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# Is mental regulation related to self-esteem? Testing a basic metacognitive model

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## Abstract

Individual differences in global self-esteem are associated with general psychological functioning and well-being, and lower self-esteem could be a target for prevention and treatment interventions. Traditionally, self-esteem is assumed to be influenced by the content of self-beliefs, but the metacognitive model of psychological disorders presents an alternative. It emphasizes mental regulation over the content in self-beliefs and suggests a role for metacognitive beliefs and corresponding metacognitive strategies. Thus, the metacognitive model has the potential to advance our understanding of self-esteem and provide new treatment interventions. Therefore, the aim of this study was to test a basic metacognitive model of self-esteem. In a cross-sectional design, 522 participants from a convenience sample completed a battery of self-report questionnaires. A metacognitive model where metacognitive strategies mediated the relationship between metacognitive beliefs and self-esteem was tested using structural equation modelling. Stronger endorsements of dysfunctional metacognitions were associated with more use of unhelpful metacognitive strategies, which further was significantly related to lower self-esteem. These relationships held even when controlling gender, age, anxiety, and personality traits as covariates. The results suggests that there is a role for dysfunctional metacognitive beliefs and strategies in self-esteem of which metacognitive strategies are the most proximal influence. This observation indicates that individual differences in mental regulation are relevant to understanding and possibly improving self-esteem. Interventions which effectively lead to metacognitive change are likely to have a positive effect on self-esteem.

**Keywords** Self-esteem · Metacognitive beliefs · Cognitive attentional syndrome · S-REF · Anxiety · Personality

Self-esteem is considered a multidimensional construct and has been conceptualized both as global and domain-specific (Kernis, 1993; Marsh, 1986; Rosenberg, 1965; Rosenberg et al., 1995). Individual differences in self-esteem have been attributed to differences in self-knowledge (Markus, 1977), or differences in the extent of liking oneself (Brown, 1993). Regardless, across definitions it is generally agreed that global self-esteem encompasses the way one feels or the cognitive representations one holds about one's self, with a clear evaluative focus on the self (e.g., Greenwald et al., 2002; Kolubinski et al., 2019). High or positive self-esteem has been linked to success and adaptation across life domains, including school and work performance, relationships, physical and mental health (Orth & Robins, 2014). Low or negative self-esteem on the other hand, has been related to a range of negative outcomes, including lower levels of overall well-being, lower relationship satisfaction and increased risk of psychological disorder (Boden et al., 2008). Low self-esteem has a reciprocal relationship with emotional distress symptoms and is considered a risk factor for development of for example depression (Sowislo & Orth, 2013). This suggests that low self-esteem could be an important target for prevention interventions. Thus, better understanding of etiological and maintenance factors contributing to self-esteem has the potential to advance formulation and interventions directed towards improving self-esteem.

During the last decades several theories and models of self-esteem have been posited such as sociometer theory (Leary et al., 1995) and terror management theory

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(Greenberg et al., 1986). In clinical psychology, the cognitive-behavioral model of low self-esteem posited by Fennel (1997) has served as a benchmark. It was derived from Beck's schema theory, which emphasizes global negative beliefs about the self as mechanistic in low self-esteem. Key interventions founded in this model include to weaken old, negative core beliefs about the self, to establish and strengthen more positive, realistic beliefs about the self, and to encourage self-acceptance (Fennel, 1998). Cognitive behavioral therapy based on the Fennel model may be efficacious for treating individuals with low self-esteem, but a limited number of trials have been conducted (Kolubinski et al., 2018). Further, moderate effects on self-esteem have been reported in psychotherapy for depression (Bhattacharya et al., 2023), and treatment effects are mixed in psychiatric disorders where a low self-esteem is a main feature or characteristic, such as personality disorders (Lampe & Malhi, 2018; Acarturk et al., 2009). Thus, there is room for improvements, and one way forward may be to think differently about how self-esteem should be formulated.

