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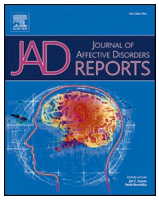

Research Paper

Psychological effects of unemployment: A prospective study on cognitive control, emotion regulation, and distress

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ABSTRACT

Background: Important individual differences exist in how people respond to major stressors. Despite the key roles attributed to emotion regulation and cognitive control in resilience and vulnerability to stress, relatively few studies have directly investigated these relationships upon confrontation with major stressors, such as unemployment.
Methods: The current preregistered study set out to prospectively test mediational hypotheses, in which baseline cognitive control (assessed by performance on a cognitive task) and self-reported effortful control predict emotion regulation (follow-up 1), in turn predicting internalizing symptomatology or resilience (follow-up 2). Data of 84 people confronted with unemployment were analyzed using path models: one based on primary outcome measures (repetitive negative thinking and symptoms of depression, anxiety and stress) and one based on secondary questionnaire outcome measures (positive thinking style and resilience).
Results: The results show that effortful control and cognitive control are relevant distal factors to consider when investigating emotional symptoms in the unemployed.
Limitations: This study has sample modest in size, so it's important to interpret the results cautiously.
Conclusion: The current study shows how cognitive factors and emotion regulation can contribute to emotional distress and resilience when facing unemployment.

Potential job loss and unemployment are strongly associated with decreased well-being (McKee-Ryan et al., 2005) and higher levels of depression and anxiety (Paul and Moser, 2009). For instance, perceived job insecurity and unemployment predict an increase in depressive symptoms (Kim and von dem Knesebeck, 2016), which is in turn associated with reduced chances of reemployment (Stolove et al., 2017). Crucially, the negative impact of unemployment on mental health cannot be fully explained by reductions in financial resources and social support only (e.g., Crowe and Butterworth, 2016; Zuelke et al., 2018).

In explaining who is negatively impacted by job loss, we need to distinguish between socioeconomic factors (e.g., the job market: Houssemand and Meyers, 2011) and intraindividual differences in psychological factors (e.g., optimism or pessimism), where the current research focuses on the latter factors. Since it is currently insufficiently clear which psychological processes contribute to an adaptive rather than maladaptive response in this context, we selected two key processes based on major theories of resilience (Kalisch et al., 2015) and stress-responding (Nolen-Hoeksema et al., 2008): emotion regulation and cognitive control. We discuss these two processes and their interplay below.

One of the key intrapsychological mechanisms determining the reaction to adverse events is emotion regulation, defined as the ability to modulate the intensity, frequency, and duration of emotional responses (Gross, 1998). Based on previous research, rumination (Nolen-Hoeksema et al., 2008) and positive (re)appraisal (Kalisch et al., 2015) are crucial emotion regulation strategies, given their impact on emotions and their role in emotional disorders. These and other cognitive emotion regulation processes have been found to significantly and independently contribute to the prediction of self-reported mental health in a large unemployed sample, even after controlling for age, education level, gender and unemployment duration (Extremera and Rey, 2014).

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A second process considered important in responding to stress, is cognitive control. Exerting cognitive control is related to the coordination of various cognitive processes in working memory (e.g., selective attention, inhibitory control, task switching) (Botvinick and Braver, 2015; Diamond, 2013; Hofmann et al., 2012), which are necessary to flexibly adapt thoughts and behavior, in order to reach one's goals (Cohen, 2017). Cognitive control, typically assessed behaviorally by means of standardized tasks, is thus conceptually similar to effortful control (Zhou et al., 2012), which can be defined as the ability to voluntarily (re)direct attention, and to activate or inhibit behavior, in order to adapt to contextual demands (Rothbart and Bates, 2007). However, effortful control is a broader construct that is mostly measured using a questionnaire indexing cognitive control aspects in daily life situations. As with cognitive control, effortful control has been put forward to help explain symptoms of depression and anxiety (e.g., Marchetti et al., 2018).

In recent years, models of adaptive and maladaptive emotion regulation have proposed that cognitive control is a key factor in determining whether individuals are able to successfully regulate emotions in stressful situations (Joormann and Vanderlind, 2014; Koster et al., 2011), as disengaging from negative thoughts and refocusing on positive appraisals, for instance, requires the cognitive functions mentioned above. Influencing one's emotions can be an immediate goal in itself, or the means by which other, higher-order goals (e.g., staying calm during a job interview) are pursued. Even though empirical studies have found links between cognitive control and reappraisal (e.g., McRae et al., 2012), there has been more attention for the role of cognitive control in Repetitive Negative Thinking (RNT), a transdiagnostic process overarching highly similar emotion regulation strategies, including rumination and worry (Ehring and Watkins, 2008). For instance, cognitive control deficits have been found in student samples reporting high levels of RNT (Beckwé et al., 2014; Joormann, 2006; Whitmer and Banich, 2007). In a convenience sample of undergraduates, cognitive control prospectively predicted RNT following the occurrence of a stressful event in daily life (De Lissnyder et al., 2012). In another unselected sample of undergraduates, it was demonstrated that a stress induction in the lab hampered performance on a cognitive control task, and that the decrease in performance prospectively predicted depressive symptomatology (Quinn and Joormann, 2015). Conversely, a recent review of cognitive control and resilience found that higher levels of cognitive control and effortful control are related to more resilience (Mecha et al., 2024).

