on a 4-point Likert scale (ranging from 1 = not at all true to 4 = exactly true). Higher scores reflect higher self-efficacy. In this study, Cronbach's alpha for the Generalized Self-Efficacy Scale was 0.85.

Rosenberg Self-Esteem Scale The Rosenberg Self-Esteem Scale (Rosenberg, 1965; Dutch translation by Franck et al., 2008) was used to assess self-esteem in our participants. The Rosenberg Self-Esteem Scale is a 10-item scale. Items are rated on a 4-point Likert scale (ranging from 1 = strongly agree to 4 = strongly disagree) with higher scores reflecting higher self-esteem. In this study, Cronbach's alpha for the Rosenberg Self-Esteem Scale was 0.89.

Attentional Control Scale The Attentional Control Scale (Derryberry & Reed, 2002; Dutch translation by Verwoerd et al., 2007) is a 20-item self-report questionnaire used to assess control of attention across two domains: focusing (i.e., the ability to maintain attention on a given task), and shifting (i.e., the ability to reallocate attention to a new task or to engage attention on multiple tasks). This questionnaire measures emotion-independent cognitive control processes (i.e., cold cognitive control). Items are rated on a 4-point Likert scale (ranging from 1 = almost never to 4 = always). Higher scores indicate better attentional control. Cronbach's alpha for the Attentional Control Scale was 0.84.

Anxiety Control Questionnaire The Dutch translation of the Anxiety Control Questionnaire (Rapee et al., 1996) was used to assess emotion-dependent cognitive control processes (i.e., hot cognitive control). The Anxiety Control Questionnaire is a 30-item self-report measure used to assess individuals´ perceived level of internal and external control over anxiety-related events. Items are rated on a 6-point Likert scale (ranging from 0 = strongly disagree to 5 = strongly agree). Higher scores indicate better anxiety control. In the present study, Cronbach's alpha for the Anxiety Control Questionnaire was 0.89.

Perceived Stress Scale The Dutch translation of the 14-item Perceived Stress Scale (Cohen et al., 1983) was used to assess the degree to which people perceived their lives as stressful in the previous month. Items are rated on a 5-point

Likert scale (ranging from 0 = never to 4 = very often) how often they found their lives to be unpredictable, uncontrollable, and overloaded in the past month. Higher scores reflect higher perceived stress in the last month. Cronbach's alpha for the Perceived Stress Scale was 0.86.

Ruminative Responses Scale The Ruminative Responses Scale (Nolen-Hoeksema & Morrow, 1991; Dutch translation by Raes et al., 2003), is a 22-item scale that was used to assess trait rumination, defined as "repetitively focusing on the fact that one is depressed; on one's symptoms of depression; and on the causes, meaning and consequences of depressive symptoms" (Nolen-Hoeksema, 1991, p 569). Items are rated on a 4-point Likert scale (ranging from 1 = almost never to 4 = most of the time). Higher scores reflect a stronger tendency to ruminate. In the present study, Cronbach's alpha was 0.94 for the Ruminative Responses Scale.

Mood and Anxiety Symptom Questionnaire The short version of the Mood and Anxiety Symptom Questionnaire (Dutch translation of the items by de Beurs et al., 2007; validation of the short version of the questionnaire in Dutch by Wardenaar et al., 2010) is a questionnaire based on the Tripartite model of anxiety and depression and is used as a transdiagnostic measure for depressive and anxious symptomatology. Participants rated their anxiety and depression symptoms on a 5-point scale (ranging from 1 = not at all, to 5 = extreme). The Mood and Anxiety Symptom Questionnaire has three subscales: General distress, Anhedonic Depression, and Anxious Arousal. In this study, we focused on the general distress subscale, a measure of non-specific symptoms of general distress. Higher scores indicate more symptoms of general distress. Cronbach's alpha for this subscale was 0.47.

Data analysis

Network analysis was used to investigate the interplay between self-esteem, self-efficacy, cognitive control (anxiety control and attentional control), perceived stress, rumination, and general distress. Network analysis relies on existing statistical approaches and models (e.g., partial correlations, MLM) to illustrate patterns of connectivity between the nodes (variables) of interest in an intuitive and data-driven manner (Bringmann & Eronen, 2018).

The analyses were conducted in R version 3.6.1 (for version information of R packages, see supplemental material). We conducted a nonparanormal transformation using the *huge* package to improve normality (cf. Epskamp & Fried, 2018; Zhao et al., 2015).