The metacognitive model of psychological disorders (Wells, 2019; Wells & Matthews, 1994) differs from other psychological theories in that it primarily emphasizes top-down influences on mental regulation by placing biases in metacognition (i.e., cognition applied to cognition) in center stage. In this approach, psychopathology and psychological problems such as low self-esteem are linked to a particular negative thinking style named the Cognitive Attentional Syndrome (CAS: Wells, 2009). The CAS consists of (1) perseverative and negative thinking processes such as worry, rumination and self-criticism, (2) threat monitoring (inflexible strategic attention towards potential threats), and (3) unhelpful coping behaviors such as avoidance, thought suppression or self-harm. It is further suggested that metacognitive knowledge, including explicit beliefs about cognition and implicit rules or plans to guide thinking, play a central role when it comes to activation and perseverance of CAS strategies (Wells, 2019; Wells & Matthews, 1996). For instance, positive metacognitive beliefs about the usefulness of CAS strategies (e.g., «rumination will help me learn from past mistakes») is important for selection of rumination in attempts to self-regulate when facing spontaneous negative thoughts. Negative metacognitive beliefs concern the uncontrollability and dangers of cognition (e.g., «When I start to ruminate, I cannot stop»), which prohibit disengagement of CAS strategies, and may even lead to perceiving cognition itself as threatening. In this framework, all humans have negative thoughts about themselves from time to time and may even believe in these thoughts. However, global self-esteem is likely related to mental regulation where those that are prone to engage in CAS strategies in response to negative thoughts due to biases in metacognitions will have lower self-esteem given that CAS strategies provides a negative and biased view of the self and the world in addition to blocking other more adaptive self-regulation strategies which could provide more balanced information about one's ability to cope and deal with stressors (Wells, 2009).

In line with the metacognitive model, previous research has found significant relationships between metacognitive beliefs, CAS strategies and self-esteem. Hagen et al. (2020) reported a moderate correlation between metacognitions and self-esteem, and further found that brooding (i.e., rumination, CAS) mediated the relationship between metacognitions and self-esteem. The authors assumed a unidirectional link from emotional distress symptoms to metacognitions, which further impacted self-esteem through brooding. This is not entirely consistent with metacognitive theory. Kolubinski et al. (2019) reported significant associations between self-esteem, generic metacognitive beliefs, and CAS strategies in the form of self-criticism and self-critical rumination. They further tested a metacognitive model of self-esteem by including indicators of anxiety, depression, stress, metacognitions about self-critical rumination, and self-critical rumination as predictors. While they obtained a good model fit to the data, thematic overlap in the indicators used can be problematic. Furthermore, it is likely that metacognitive beliefs and strategies specifically relevant to self-esteem also will lead to emotion disorder symptoms, rather than a unidirectional influence from symptoms to CAS strategies as modelled by Kolubinski et al. (2019). Additionally, self-esteem is likely linked to the CAS more generally, and not limited to self-critical rumination or brooding. Thus, testing a more general metacognitive model of self-esteem has the advantage of reducing risk for introducing overlap between predictors and outcome, and may serve as a basic test of the transdiagnostic nature of the metacognitive approach.

In sum, the metacognitive model suggests a role for metacognitive beliefs and CAS strategies when explaining individual differences in self-esteem, and a few studies have reported correlations supporting this notion. This suggests that a more specific test of these relationships ais warranted. In the current study we therefore set out to test a basic metacognitive model of self-esteem where metacognitive beliefs contribute to self-esteem through CAS strategies. We hypothesized that the basic metacognitive model of self-esteem would demonstrate a good fit to the data, and that the effect of metacognitive beliefs on self-esteem would be mediated by CAS strategies. Further, to provide a more stringent test of the metacognitive model, several factors previously shown to be associated with self-esteem were controlled. We controlled for gender due to females on average reporting lower self-esteem (Kling et al., 1999). We controlled for general anxiety since it has demonstrated a reciprocal relationship with a low self-esteem (Sowislo

& Orth, 2013) and as the MCQ-30 assesses metacognitive beliefs related to worry, which is particularly relevant to anxiety (Nordahl et al., 2023). Finally, to account for trait-influences on self-esteem, we controlled for big-5 personality traits as prior studies have demonstrated that self-esteem correlates strongly with neuroticism, moderately to strong with extraversion and conscientiousness, and weakly with both openness to experience and agreeableness (Robins et al., 2001; Watson et al., 2002).

## Methods

### Participants and Procedure

The study included participants aged 18 or older who were proficient in the Norwegian language. The survey was conducted online, and participants were gathered at convenience through promotion across multiple social media platforms. The survey was administered through an online survey program and was registered with the Norwegian Centre for Research Data (Ref nr.: 718942). Ethical approval for the study was obtained by the Regional Committees for Medical and Health Research Ethics (Ref nr. 285286) and participants were required to give informed consent prior to participation.