Despite the key roles attributed to emotion regulation and cognitive control in resilience and vulnerability to stress (Joormann and Vanderlind, 2014; Kalisch, 2015), it is unclear whether these factors also determine the response to (impending) job loss and unemployment. Naturally, this response is also dependent on the broader context. Being effectively unemployed for a longer period of time is different from the period that immediately follows job loss, which may again be different from a notice period that precedes the formal end of an individual's contract. Moreover, a sense of job insecurity among employed individuals has been shown to have a negative impact on health and other outcomes as well (Cheng and Chan, 2008; Jiang and Lavaysse, 2018; Sverke et al., 2002). Indeed, these and other professional life stressors and events likely come with their own particularities. Still, emotion regulation strategies such as RNT and reappraisal are likely crucial across such stressors and events. The goal of the current study is therefore not to determine in which specific cases the interplay of cognitive control and emotion regulation is more or less relevant. Instead, we aimed to extend previous work on this topic, which was often done in student samples, with stressors that have been either mild, specific to a laboratory context or entirely absent, thus limiting the generalizability and applied value of the findings.

We set out to test a key mediational hypothesis of models of cognitive control and emotion regulation (Joormann and Vanderlind, 2014; Koster et al., 2011) in a sample of people that were unemployed or facing job loss: Do cognitive control and effortful control prospectively predict symptoms of depression, anxiety and stress, through their effects on RNT (see Fig. 1)? The current study, including this primary hypothesis, was preregistered on the Open Science Framework (https://osf.io/n3zu9, see research line 1). Additionally, a secondary theory-driven hypothesis was formulated, with positive thinking style as mediator and resilience as outcome measure, given that the tendency to appraise in a *non-negative* or even consistently positive way, is considered the primary pathway to resilience (Kalisch et al., 2015).

Materials and methods

Participants

A total of 91 participants (54 female, 37 male) completed the baseline measures[1]. The participants were either currently unemployed (N = 82 or 90.11 % of the current sample) or had been informed that they were going to be dismissed by their employer (N = 9 or 9.89 % of the current sample) after a specified notice period, which had started one to three months earlier in all cases, but could last past the study's final phase for some (N = 4).[1] The sample showed strong heterogeneity in terms of current unemployment duration (*Mean* = 21.83 months, *SD* = 37.29 months), highest level of education (2 PhDs, 27 Masters, 27 Bachelors, 31 secondary education, 4 primary education) and age (*Mean* = 43.64 years, *SD* = 10.56 years). Of these 91 participants, 87 (95.6 %) completed the measurements of follow-up 1. Another 3 participants dropped out in between follow-up 1 and follow-up 2, resulting in a complete sample of 84 participants (92.3 %). The participants received a financial compensation (25 euros) each time they completed all measurements of a phase (baseline, follow-up 1 and follow-up 2).

For context purposes, the unemployment rate in Belgium in the time frame of the study (in individuals between 20 and 64 years old) was around 4 %, within an extensive system of social security measures to protect against large financial ramifications of unemployment.

The project was approved by the medical ethical committee of Ghent University Hospital.

Design

This study represents one of two research lines within a broader project, that aims to investigate the relation between cognitive control, emotion regulation and symptoms of depression, anxiety and stress (https://osf.io/n3zu9/wiki/home/). More specifically, the current paper reports on the longitudinal data, consisting of three measuring phases: the baseline phase and two follow-up phases (three and six months following baseline; i.e., research line 1). The questionnaires (see below) were administered during each of these phases, whereas the cognitive task was only administered at baseline. Immediately after completion of the baseline measurements, there was an optional 14-day experience sampling phase (i.e., research line 2), for which the results will be reported elsewhere.

Measurements

Cognitive Task. To assess cognitive control performance, we administered the non-adaptive Paced Auditory Serial Addition Task (PASAT; Gronwall, 1977), which has demonstrated good psychometric

[1] We estimated a total sample size of 270 participants and set a maximum study duration of two years in our preregistration (https://osf.io/xsb67/wiki/home/), where we described both the uncertainty within our power analysis parameters, as well as possible difficulties with recruitment of the unemployed population and its potential drop-out risk (e.g., participants finding a new job during the course of the study). Due to slower-than-anticipated enrolment in the study, the study duration period was reached first.