Using the *qgraph* package (Epskamp et al., 2012), we estimated a Gaussian Graphical Model (GGM; Epskamp & Fried, 2018) including the variables of interest (Attentional Control, Anxiety Control, Self-Esteem, Self-Efficacy, Perceived Stress, Rumination, and General Distress). The obtained GGM is a regularized partial correlation network. As such, edges represent unique associations between each of the nodes. Regularization was based on the Graphical Least Absolute Shrinkage and Selection Operator (gLASSO; Friedman et al., 2014) with Extended Bayesian Information Criterion model selection (EBIC; $\gamma = 0.5$). In addition, we implemented thresholding to maximize model specificity. As a result, spurious edges were excluded from the model.

We then proceeded with bootstrapping procedures to assess the reliability of the obtained network model. We used *bootnet* (Epskamp et al., 2018) to compute the accuracy of the edge weights, providing 95% confidence intervals for all edges in the model. In addition, we plotted significant differences between edge weights, and estimated the stability of Strength as a main centrality index. That is, network models provide several indexes of centrality, among which Strength has shown to be the most stable index (e.g., Beard et al., 2016; Costantini et al., 2015; Epskamp et al., 2018; see Bringmann et al., 2019 for a discussion of other centrality indices). Node Strength provides an estimate of the sum of absolute edge weights connected to each node, indexing strength of connectivity for a given node (Costantini et al., 2015). Following the procedure outlined by Epskamp and colleagues (2019), we used a case-dropping subset bootstrap with 1,000 samples to assess the stability of the order of Strength centrality within subsets of the data using $r = 0.70$. The resulting correlation stability coefficient should not be below 0.25 and ideally exceed 0.50 (Epskamp et al., 2018) in order to be considered stable. None of the participants had missing data.

The corresponding network model was plotted with the *qgraph* package. Using a modification of the Fruchterman-Reingold's algorithm (Fruchterman & Reingold, 1991), the position of the nodes in the model is based on their level of connectivity. That is, strongly connected nodes hold a more central position in the model, whereas less strongly connected nodes appear in the periphery of the network model. The thickness and color of the edges reflect the strength and valence of the unique associations between two given nodes (blue/full = positive, red/dashed = negative).

Importantly, although GGMs are mathematically equivalent to factor and structural equation modeling models (i.e., an equivalent factor model can be obtained for every network model, and vice versa), these statistical approaches do not lead to the same inferences or meta-parameters. In contrast to factor models, GGM edges represent unique associations between two given nodes and, based on these patterns of connectivity, the position of each node in the model reflects the centrality of a given node within a network. As such, network analysis provides an intuitive understanding of the complex structure of a model (Bringmann, 2016). In the current study, we were interested in conditional dependence relations among stress regulatory factors (expectancy, self-esteem, and cognitive control) and stress-related variables (perceived stress, rumination, and general distress), which we believe to be based on mutual interactions. Thus, network analysis is the best statistical approach considering the aim and hypothesis of this study.

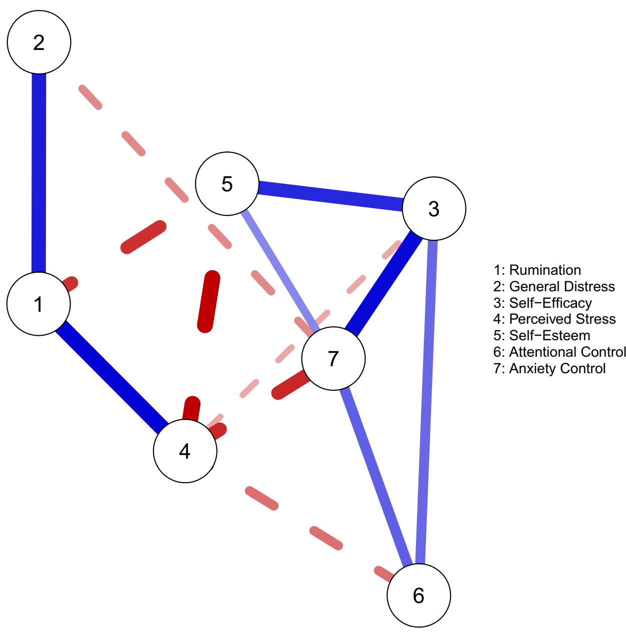

Fig. 1 Regularized Partial Correlation Network. Note: Maximum absolute edge strength = .30. The thickness of the edges represents the strength of the association between constructs. Blue/full edges represent positive associations, and red/dashed edges represent negative associations. The regularized partial correlation values are presented in the text of the Results section. The edge weights presented in the model can be found in Table 2