A total of 522 participants were recruited, of whom 436 (83.5%) were females and 86 (16.5%) were male. The mean age was 41.25 (*SD* = 11.65). In terms of marital status, 112 (21.5%) reported being single, 51 (9.8%) were in a romantic relationship, 330 (63.2%) were either cohabitants or married, 26 (5.0%) were separated or divorced, and 2 (0.4%) were widowed. One individual did not disclose a marital status. Regarding occupational status, 101 (19.3%) reported being students, 421 (80.7%) were employed, 11 (2.1%) were job seekers, 23 (4.4%) were on sick leave, 58 (11.1%) were recipients of work assessment allowance or disability pension, and 5 (1.0%) were retired. In terms of educational level, 316 (60.5%) participants had completed more than three years of university, 109 (20.9%) had completed between one and three years of university, and the remaining 97 (18.6%) reported high school or primary school as their highest level of education. Concerning mental health, 192 (36.8%) disclosed having received a psychiatric diagnosis at some point in their lives.

### Measures

Rosenberg Self-Esteem Scale (RSES; Rosenberg, 2015) is a 10-item measure of global self-esteem. Response options range from 0 ("Strongly Disagree") to 3 ("Strongly Agree"). The questionnaire has shown good mean internal consistency across samples from several countries (α = 0.81, Schmitt & Allik, 2005). In our study the internal consistency was excellent (α = 0.93).

The metacognitions questionnaire 30 (MCQ-30; Wells & Cartwright-Hatton, 2004) is a 30-item measure of dysfunctional metacognitive beliefs. Items are divided into five subscales and response options range from 1 ("do not agree") to 4 ("agree very much"). The questionnaire has shown good psychometric properties (Wells & Cartwright-Hatton, 2004). In our study the internal consistency of each subscale was acceptable to good: positive metacognitive beliefs (α = 0.81), negative metacognitive beliefs (α = 0.84), cognitive confidence (α = 0.89), need to control thoughts (α = 0.75), and cognitive self-consciousness (α = 0.80).

The CAS-1 (Wells, 2009) is a 16-item scale used to assess the cognitive attentional syndrome (CAS), positive metacognitive beliefs and negative metacognitive beliefs. The current study only included items measuring CAS strategies as metacognitions were assessed with the MCQ-30. In the current study the CAS strategies were labelled as follows: worry/rumination = CAS-1 (single item scale), threat monitoring = CAS-2 (single item scale), unhelpful coping behaviours = CAS-Behaviour (mean score of six items). Response options range from 0 ("none of the time") to 8 ("all of the time"). The CAS strategies latent subscale has shown good internal consistency (α = 0.89, Nordahl & Wells, 2019). In our study the internal consistency was good (α = 0.89).

The Generalized Anxiety Disorder 7 (GAD-7; Spitzer et al., 2006) is a seven-item scale used to measure symptoms of generalized anxiety. Response options range from 0 ("not at all") to 3 ("nearly every day"). The measure has shown excellent internal consistency (α = 0.92; Spitzer et al., 2006). In our study the internal consistency was good (α = 0.88).

The Big Five Inventory 10 (BFI-10; Rammstedt & John, 2007) is a 10-item scale used to measure five personality traits: Neuroticism, Extraversion, Openness, Agreeableness, and Conscientiousness. The scale is an abbreviated version of the 44-item Big Five Inventory (John & Srivastava, 1999). Each personality trait is measured by two items. Response options range from 1 ("strongly disagree") to 5 ("strongly agree"). It has shown acceptable psychometric properties, comparable to the full-length versions of big-five factor measures (Rammstedt & John, 2007).

### Statistical analyses

Statistical analyses were performed in Mplus 8.9 (Muthén & Muthén, 1998–2023), using structural equation modelling (SEM) with Full-information maximum likelihood (MLR). The analyses were performed in three stages. In the first stage, we performed separate analyses to find well-fitting measurement models of the latent constructs prior

to estimating structural paths in the mediation model. The latent factor of dysfunctional metacognitions was specified by the five MCQ-30 factors, and the latent CAS strategies factor by CAS-1 (worry/rumination), CAS-2 (threat monitoring) and CAS-Behaviour (unhelpful coping behaviours). The latent self-esteem factor was specified by 10 items of the self-esteem scale.

