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Emotion Regulation Strategies and Symptoms of Depression, Anxiety, Aggression, and Addiction in Children and Adolescents: A Meta-Analysis and Systematic Review

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Emotion regulation has been put forward as an important transdiagnostic process. However, previous analyses of the relationships between emotion regulation strategies and symptoms of psychopathology in children and adolescents have produced mixed results. The present meta-analysis examines the relationships between youth's habitual use of three adaptive (acceptance, problem-solving, and cognitive reappraisal) and three maladaptive (rumination, avoidance, and suppression) strategies with symptoms of depression, anxiety, aggression, and addiction. A total of 181 articles with 386 effect sizes were analyzed. Rumination, avoidance, and acceptance showed the largest effect sizes across all symptoms. Maladaptive strategies showed, in general, larger effect sizes than adaptive strategies. Effect sizes were generally larger for internalizing compared to externalizing symptoms. The findings underscore the importance of emotion regulation for mental health in youth.

Public Health Significance Statement
Emotion regulation strategies are significantly linked to symptoms of psychopathology in youth. Rumination, avoidance, and acceptance show the largest effects across symptoms. Emotion regulation strategies should be taught in school and clinical practice for prevention and treatment.

Keywords: emotion regulation, symptoms, youth, meta-analysis, transdiagnostic

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The American Psychiatric Association's (2013) *Diagnostic and statistical manual of mental disorders* (now in its 5th edition) and the World Health Organization's (2020) *International statistical classification of diseases and related health problems* (now in its 11th edition) categorize mental disorders as latent diseases based on certain clusters of symptoms. Finding clear-cut causes and mechanisms that lead to such complex entities is difficult. This may in part be due to the existence of several important levels of analysis (Hayes et al., 2020): genetic and epigenetic, neurobiological and neurocomputational, psychological and (overt) behavioral, social and cultural, and contextual and developmental. When emphasizing only one or a couple of these levels, without integrating knowledge of the others, investigations are prone to miss the complexity of the human psyche, thus hindering effective and long-lasting therapeutic change (Borsboom et al., 2019; Deacon, 2013; Hofmann & Hayes, 2019). There certainly is a need for cross-fertilization and translational work across the corresponding disciplines in research and practice with concepts that have multilevel empirical plausibility and evidence (Deacon, 2013; Fried & Robinaugh, 2020).

Besides the call for a multilevel approach, these diagnostic manuals have been criticized for being blind to different trajectories that lead to the same mental disorders (equifinality) and single processes or factors leading to multiple disorders (multifinality; Cicchetti & Rogosch, 1996; Nolen-Hoeksema & Watkins, 2011). Equifinality implies the possibility of multicausality and the need for individualized treatment strategies, depending on the patient's specific etiological trajectories (Fried & Robinaugh, 2020; Stephan et al., 2015). Multifinality implies the possibility of ensuing comorbidities for an individual and the need for targeting those mechanisms that (can) unfold transdiagnostically, that is, across disorders (Dalgleish et al., 2020; Harvey et al., 2004). Identifying transdiagnostic

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processes is therefore of great importance not only for their overall impact on mental health across patients—where several patients may suffer from single (but different) disorders based *on the same* process(es)—but also for many *individual* patients, who may experience concurrent or sequential comorbidities—where a *single* patient can have several disorders based *on the same* process(es) (Dalgleish et al., 2020).

Emotion Regulation

Emotion regulation has been commonly defined as *the processes involved in influencing which emotions one has, when one has them, and how one experiences and expresses these emotions* (Gross, 1998). The most influential model of emotion regulation is the process model of Gross (1998), which has recently been extended (Gross, 2015). At its core is the idea that emotion regulation can take place at different time points within an emotion-generative process: prior to, during, or after an emotion (Gross, 1998, 2015). The *extended process model of emotion regulation* (*EPM*; Gross, 2015) adds complexity to the original process model (Gross, 1998): For example, it emphasizes the significance of *context* (when best/worst to implement different strategies for different regulatory goals) and the importance of *simultaneous* and *sequential* strategies, which, in turn, depend on simultaneous and sequential emotion targets and goals (for a more thorough description of the EPM, see Gross, 2015). This extension of the process model has been inspired by, and triggered further, advances in the study of emotion regulation, which are of great relevance for understanding psychopathological phenomena associated with emotion dysregulation (Sheppes et al., 2015). For example, the emphasis on *emotion regulation flexibility* and *emotion regulation choice* takes context into account and abandons the idea that certain strategies are *always* adaptive or *always* maladaptive (Aldao et al., 2015; Sheppes et al., 2014). Rather, adaptivity largely depends on the given situation for the given person with their given goals (Gross, 2015). However, it has been valuable to categorize certain emotion regulation strategies as either adaptive or maladaptive because of their respective links to psychopathology when used habitually (e.g., Aldao et al., 2010).

There is a growing consensus that emotion regulation (ER) may have a major transdiagnostic impact on psychopathology across the lifespan (Aldao et al., 2016; Chu et al., 2017; Cludius et al., 2020; Essau et al., 2017). It has also been shown that the use of maladaptive emotion regulation strategies (ERS) decreases significantly after treatment across interventions and disorders (Sloan et al., 2017). A further merit of ER is that it has been conceptualized across different levels of analysis and could thus be integrated into the Research Domain Criteria framework or promote other interdisciplinary endeavors (Braunstein et al., 2017; Fernandez et al., 2016). A developmental perspective on ER is of particular interest because certain ER strategies involve capacities that are expected to evolve during development (Gross, 2015). While infants and young children are often reliant on extrinsic ER, self-regulatory strategies become more frequent and complex as children and adolescents mature emotionally and cognitively (Eisenberg et al., 2014; LeBlanc et al., 2017).