Results

Descriptive statistics for the study sample and the variables of interest are reported in Table 1. The obtained undirected regularized partial correlation network/GGM is depicted as Fig. 1. Our findings indicate that Attentional Control is indirectly related to General Distress, whereas a direct association between Anxiety Control and General Distress is observed linking Attentional Control with General Distress. That is, Attentional Control is directly connected to Anxiety Control, Self-efficacy, and Perceived Stress. In particular, high Attentional Control is related to more Anxiety Control, higher Self-Efficacy, and lower stress levels (Perceived Stress). Each of these constructs is linked to Self-Esteem, suggesting a unique positive association for Anxiety Control and Self-Efficacy, and a negative association for Perceived Stress. In addition, Perceived Stress and Self-Esteem demonstrated a unique association with Rumination, with higher levels of Perceived Stress being related to Rumination. The inverse relation was observed for Self-Esteem. Finally, Rumination and Anxiety Control show unique associations to General Distress. The correlation- and edge- weight matrix is reported in Table 2 (for edge accuracy, see Supplemental Fig. 1 containing confidence intervals for each of the edges presented in the model).

Perceived Stress and Anxiety Control emerged as the most central nodes in the model in terms of average Strength of connectivity (Strength; Fig. 2). Stability analysis (Supplemental Fig. 2) suggests good stability for Strength centrality (correlation stability coefficient = 0.59). This indicates that the order of nodes in terms of Strength centrality would remain similar when dropping a considerable portion of the sample.

Surprisingly, although the Mood and Anxiety Symptom Questionnaire is considered a valid and reliable instrument (e.g., Wardenaar et al., 2012), the Cronbach's alpha for the General distress subscale in our study was low (i.e., 0.47). Excluding this measure from the analysis resulted in a highly similar model, with the exception of two additional

Table 2 Correlation and Edge Weights Matrix

	1	2	3	4	5	6	7
Rumination [1]	–	.41	-.32	.63	-.57	-.38	-.51
General Distress [2]	.27	–	-.13	.30	-.19	-.20	-.32
Self-Efficacy [3]	.00	.00	–	-.55	.57	.48	.61
Perceived Stress [4]	.30	.00	-.10	–	-.68	-.52	-.67
Self-Esteem [5]	-.24	.00	.25	-.30	–	.42	.61
Attentional Control [6]	.00	.00	.18	-.17	.00	–	.53
Anxiety Control [7]	.00	-.14	.29	-.25	.14	.19	–

The right upper half of the table presents the correlation matrix, the Weight Matrix of the GGM is presented in the left lower half of the table