In the second stage, we estimated a full structural equation model with dysfunctional metacognition as the focal predictor, CAS strategies as the mediator variable and self-esteem as the outcome variable (Fig. 1A). A significant mediation effect was established when the 95% confidence interval based on 1000 bootstrap draws did not contain zero. This is preferred over traditional approaches in testing mediation (Hayes, 2009, 2013) such as the causal steps approach, the test of joint significance approach (Baron & Kenny, 1986), or the product of coefficients approach (Sobel, 1982, 1986).

In the third stage, demographic variables, personality variables, and anxiety were added to the mediation model. This was done to control for their effects while testing the hypothesis that CAS strategies mediate the relationship between dysfunctional metacognition and self-esteem over and above the covariates (Fig. 1B). Adequate model fit was evaluated with the following indices: Standardized Root Mean Square Residual (SRMR) (Browne & Cudeck, 1993) and Root Mean Square Error of Approximation (RMSEA) (Hu & Bentler, 1999) values less than 0.08 and values equal to or less than 0.06 (upper 90% CI close to or < 0.08) respectively, a Comparative Fit Index (CFI) and a non-Normed Fit index (NNFI; aka TLI) greater than 0.90 (Hu & Bentler, 1999).

## Results

Table 1 contains the means, standard deviations, and the correlation between the variables in the study.

### CFA of latent factors

The fit of the dysfunctional metacognition latent factor was acceptable ($\chi^2 = 14.23$, $df = 5$, $p < .05$; SRMR = 0.03; RMSEA = 0.06 [90% CI = 0.02, 0.09]; CFI = 0.98; TLI = 0.96). However, two residual covariances were freely estimated for the self-esteem latent factor to reach acceptable model fit ($\chi^2 = 190.545$, $df = 33$, $p < .001$; SRMR = 0.04; RMSEA = 0.09 [90% CI = 0.8, 0.11]; CFI = 0.94; TLI = 0.92), although the RMSEA indicated some degree of potential misfit. As the CAS Strategies latent factor was measured by three indicators, the model chi-square value was 0.

### Mediation model of dysfunctional metacognitions, CAS strategies and lower self-esteem

The fit of the mediation model was acceptable ($\chi^2 = 389.685$, $df = 130$, $p < .001$; SRMR = 0.05; RMSEA = 0.06 [90% CI = 0.05, 0.07]; CFI = 0.95; TLI = 0.94), so we proceeded to interpret the coefficients of the structural paths. The total effect of dysfunctional metacognition on self-esteem was (Standardized: $\beta = -0.68$, $p < .001$). When CAS strategies was introduced into the model as mediator variable, the direct effect of CAS strategies on self-esteem was ($\beta = -0.57$, $p < .001$), and from dysfunctional metacognitions to CAS strategies was ($\beta = 0.90$, $p < .001$). The effect of dysfunctional metacognition on self-esteem ($\beta = -0.16$, $p = .287$) was no longer significant with the disappearance of the effect between dysfunctional metacognitions