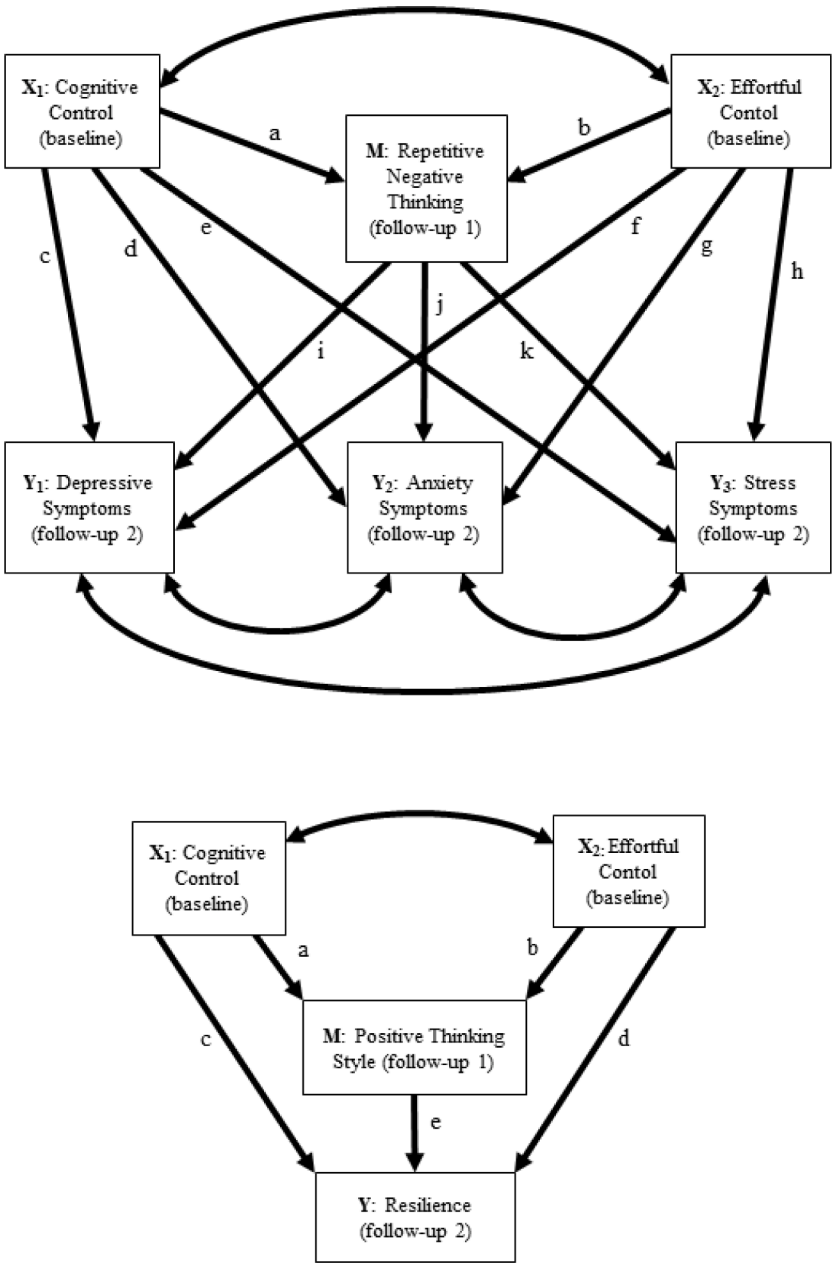

Fig. 1. Path models using primary (top) and secondary (bottom) outcome measures.

properties and reliability for research assessing cognitive functioning (Tombaugh, 2006; Nikravesh et al., 2017). In this task, participants were required to keep track of a continuous auditory stream of stimuli (i.e., random digits ranging between 1 and 9), in order to manipulate these stimuli in working memory. For every new digit that was presented verbally, the participants were asked to calculate the sum with the previously presented digit, as quickly and as accurately as possible, whilst resisting distractions (e.g., from no longer relevant digits/sums). Then, the participant had to click/tap on the corresponding value on the screen of his/her device, where all possible answers (ranging from 2 to 18) were presented uninterruptedly throughout an entire block. There were three blocks, each consisting of 60 trials (one trial corresponded with one aurally presented digit). The blocks only differed in terms of the intertrial intervals (3000 ms, 2000 ms, and 1500 ms, respectively): the pace of the digits increased per block, reducing the window for the participant to respond and thus providing an increasingly challenging task.