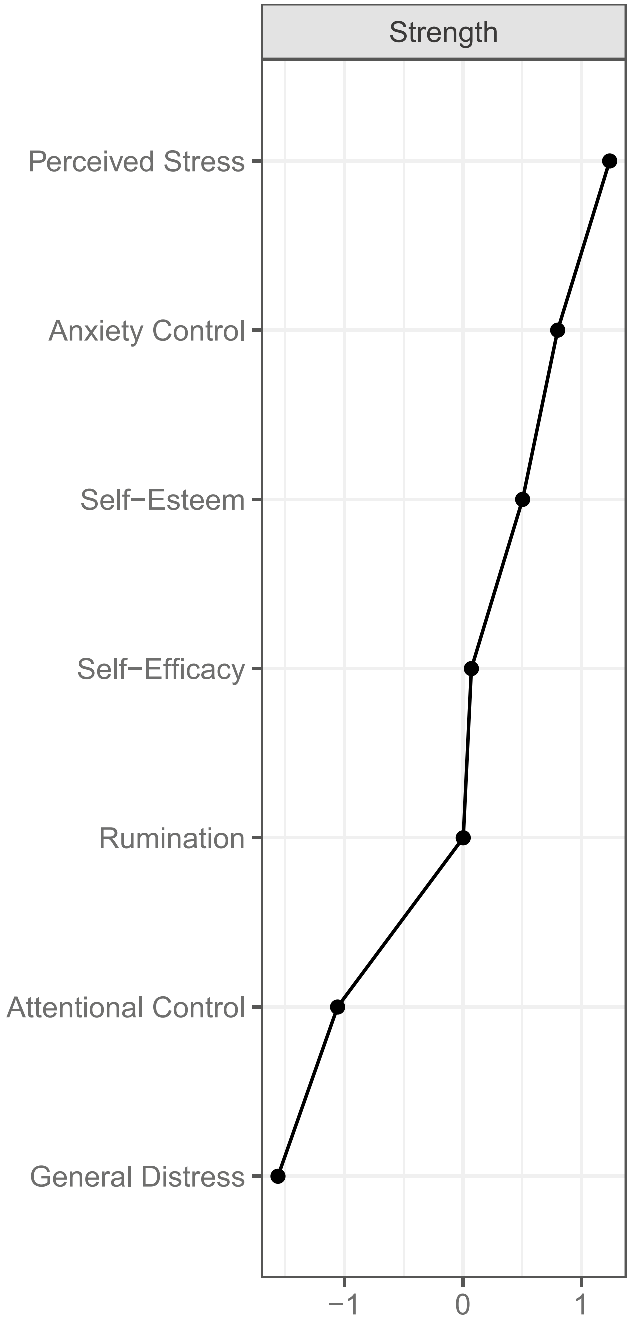

Fig. 2 Standardized Centrality Indices. *Note:* This figure ranks nodes included in the network model based on level of node Strength (strength of connectivity), representing the extent to which these take a more central position in the network. Perceived Stress and Anxiety Control emerged as the most central nodes in the model

edges directly linking Rumination to Self-Efficacy and Anxiety control, whereas Rumination was previously only linked to General Distress, Perceived Stress and Self-Esteem. Therefore, the conclusions of this study also hold for a model without the measure of general distress.

Discussion

This study aimed to investigate the relationships between expectancy, self-esteem, and cognitive control, and how they relate to stress, rumination, and symptoms of general distress. The relationships were investigated using network analyses to obtain a comprehensive, data-driven view on the interplay between these constructs. The results showed robust stability and accuracy and provided support for the complex patterns of relationships between expectancy (self-efficacy), self-esteem, and cognitive control (anxiety and attentional control), constructs which have been identified to participate in the process of anticipatory stress regulation. Our results indicate that lower expectancy and self-esteem relate to more stress perception via less cognitive control, especially via less anxiety control, and that more stress perception relates to more symptoms of general distress via rumination. Moreover, less anxiety control, but not attentional control, was related to more symptoms of general distress.

Our analysis shows that high self-esteem is strongly related to more positive expectancies (as assessed via self-efficacy, a measure of the strength of individuals' belief about their ability to deal with novel and stressful situations), which in turn shows a strong association with more anxiety control, and to a lower overall perceived stress during the past month. Together, these associations are in line with recent studies showing that an increased expectancy is related to improved stress regulation and that anticipatory stress regulation mediates the association between positive expectancy and better stress regulation during the confrontation with the stressor (Pulopulos, Baeken, et al., 2020; Pulopulos et al., 2018a). Importantly, we observed that both self-esteem and expectancy showed a stronger relationship with perceived stress via anxiety control (a measure related to hot cognitive control) than via attentional control (a measure related to cold cognitive control). Moreover, anxiety control and attentional control were highly associated, but anxiety control showed a stronger association with perceived stress, and only anxiety control was related to more symptoms of distress. Our findings are in line with the idea that deficits in emotion-independent cognitive control process may facilitate the expression of emotion-dependent cognitive control deficits, leading to stress-related mental health problems (Ahern et al., 2019), and that individuals´ ability to employ cognitive control resources in stress-related events is critical to regulate stress successfully (Hoorelbeke et al., 2015). Together these results highlight the importance of targeting hot cognitive control processes when Neurocognitive Therapies are used to treat stress-related disorders and support the idea that cognitive control deficits may reflect a biological vulnerability to regulate stress (e.g., De Raedt & Hooley, 2016; De Raedt & Koster, 2015).