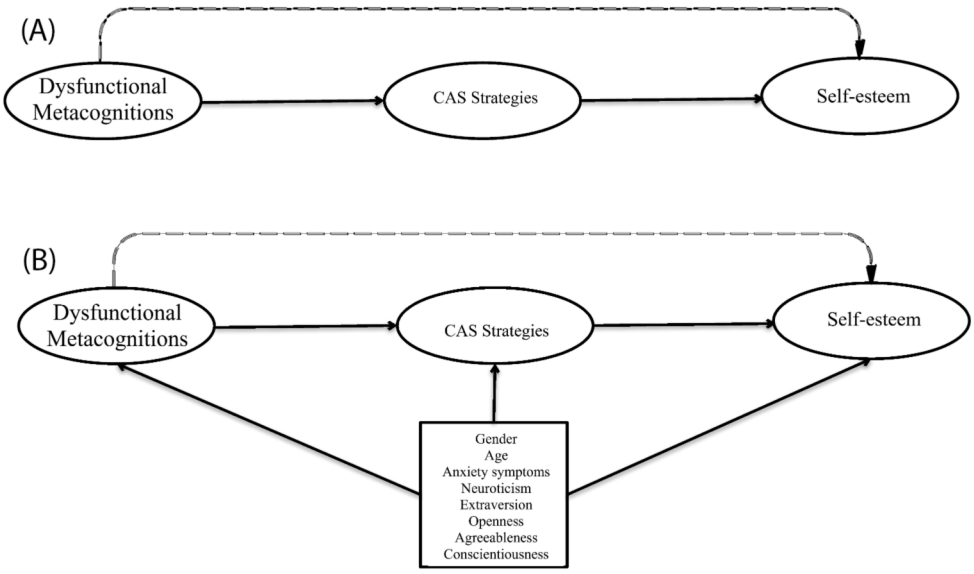


**Fig. 1** **A**: The conceptual simple mediation model. **B**: The conceptual simple mediation model with covariates

**Table 1** Means with standard deviations and bivariate correlations between the variables ($N = 522$)

| | | 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. | 12. | 13. | 14. | 15. | Mean (SD) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | RSES | | | | | | | | | | | | | | | | 29.29 (6.93) |
| 2. | POS | −0.31** | | | | | | | | | | | | | | | 8.08 (2.54) |
| 3 | NEG | −0.57** | 0.31** | | | | | | | | | | | | | | 10.35 (3.95) |
| 4 | CC | −0.37** | 0.21** | 0.27** | | | | | | | | | | | | | 9.83 (4.11) |
| 5 | NC | −0.48** | 0.34** | 0.61** | 0.26** | | | | | | | | | | | | 8.54 (2.99) |
| 6 | CSC | −0.34** | -35** | 0.54** | 0.12** | 0.51** | | | | | | | | | | | 11.47 (3.75) |
| 7 | CAS1 | −0.63** | 0.37** | -68** | 0.23** | 0.55** | 0.53** | | | | | | | | | | 2.34 (2.01) |
| 8 | CAS2 | −0.54** | 0.30** | 0.64** | 0.22** | 0.47** | 0.46** | 0.77** | | | | | | | | | 1.40 (1.76) |
| 9 | CAS_beh | −0.63** | 0.33** | 0.66** | 0.32** | 0.61** | 0.48** | 0.73** | 0.70** | | | | | | | | 1.23 (1.26) |
| 10 | GAD | −0.65** | 0.38** | 0.71** | 0.30** | 0.54** | 0.48** | 0.79** | 0.73** | 0.74** | | | | | | | 5.36 (4.30) |
| 11 | N | −0.58** | 0.29** | 0.52** | 0.30** | 0.32** | 0.28** | 0.53** | 0.51** | 0.50** | 0.64** | | | | | | 5.34 (2.32) |
| 12 | E | 0.40** | −0.09 | −0.27** | −0.18** | −0.17** | −0.14** | −0.24** | −0.22** | −0.25** | −0.28** | −0.32** | | | | | 6.82 (2.27) |
| 13 | O | 0.09* | 0.01 | 0.06 | −0.04 | −0.02 | 0.12** | 0.04 | 0.07 | 0.04 | 0.06 | 0.00 | 0.16** | | | | 6.92 (2.07) |
| 14 | A | 0.25** | −0.14** | −0.23** | −0.09* | −0.13** | −0.16** | −0.23** | −0.16** | −0.21** | −0.25** | −0.31** | 0.22** | 0.04 | | | 7.35 (1.71) |
| 15 | C | 0.19** | −0.08 | −0.10* | −0.18** | −0.02 | 0.01 | −0.11* | −0.08 | −0.13** | −0.16** | −0.20** | 0.14** | 0.01 | 0.14** | | 8.11 (1.56) |

Note Correlations, means and standard deviations were only calculated among those with complete data on all measures. SD = standard deviation, RSES = Rosenberg Self-Esteem Scale, POS = positive metacognitive beliefs, NEG = negative metacognitive beliefs, CC = cognitive confidence, NC = need to control thoughts, CSC = cognitive self-consciousness, CAS1 = worry/rumination, CAS2 = threat monitoring, CAS_beh = unhelpful coping behaviours, GAD = generalized anxiety disorder symptoms, N = neuroticism, E = extraversion, O = openness, A = agreeableness, C = conscientiousness *$p < .05$, **$p < .01$.

and self-esteem representing full mediation as the indirect effect was significant ($\beta = -0.51$, $p < .001$; [95% CI: -0.78, -0.25]).