Average accuracy scores were calculated after aggregating all blocks. We estimated the internal consistency of the PASAT accuracy using a permutation-based split-half approach with 5000 random splits using the splithalf package in R (Parsons, 2021). The Spearman-Brown corrected split-half reliability was $r = 0.93$ (95 % CI [0.91, 0.95]), indicating excellent reliability.

Self-report questionnaires. Of primary importance were the Perseverative Thinking Questionnaire (PTQ, 15 items, Cronbach's $\alpha = 0.951$; Ehring et al., 2011, 2012) and the shortened, 21-item version (Henry and Crawford, 2005) of the Depression Anxiety Stress Scales (DASS-21; de Beurs et al., 2001; Lovibond and Lovibond, 1995), to measure Repetitive Negative Thinking (RNT) and psychopathological symptoms, respectively. Separate subscales for depression ($\alpha = 0.918$), anxiety ($\alpha = 0.843$) and stress ($\alpha = 0.904$) were calculated, by summing up the seven items of each corresponding scale of the DASS-21. The Effortful Control scale (19 items, $\alpha = 0.772$) of the Adult Temperament Questionnaire (ATQ; Evans and Rothbart, 2007; Hartman et al., 2001)

was also a primary outcome measure, as it complemented the assessment of the broader construct of cognitive control with a self-report evaluation. Put differently, the effortful control score (a subjective indicator of the broader concept of cognitive control in daily life situations) and task performance on the PASAT (an objective indicator of cognitive control) allow us to approach our main hypothesis from different angles.

The Cognitive Emotion Regulation Questionnaire (CERQ; Garnefski, Kraaij, and Spinhoven, 2001) and the Connor-Davidson Resilience Scale (CD-RISC; Connor and Davidson, 2003; Markowitz et al., 2014) were secondary outcome measures, that allowed for the quantification of emotion regulation strategies that are considered more adaptive, and resilience. More specifically, a positive thinking style score ($\alpha = 0.908$) was calculated by summing up three specific cognitive strategies measured by the CERQ: (1) focusing on other, positive things, (2) positive reappraisal and (3) putting things into perspective (four items each). For resilience, a total score across all 25 items of the CD-RISC ($\alpha = 0.898$) was calculated.

Procedure

The study took place in Flanders (i.e., the Northern part of Belgium), through collaborative efforts of Ghent University, VDAB (a public agency tasked with providing support for employment and job search) and RiseSmart (a private company offering outplacement services). Data collection was carried out via an online platform dedicated to research on Cognitive Control in the context of depression (http://cogtrain.ugent.be/nl/about-us). People interested in participating in the study could get in contact with the researchers via a contact form on the project's website. The researchers then emailed potential participants, to check whether or not inclusion criteria were met (i.e., currently unemployed or in a notice period). When this was the case, participants received an information letter and login details for a personal account on the project's website. Upon logging in for the first time, participants viewed video instructions and were subsequently asked to give their informed consent for participation to the study. As soon as participants gave informed consent, they were able to continue to the baseline measurements. After three and six months, participants received emails prompting them to complete the follow-up questionnaires.

Statistical analyses

The R-package Lavaan (Rosseel, 2012) was used to test the hypothesized mediation models (see Fig. 1). For the Maximum Likelihood-based path model based on the primary outcome measures, cognitive control (i.e., PASAT performance, assessed by the percentage of correct trials) and the baseline effortful control score were allowed to covary and were used as independent variables that predict depression, anxiety and stress scores (follow-up 2), both directly and indirectly via RNT (follow-up 1). RNT and effortful control were included in the model via the total scores on the PTQ and the effortful control factor of the ATQ, respectively.

We also tested an alternative path model (see Fig. 1), based on the preregistered secondary outcome measures (https://osf.io/n3zu9/components) In this model, cognitive control and baseline effortful control were allowed to covary and were used as both direct and indirect (via positive thinking style, follow-up 1) predictors of resilience (follow-up 2). Standard errors and confidence intervals (CI) were obtained via bootstrapping (10.000 resamples).

Results

Descriptive measures

Means and standard deviations of all measures are reported in the Supplementary Material (see Table S1). Mean levels of depression, anxiety and stress scores, especially at baseline, were noticeably higher than DASS norm scores obtained from the general population (Henry and Crawford, 2005). The mean PTQ scores, representing the level of RNT, seemed to be higher than in healthy samples, but lower than in anxious or depressed groups (Ehring et al., 2011). At baseline, the average PTQ score in our sample was closer to the mean of anxious groups than to the mean of the healthy groups in previous research. The follow-up scores, however, were more in line with healthy than with clinical norms. Repeated measures ANOVAs revealed a significant effect of time (see Table S2) for all but one questionnaire (CD-RISC). There was a decrease in RNT (PTQ) and symptoms (DASS-21) over time, whereas effortful control (ATQ) and positive thinking style (CERQ) showed increases (see Table S3). At baseline, unemployment duration was not correlated with any of the outcome measures ($r_{range} = [-.084, 0.072]$, all p-values > 0.427).