We observed that a decreased stress regulatory control is related to rumination via perceived stress, and to more symptoms of general distress. These results agree with the Perseverative Cognition Hypothesis (Brosschot et al., 2006) and the Response Style Theory (Nolen-Hoeksema, 2004), two frameworks proposing that rumination is a crucial factor in understanding the link between stress and stress-related disorders. Rumination, characterized by a tendency to repetitively think about the causes and consequences of one's problems and negative feelings, is considered a transdiagnostic vulnerability and maintenance factor of mental disorders (Nolen-Hoeksema, 1991; Smith & Alloy, 2009). Rumination negatively impacts individuals through the activation of negative thoughts and memories, exacerbating the impact of depressed mood on thinking and increasing the likelihood that individuals will make depressogenic and anxiogenic inferences concerning their current circumstances. Along this line, the Neurocognitive Framework for Regulation Expectation proposes that individuals with low actual self-esteem and expectancy tend to show a passive but stressful anticipation, leading to increased negative self-referential thoughts, which is related to an increased amygdala activity and worse stress regulation (De Raedt & Hooley, 2016).

Successful regulation during past stressors may also contribute to increase self-esteem and create positive expectancies about future stress regulation (De Raedt & Hooley, 2016). In line with this idea of reciprocity between past and future stressful experiences, we observed that lower perceived stress was related to higher expectancies about future stressful events, and strongly related to higher actual self-esteem. These results suggest that after negative experiences with stressful events, a decrease in self-esteem would influence the anticipation of similar future events. This effect could be driven by the activation of dysfunctional schemas and self-reflective negative thoughts, and a decrease in the perceived ability to deal with future stressful events (i.e., expectancy). Along this line, higher rumination was also associated with lower self-esteem and, in the model without general distress, with lower expectancy and anxiety control. Importantly, in a recent study, Nasso et al. (2018) showed that high ruminators benefit less than low ruminators from the use of reappraisal, showing worse emotion regulation (reflected in lower heart rate variability) during the anticipation and the actual confrontation with a stressful event. Together, these results indicate that a decrease in self-esteem and expectancy would be specially observed in individuals that tend to engage in ruminative thinking after stressful events. Thus, our findings suggest that, in clinical treatments of patients with stress-related disorders, it may be important to target ruminative thinking to reduce the negative effects of a possible spiral derived from the reciprocal influence between rumination, self-esteem, and expectancy.

Some limitations of our approach should be considered. Although network analysis offers a unique opportunity to investigate the complex interplay between different constructs in a data-driven manner, the cross-sectional nature of this study precludes inferences about causal relationships. As such, no inferences can be made regarding the direction of observed relations between the included variables. Nonetheless, the obtained network structure allows for hypothesis generation based upon which future research could investigate the interplay between the factors included in this model using longitudinal or experimental designs. Another limitation of the study is that the sample is composed of mostly women and highly educated participants. Previous research has shown sex- and education-related differences in stress and emotion regulation processes (e.g., Hittner et al., 2019; Pulopulos, Hidalgo, et al., 2018). Thus, although our results are supported by previous studies and frameworks in the field (e.g., articles described above: Brosschot et al., 2006; De Raedt & Hooley, 2016; Hoorelbeke et al., 2015; Nolen-Hoeksema, 2004; Pulopulos, Baeken, et al., 2020), the characteristics of the study sample may reduce the generalizability of our findings. Finally, the reliability index was low for the general distress subscale of the Mood and Anxiety Symptom Questionnaire. We do not have an explanation for this result since we used a validated Dutch version of the questionnaire, and the scores were relatively well distributed compared with previous studies in healthy and clinical populations (e.g., Schulte-van Maaren et al., 2012). Thus, although this issue does not seem to affect the rest of the model (i.e., the relationship between the other constructs in the model remain very similar without the measure of general distress), future research is needed to confirm whether the interplay between cognitive control, self-esteem and self-efficacy may lead to general distress (via perceived stress and rumination).

In conclusion, this study is the first to provide a data-driven test of how self-esteem, expectancies, and cognitive control processes participate in successful stress regulation. Our results suggest that individuals with low self-esteem and expectancy, and deficits in cognitive control processes may have difficulties in dealing with daily stressful situations and may be at risk of developing stress-related disorders.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s12144-022-02840-6.

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Data availability The data that support the findings of this study are available from the corresponding author upon reasonable request.

Code Availability Code is provided in supplementary materials.

Declarations

Additional declarations for articles in life science journals that report the results of studies involving humans and/or animals Not applicable.

Ethics approval The study was approved by the Ethical Committee of the Faculty of Psychology at Ghent University.

Consent to participate (include appropriate statements) All participants provided informed consent prior to completing the survey.

Consent for publication (include appropriate statements) Not applicable.

Conflicts of interest/Competing interests None.

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