This means that the association between dysfunctional metacognitions and lower self-esteem can be explained by the fact that dysfunctional metacognitions is associated with greater use of CAS strategies, which in turn is associated with lower self-esteem. The full mediation model is displayed in Fig. 2.

### Effects of relevant covariates in the mediation of dysfunctional metacognitions and self-esteem by CAS strategies

Relevant covariates were added to the mediation model to examine whether the CAS strategies would still mediate the relation between dysfunctional metacognitions and lower self-esteem over and above the covariates. The fit of the mediation model with covariates was acceptable ($\chi^2 = 628.328$, $df = 250$, $p < .001$; SRMR = 0.05; RMSEA = 0.05 [90% CI = 0.05, 0.06]; CFI = 0.94; TLI = 0.92). Table 2 contains all path coefficients from the mediation model with relevant covariates included.

Women reported significantly lower dysfunctional metacognitions ($\beta = -0.08$, $p < .05$). Higher anxiety symptoms were associated with higher dysfunctional metacognition ($\beta = 0.75$, $p < .001$) and CAS strategies ($\beta = 0.44$, $p < .001$). Higher neuroticism was associated with lower self-esteem ($\beta = -0.18$, $p < .001$), whereas higher extraversion ($\beta = 0.18$, $p < .001$), openness ($\beta = 0.11$, $p < .01$), and conscientiousness ($\beta = 0.08$, $p < .05$) were all significantly associated with higher self-esteem.

The total effect of dysfunctional metacognition on self-esteem was ($\beta = -0.37$, $p < .001$). The direct effect of CAS strategies on self-esteem was ($\beta = -0.41$, $p < .01$), and from dysfunctional metacognitions to CAS strategies was ($\beta = 0.52$, $p < .001$). The direct effect of dysfunctional metacognition on self-esteem ($\beta = -0.16$, $p = .212$) was not significant, but the indirect effect of dysfunctional metacognitions through CAS strategies on self-esteem was significant ($\beta = -0.21$, $p < .01$; [95% CI: -0.38, -0.05]), representing full mediation by CAS strategies over and above the covariates.

## Discussion

The aim of the current study was to test the statistical fit of a basic metacognitive model of self-esteem where dysfunctional metacognitive beliefs are correlated with self-esteem, a relationship mediated by CAS (i.e., metacognitive) strategies. In line with metacognitive theory (Wells, 2009), we found that the metacognitive model fitted the data well, and that CAS strategies fully mediated the relationship between metacognitive beliefs and self-esteem. These effects remained when controlling for covariates associated with self-esteem, such as gender, age, anxiety symptoms, and big-5 personality traits.

All domains of dysfunctional metacognitive beliefs showed a significant correlation of moderate strength with self-esteem in the expected direction (i.e., higher dysfunctional metacognitions correlating with lower self-esteem). Among the metacognitive belief domains, negative metacognitive beliefs about the uncontrollability and danger of