The zero-order correlations of the models' variables, calculated using the baseline scores of the final sample ($N = 84$), are reported in Table 1. The various questionnaires showed statistically significant, medium to strong correlations with one another, in the expected directions. PASAT performance, however, was not significantly correlated with any of the questionnaires, with the exception of the CD-RISC. Although small (–.229), this correlation indicates that people who report being relatively less resilient, may tend to perform better.

Path analyses

The results pertaining to the primary outcome measures are reported in Table 2, while Fig. 2 visualizes the direct paths and covariances that were statistically significant ($p < .05$). Zooming in on effortful control, the hypothesized indirect effects (via RNT) were simultaneously present for all three symptom types: depression ($b*i = –0.186$, $z = –2.761$, *95 % CI* = [–0.350, –0.078]), anxiety ($b*j = –0.172$, $z = –3.139$, *95 % CI* = [–0.310, –0.085]) and stress ($b*k = –0.185$, $z = –3.135$, *95 % CI* = [–0.339, –0.092]). Higher effortful control was associated with less symptoms. However, these indirect effects were not present for cognitive control, as RNT (i.e., the mediating variable) was not significantly predicted by cognitive control ($a = 0.070$, $z = 0.714$, *95 % CI* = [–0.111, 0.271]). In addition, cognitive control and effortful control did not significantly covary (*COV* = –31.485, $z = –1.415$, *95 % CI* = [–80.020, 8.101]). Interestingly, stress symptoms were significantly predicted by cognitive control ($e = –0.166$, $z = –1.999$, *95 % CI* = [–0.326, –0.002]), in addition to the indirect effect of effortful control. Residual covariances between symptoms of depression and anxiety (*COV* = 6.696, $z = 4.160$, *95 % CI* = [4.053, 10.317]), depression and stress (*COV* = 10.544, $z = 5.216$, *95 % CI* = [7.270, 15.470]) and anxiety and stress (*COV* = 6.529, $z = 4.080$, *95 % CI* = [3.948, 10.444]) were all positive and statistically significant ($p < .001$). These residual covariances correspond to correlations of 0.481, 0.646 and 0.595, respectively. Of note, the pattern of results as presented in Fig. 2 remains identical when repeating the analyses after filtering out the nine participants who were still in their notice period at baseline. The direct predictive effect of cognitive control on stress symptoms, for instance, is in that case estimated as $e' = –0.191$ ($z = –2.162$, *95 % CI* = [–0.359, –0.013], $p = .031$).

The results pertaining to the secondary outcome measures are reported in Table 3. Again, there is an indirect effect on resilience via positive thinking style, for effortful control ($b*e = 0.103$, $z = 2.236$, *95 % CI* = [0.005, 0.182]), but not for cognitive control ($a*e = –0.066$, $z = –1.169$, *95 % CI* = [–0.186, 0.023]). Importantly, this indirect effect of effortful control seems to be mainly driven by the path from positive thinking style to resilience ($e = 0.467$, $z = 3.715$, *95 % CI* = [0.268, 0.823]), rather than by the path from effortful control to positive thinking style ($b = 0.221$, $z = 1.910$, *95 % CI* = [–0.008, 0.429]). More positive thinking was positively associated with higher levels of resilience.

Table 4 lists the total and residual variances of all outcome variables, as well as the corresponding proportions of total variance, that are

Table 1
Zero-order correlations(below diagonal) and 95 % confidence intervals (above diagonal), based on the final sample's baseline scores ($n = 84$) PASAT = Paced Auditory Serial Addition Task; acc. (%) = accuracy (as percentage); ATQ Effortful Control = Effortful Control factor from the Adult Temperament Questionnaire; PTQ = Perseverative Thinking Questionnaire; CERQ = Cognitive Emotion Regulation Questionnaire; DASS = Depression Anxiety Stress Scales; CD-RISC = Connor-Davidson Resilience Scale. Note: *** $p < .001$, ** $p < .01$, * $p < .05$, $^{+}$ $p < .10$.