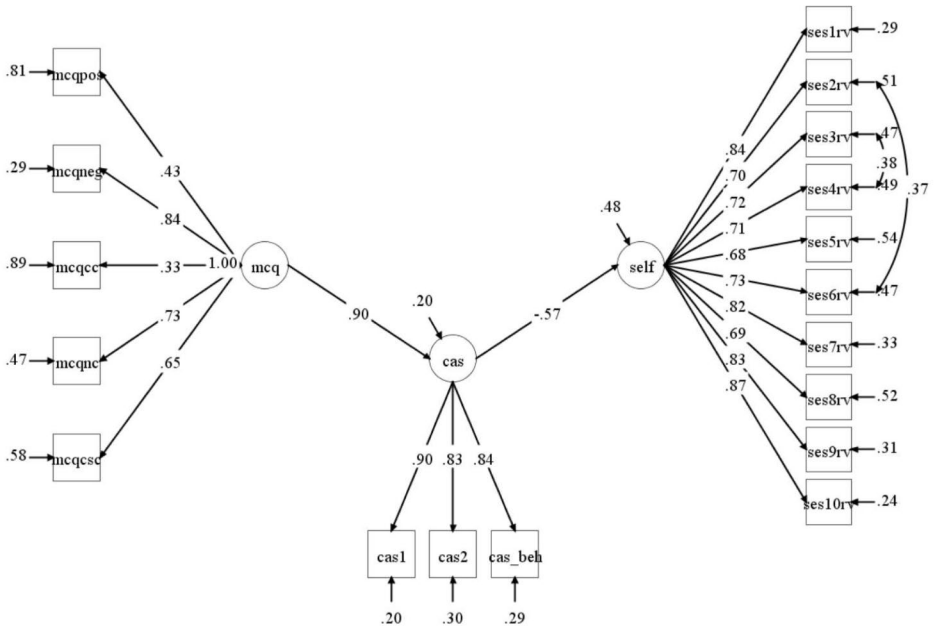


**Fig. 2** A full mediation model of the relationship between Dysfunctional Metacognition (mcq) CAS strategies (cas) and Self-esteem (self) in the SEM framework. *Note* mcqpos = positive beliefs about worry, mcqneg = negative beliefs about the uncontrollability and danger of worry, mcqcc = lack of cognititve confidenc, mcqnc = need to control thoughts, mcqcsc = cognitive self-consciousness, cas1 = worry/rumination, cas2 = threat monitoring, cas_beh = unhelpful coping behaviours, ses1rv to ses10rv = observed indicators of self-esteem

**Table 2** Path coefficients in the full SEM

| Path | β | SE | p |
|---|---|---|---|
| **Dysfunctional metacognitions** | | | |
| Gender (Females) → | **−0.08** | **0.03** | **0.014** |
| Age → | −0.05 | 0.04 | 0.197 |
| Anxiety symptoms → | **0.75** | **0.04** | **0.000** |
| Neuroticism → | 0.07 | 0.05 | 0.145 |
| Extraversion → | −0.06 | 0.04 | 0.113 |
| Openness → | 0.04 | 0.03 | 0.276 |
| Agreeableness → | −0.04 | 0.03 | 0.242 |
| Conscientiousness → | 0.06 | 0.04 | 0.087 |
| **CAS strategies** | | | |
| Gender (Females) → | 0.03 | 0.02 | 0.210 |
| Age → | **−0.05** | **0.03** | **0.035** |
| Anxiety symptoms → | **0.44** | **0.06** | **0.000** |
| Neuroticism → | 0.02 | 0.04 | 0.632 |
| Extraversion → | −0.01 | 0.03 | 0.815 |
| Openness → | 0.01 | 0.02 | 0.836 |
| Agreeableness → | 0.01 | 0.03 | 0.661 |
| Conscientiousness → | 0.00 | 0.03 | 0.958 |
| **Self-esteem** | | | |
| Gender (Females) → | −0.04 | 0.03 | 0.161 |
| Age → | −0.02 | 0.03 | 0.524 |
| Anxiety symptoms → | 0.00 | 0.09 | 0.974 |
| Neuroticism → | **−0.18** | **0.04** | **0.000** |
| Extraversion → | **0.18** | **0.04** | **0.000** |
| Openness → | **0.11** | **0.03** | **0.001** |
| Agreeableness → | 0.01 | 0.03 | 0.839 |
| Conscientiousness → | **0.08** | **0.03** | **0.026** |
| **Total effect** | | | |
| Dysfunctional metacognitions → Self-esteem | **−0.37** | **0.08** | **0.000** |
| **Direct effects in mediation model** | | | |
| Dysfunctional metacognitions → Self-esteem | −0.16 | 0.13 | 212 |
| Dysfunctional metacognitions → CAS Strategies | **0.52** | **0.06** | **0.000** |
| CAS Strategies → Self-esteem | **−0.41** | **0.15** | **0.007** |
| **Indirect effect in mediation model** | | | |
| Dysfunctional metacognitions → CAS Strategies → Self-esteem | **−0.21** | **0.08** | **0.013** |

*Note* Statistically significant paths are shown in boldface.

worrying showed the strongest relationship with self-esteem. This is in line with previous research on metacognitive beliefs and self-esteem (Hagen et al., 2020; Kolubinski et al., 2017, 2019). Moreover, all three CAS-variables showed moderate significant correlations with self-esteem in the expected direction. This indicated that increased amount of worry/rumination, threat monitoring, and coping behaviours were all associated with lower self-esteem. Former research also suggests lower self-esteem is associated with increased amount of rumination (Hagen et al., 2020; Kolubinski et al., 2019; Kuster et al., 2012). Adding to previous research, but in line with the metacognitive model (Wells, 2009), we found a significant relationship between self-esteem and the CAS strategy domains "threat monitoring" and "maladaptive coping behaviours". In line with previous research, and our argument for including the covariates in the SEM analysis, higher anxiety symptoms and neuroticism, and lower extraversion, openness, agreeableness and conscientiousness, were significantly correlated with self-esteem in their expected direction (Riketta, 2004; Robins et al., 2001; Watson et al., 2002).