	1	2	3	4	5	6	7	8
1. PASAT acc. (%)	—	[–.398, 0.25]	[–.088, 0.334]	[–.317, 0.107]	[–.040, 0.376]	[–.065, 0.354]	[–.281, 0.146]	[–.423, –.015]
2. ATQ Effortful Control	–.191 $^{+}$	—	[–.674, –.365]	[.137, 0.518]	[–.540, –.167]	[–.516, –.135]	[–.603, –.256]	[.189, 0.556]
3. PTQ (total score)	.129	–.537 ***	—	[–.700, –.407]	[.559, 0.788]	[.445, 0.723]	[.473, 0.740]	[–.687, –.386]
4. CERQ Positive Thinking Style	–.110	.341 **	–.571 ***	—	[–.633, –.301]	[–.527, –.149]	[–.556, –.189]	[.409, 0.701]
5. DASS Depression	.176	–.368 ***	.691 ***	–.484 ***	—	[.467, 0.736]	[.586, 0.803]	[–.560, –.194]
6. DASS Anxiety	.151	–.339 **	.602 ***	–.352 **	.619 ***	—	[.540, 0.778]	[–.550, –.181]
7. DASS Stress	–.071	–.446 ***	.624 ***	–.388 ***	.711 ***	.676 ***	—	[–.523, –.143]
8. CD-RISC (total score)	–.229 *	.388 ***	–.555 ***	.573 ***	–.392 ***	–.380 ***	–.347 **	—

Table 2
Overview of the path analysis results: primary outcome measures.

	Estimate	SE	Z	p	95% CI
Paths to/from mediator					
$X_1 \rightarrow M$ (path a)	0.070	0.098	0.714	.476	[–0.111, 0.271]
$X_2 \rightarrow M$ (path b)	–0.419	0.105	–3.987	<0.001 ***	[–0.622, –0.206]
$M \rightarrow Y_1$ (path i)	0.443	0.140	3.172	.003 **	[0.182, 0.728]
$M \rightarrow Y_2$ (path j)	0.410	0.108	3.786	<0.001 ***	[0.215, 0.637]
$M \rightarrow Y_3$ (path k)	0.442	0.122	3.617	<0.001 ***	[0.231, 0.719]
Indirect Effects					
$X_1 \rightarrow M \rightarrow Y_1$ (a*i)	0.031	0.045	0.695	.487	[–0.046, 0.136]
$X_1 \rightarrow M \rightarrow Y_2$ (a*j)	0.029	0.043	0.663	.507	[–0.042, 0.132]
$X_1 \rightarrow M \rightarrow Y_3$ (a*k)	0.031	0.046	0.672	.501	[–0.045, 0.142]
$X_2 \rightarrow M \rightarrow Y_1$ (b*i)	–0.186	0.067	–2.761	.006 **	[–0.350, –0.078]
$X_2 \rightarrow M \rightarrow Y_2$ (b*j)	–0.172	0.055	–3.139	.002 **	[–0.310, –0.085]
$X_2 \rightarrow M \rightarrow Y_3$ (b*k)	–0.185	0.059	–3.135	.002 **	[–0.339, –0.092]
Direct Effects					
$X_1 \rightarrow Y_1$ (path c)	0.117	0.109	1.068	.285	[–0.100, 0.326]
$X_1 \rightarrow Y_2$ (path d)	0.066	0.102	0.648	.517	[–0.122, 0.275]
$X_1 \rightarrow Y_3$ (path e)	–0.166	0.083	–1.999	.046 *	[–0.326, –0.002]
$X_2 \rightarrow Y_1$ (path f)	0.005	0.141	0.036	.971	[–0.283, 0.263]
$X_2 \rightarrow Y_2$ (path g)	–0.169	0.123	–1.375	.169	[–0.412, 0.076]
$X_2 \rightarrow Y_3$ (path h)	–0.237	0.0137	–1.726	.084	[–0.484, 0.052]
Total Effects					
$X_1 \rightarrow Y_1$ (c + a*i)	0.148	0.119	1.243	.214	[–0.082, 0.388]
$X_1 \rightarrow Y_2$ (d + a*j)	0.095	0.108	0.879	.379	[–0.105, 0.318]
$X_1 \rightarrow Y_3$ (e + a*k)	–0.135	0.094	–1.429	.153	[–0.318, 0.054]
$X_2 \rightarrow Y_1$ (f + b*i)	–0.181	0.144	–1.259	.208	[–0.460, 0.101]
$X_2 \rightarrow Y_2$ (g + b*j)	–0.341	0.126	–2.696	.007 **	[–0.591, –0.091]
$X_2 \rightarrow Y_3$ (h + b*k)	–0.422	0.120	–3.511	<0.001 ***	[–0.631, –0.151]

X_1 = Cognitive Control (baseline), X_2 = Effortful Contol (baseline), M = Repetitive Negative Thinking (follow-up 1),
Y_1 = Depressive Symptoms (Follow-up 2), Y_2 = Anxiety Symptoms (Follow-up 2), Y_3 = Stress Symptoms (Follow-up 2)

accounted for by all predictors in the model (R^2). These results suggest that, for instance, 33.3 % of the variance in the stress symptoms is explained. Cognitive control and effortful control explained a combined 19.2 % of the variance in RNT, as opposed to 8.1 % of the variance in positive thinking style.