Consistent with metacognitive theory (Wells & Matthews, 1994; Wells, 2009), a basic metacognitive model where metacognitive beliefs associated with CAS strategies which further was associated with self-esteem provided a good model fit to the data. The CAS strategies fully mediated the relationship between dysfunctional metacognitive beliefs and self-esteem, and CAS strategies explained a substantial amount of the variance in self-esteem. Metacognitions explained the majority of the variance in CAS

strategies. When adding covariates, the fit of the basic metacognitive model was still acceptable. All of the big-5 personality traits, with the exception of agreeableness, were uniquely associated with self-esteem beyond the metacognitive factors in their expected direction. This is in line with previous research on a link between personality traits and self-esteem (Robins et al., 2001; Watson et al., 2002). Nonetheless, our results are consistent with an independent role for metacognitive beliefs through metacognitive strategies to self-esteem, which indicates that metacognition and mental regulation are relevant to self-esteem beyond factors such as age, gender, symptoms of anxiety and personality traits.

Our results have implications for further research and clinical practice. Self-esteem is linked to mental regulation and metacognition, and further research should test a potential unique role of metacognitive factors when accounting for self-knowledge (cognitive beliefs) as emphasised in the cognitive-behavioural perspective (Fennel, 1997). As suggested by Wells (2009), it could be that cognitive processing, under the influence of metacognition, is more relevant to understanding psychological dysfunction than the content of one's self-beliefs. This suggestion might generalize to self-esteem, as it is possible that biased metacognition contributes to both (lower) self-esteem and the cognitive beliefs associated with it, in line with recent studies reporting these relations among metacognitive- and cognitive belief domains and social anxiety (Nordahl et al., 2022) and depression (Strand et al., 2023a). In line with our findings, targeting metacognitive beliefs and corresponding CAS strategies may improve self-esteem. This suggests that metacognitive therapy (MCT; Wells, 2009), which was specifically developed to target these mechanisms, offers a new set of techniques and interventions that should be evaluated in further research. MCT is considered a transdiagnostic treatment as it focuses on dysfunctional metacognitions and the CAS as common factors across disorders and psychological problems. In line with this notionStrand et al. (2023b) reported large and significant improvements of global self-esteem after completion of generic group MCT for patients with primary major depressive disorder.

This study has several limitations that should be acknowledged. The sample was gathered with convenience sampling through promotion across multiple social media platforms. There were a significantly higher proportion of females compared to males, and findings may therefore not generalize to other populations. We used a cross-sectional design, so it is not possible to draw causal inferences from our results. We used the RSES (Rosenberg, 2015) as an indicator of global self-esteem, but as summarized by others (e.g., Kolubinski et el., 2019), self-esteem is a multifaceted construct which cannot be exhaustively assessed with a single self-report scale. Nonetheless, a strength of our study is that we make an incremental contribution to previous literature by testing a metacognitive model of self-esteem based on prespecified sound theory separating underlying metacognitive beliefs and corresponding CAS strategies without using indicators referring to constructs in risk of criterion contamination (e.g., metacognitive beliefs about self-critical thinking - self-critical thinking – low self-esteem). Future research should test the role of metacognitive factors in self-esteem with broader indicators of self-esteem, longitudinal designs and in clinical samples.

## Conclusion

The present study found that a basic metacognitive model of self-esteem fitted the data well, and that CAS strategies fully mediated the relationship between metacognitive beliefs and self-esteem. This finding indicates a role for mental regulation in self-esteem and supports the metacognitive model which suggests that global self-esteem may be a product of strategic cognitive activity under the influence of metacognition. If that notion holds, treatment interventions which effectively modify dysfunctional metacognitions are expected to improve self-esteem and has the potential to advance clinical management in cases where low self-esteem is part of the presenting problems.

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**Data availability** data are available from the corresponding author upon reasonable request.

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