Discussion

Unemployment and (impending) job loss are potentially major stressors that are associated with heightened risk to develop depression and anxiety symptoms. As to date, it is unclear which intrapersonal factors are associated with (mal)adaptive responding to these stressors. Based on influential theories of stress-vulnerability and resilience, we examined the role of cognitive control and emotion regulation using a prospective research design, where we applied path analyses to both objective and subjective assessments of cognitive control. Our findings suggest (1) that emotional symptoms were predicted by effortful control (via RNT) and cognitive control, in distinct ways; and (2) that effortful control was also predictive of resilience, through positive thinking style. We will discuss these findings in turn.

The results of our model on emotional symptoms suggest that cognitive control, measured using a behavioral task (i.e., the PASAT), and its self-reported broader counterpart (i.e., effortful control) are not correlated. This finding is consistent with earlier research (e.g., Hoorelbeke et al., 2016), and may indicate that these measurements, despite referring to highly similar concepts, capture different constructs. In other words, performance on a standardized task that relies on attention and working memory could be far removed from an individual's perceived ability to adapt his or her behavior in daily life. Interestingly, cognitive and effortful control each predicted internalizing symptomatology in unique ways. In the case of effortful control, our preregistered mediational hypotheses were confirmed for all symptom types, providing further prospective support for current theories on the role of cognitive control in emotion regulation and psychopathology (e.g., Joormann and Vanderlind, 2014). PASAT performance, however, was able to *directly* predict stress symptoms in particular, while controlling for the influence of effortful control, despite the fact that six months of time had passed in between these measurements. This finding may be explained by the fact that the PASAT can be a frustrating task (for a review, see Tombaugh, 2006), and that performance may therefore depend on the participant's ability to down-regulate negative arousal. The proportions of explained variance (R^2) in the outcome measures of this primary model (ranging from around 20 % to more than 30 %) indicate that the mechanisms under investigation play an important role in explaining risk for the development of internalizing symptomatology.

The alternative path model, in which resilience (23.5 % of variance explained) was predicted by positive thinking style three months earlier, is in line with the model of Kalisch and colleagues (2015), as the positive thinking style score is reflective of the appraisal style that is considered the primary pathway to resilience. However, contrary to predictions there was no significant association between cognitive control and

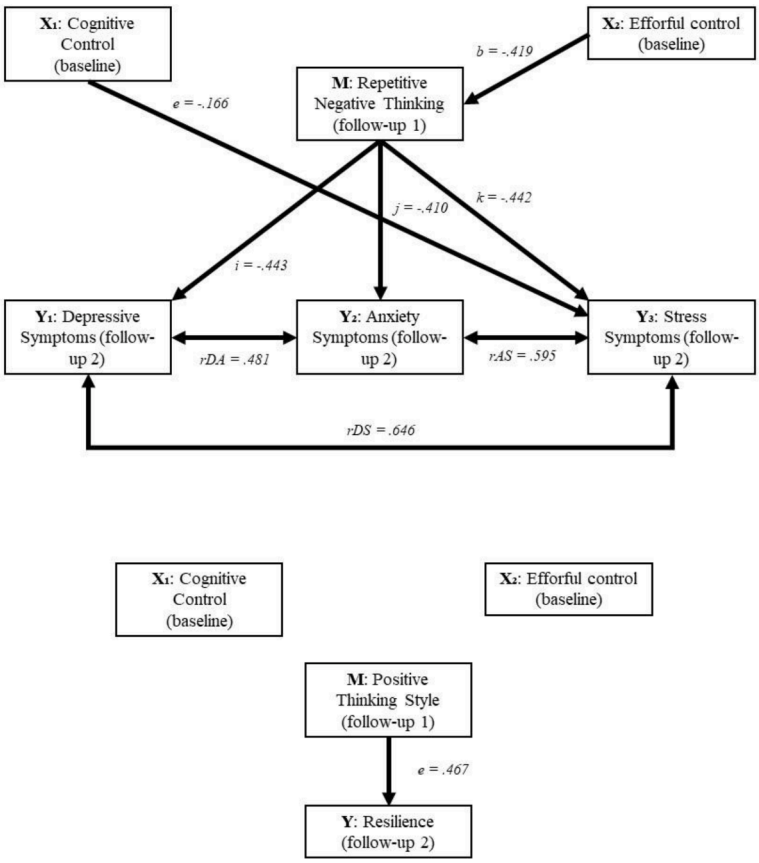

Fig. 2. Path models: overview of significant effects ($p < .05$).

Table 3
Overview of the path analysis results: secondary outcome measures.

	Estimate	*se*	*z*	*p*	*95% CI*
Paths to/from mediator					
$X_1 \rightarrow M$ (path a)	–0.142	0.113	–1.259	.208	[–0.375, 0.079]
$X_2 \rightarrow M$ (path b)	0.221	0.116	1.910	.056	[0.008, 0.429]
$M \rightarrow Y$ (path e)	0.467	0.126	3.715	<0.001 ***	[0.268, 0.823]
Indirect Effects					
$X_1 \rightarrow M \rightarrow Y$ (a*e)	–0.066	0.057	–1.169	.242	[–0.186, 0.023]
$X_2 \rightarrow M \rightarrow Y$ (b*e)	0.103	0.046	2.236	.025 *	[0.005, 0.182]
Direct Effects					
$X_1 \rightarrow Y$ (path c)	0.018	0.085	0.213	.831	[–0.139, 0.194]
$X_2 \rightarrow Y$ (path d)	0.067	0.142	0.474	.636	[–0.140, 0.451]
Total Effects					
$X_1 \rightarrow Y$ (c + a*e)	–0.048	0.108	–0.449	.654	[–0.236, 0.210]
$X_2 \rightarrow Y$ (d + b*e)	0.170	0.150	1.134	.257	[–0.105, 0.546]

X_1 = Cognitive Control (baseline), X_2 = Effortful Contol (baseline), M = Positive Thinking Style (follow-up 1),
Y = Resilience (follow-up 2)

Table 4
Total variances, residual variances and R2-values for the path models.

	Total	Residual	R^2
PASAT acc. (%)	149.040	—	—
ATQ Effortful Control	183.165	—	—
Primary Model			
PTQ (total score)	105.417	85.198	.192
DASS Depression	26.647	20.695	.223
DASS Anxiety	12.862	9.348	.273
DASS Stress	19.289	12.874	.333
Secondary Model			
CERQ Positive Thinking Style	73.109	67.188	.081
CD-RISC (total score)	154.963	118.584	.235

R^2 = the proportion of the total variance that is explained by all predictors in the model.

effortful control and positive thinking style.

Taken together, our data confirm that intra-individual variables explain a considerable amount of variance in the response to potentially major stressors such as job loss and unemployment, both at the level of emotional symptoms as well as resilience. Understanding the mechanisms involved in engaging in (mal)adaptive responses to stress is key (1) to identify individuals at risk for the development of internalizing psychopathology in this context (which is also associated with further unemployment), and (2) to understand the factors that are involved, in order to be able to intervene. It is noteworthy that interventions are available to improve emotion regulation (Berking et al., 2008) as well as cognitive control (Siegle et al., 2007).). Our findings are in line with key ideas of theoretical models of cognitive control and emotion regulation (Joormann and Vanderlind, 2014). At the same time, some of the associations were observed with self-reported cognitive complaints while other effects were related to performance-based cognitive control assessment. Further specification of these models seems necessary to account for our findings.

Limitations

The prospective nature of the data, along with the incorporation of (impending) unemployment as a real-life and potentially major stressor, make the current study one of the first of its kind. Nonetheless, some limitations remain to be addressed in future research: the sample was modest in size and was followed up for a limited amount of time. Sample size is much smaller than the 270 identified in the pre-registration. Enrolment to the study was much slower than anticipated, where further replication in larger samples is warranted. Moreover, a larger sample would have allowed comparing participants in terms of their professional context (e.g., job uncertainty, certain job loss in the near future, actual unemployment…). Furthermore, only a limited set of demographic variables were included (e.g., age, gender and education level), precluding the evaluation of ethnic and cultural diversity in the sample. Provided the interesting findings, these shortcomings should be addressed in future research.

Conclusion

In sum, we found that effortful control and cognitive control are relevant distal factors to take into account when investigating emotional symptoms, in the context of unemployment. The current study paves the way for more large scale, representative efforts. Especially in times of economic hardship it is crucial to understand risks for stress-related psychopathology and longer unemployment status, both from a mental health as well as a health economic point-of-view.

CRediT authorship contribution statement

Nathan Van den Bergh: Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Igor Marchetti:** Writing – review & editing, Conceptualization. **Kristof Hoorelbeke:** Writing – review & editing, Methodology, Conceptualization. **Alvaro Sanchez-Lopez:** Writing – review & editing, Conceptualization. **Rudi De Raedt:** Writing – review & editing, Funding acquisition, Conceptualization. **Ernst H.W. Koster:** Writing – original draft, Supervision, Funding acquisition, Conceptualization.

Declaration of competing interest

The authors declared that there were no conflicts of interest with respect to the authorship or the publication of this article.

Role of the funding source

The funding sources had no involvement in the design and execution of the study and the writing of the manuscript.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.jadr.2024.100848.

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