Although the view of ER as a transdiagnostic process is reasonable, it has been argued that identifying and targeting *specific* ERS will be necessary for research and clinical practice because ER itself is too broad of a concept to be specifically targeted (Cludius et al., 2020; Sheppes et al., 2015).

Adaptive and Maladaptive Emotion Regulation

In their highly influential meta-analysis, Aldao et al. (2010) examined the relationship between three ERS commonly regarded as maladaptive (rumination, avoidance, and suppression) and three strategies commonly regarded as adaptive (acceptance, problem-solving, and cognitive reappraisal) with symptoms of psychopathology. The same six strategies are reviewed here because they are central to mental health, as will be delineated below.

Rumination. *Rumination* involves repetitively focusing on feelings and problems, their causes and consequences, without taking action for change (Nolen-Hoeksema et al., 2008). Its maladaptivity is grounded in the amplification of moods and problems and impairing of behavioral problem-solving (Nolen-Hoeksema & Watkins, 2011). Rumination is regarded as one of the most influential factors in the development and maintenance of depression (Nolen-Hoeksema, 2000), which has led to rumination-focused cognitive–behavioral therapy for depression (Watkins, 2016). Recent research has associated rumination with several other disorders, shedding light on its potential transdiagnostic nature (Aldao et al., 2010; du Pont et al., 2019).

Avoidance. *Avoidance* encompasses both *experiential avoidance* (i.e., the negative valuation and intolerance of aversive emotions, thoughts, memories, or bodily sensations; Hayes et al., 1996) and *behavioral avoidance* (i.e., actions that function to avoid certain aversive situations or emotions; Moitra et al., 2008). Avoidance is a very natural ERS with short-term positive effects. However, it often encompasses long-term psychological problems if it maintains anxiety, disconnects from goals and meaningful activities, or impairs social functioning (Kashdan et al., 2006; LeDoux et al., 2017). Behavioral avoidance is one of the key symptoms of anxiety disorders and, consequently, the target of their treatment (Craske et al., 2009; Hofmann & Hay, 2018). Experiential avoidance is one of the main targets in acceptance and commitment therapy (ACT; Hayes et al., 2011), and both experiential avoidance and behavioral avoidance have been regarded as transdiagnostic processes (Aldao et al., 2010; Harvey et al., 2004).

Suppression. *Suppression* refers to both *expressive suppression* (i.e., hiding and countering emotional expressions; Gross, 1998) as well as *thought suppression* (i.e., attempts to voluntarily suppress thoughts; Wenzlaff & Wegner, 2000). Expressive suppression has been found to decrease positive but not negative emotion experience. Furthermore, it increases sympathetic nervous system responses and leads to greater activation of emotion-generative brain regions such as the amygdala, worse memory in situ (for being distracted), and less liking from social interaction partners (see Gross, 2014 for a review). Thought suppression has been shown to reverse the intention of its user, that is, it leads to higher accessibility of the unwanted thought, and it can trigger various maladaptive physiological responses (see Wenzlaff & Wegner, 2000 for a review). Suppression has also been linked to various disorders (Harvey et al., 2004; Najmi & Wegner, 2008), highlighting its importance for psychotherapy in general.

Acceptance. *Acceptance* primarily refers to the openness and acceptance of experiencing negative *emotions*, but can also encompass the acceptance of other internal events, like thoughts, memories, and bodily sensations (Hayes et al., 2006). It does not mean passively accepting a situation, giving up or resigning in any way (Hayes et al., 2011). While high acceptance has been associated with positive psychological outcomes (Hayes et al., 2011), low acceptance has been linked to various psychopathological symptoms (Hayes et al., 2011; Schäfer et al., 2017). Acceptance is

conceptualized as an alternative to experiential avoidance and plays a central role in ACT, where acceptance is meant to be linked with values-based *action* (Hayes et al., 2006, 2011).

Problem-Solving. *Problem-solving* targets emotions indirectly. It refers to conscious attempts to change the situations that elicit emotional responses (Billings & Moos, 1981). The type of problem-solving considered here is *behavioral* problem-solving, as opposed to mere *cognitive* problem-solving (i.e., actually *doing* something vs. just *thinking* about what to do in the face of a problem). Cognitive problem-solving is a necessary step prior to (conscious) behavioral problem-solving. However, it is in itself part of rumination (Treynor et al., 2003) and thus cannot be seen as merely adaptive. Low engagement in problem-solving has been associated with various disorders (e.g., Aldao et al., 2010; Schäfer et al., 2017). Promoting problem-solving is, thus, a central goal of cognitive behavioral therapy (e.g., Hofmann & Asmundson, 2017). There is also *problem-solving therapy*, which is suitable for a range of mental disorders and problems (D'Zurilla & Nezu, 2010).

Cognitive Reappraisal. *Cognitive reappraisal* refers to generating different perspectives on emotion-eliciting situations to change their emotional impact in a positive manner (Gross, 1998). In a review of experimental studies, cognitive reappraisal has been regarded as one of the most effective ERS based on experiential, behavioral, and physiological measures (Webb et al., 2012). It is also regarded as a key target in cognitive behavioral therapy (Hofmann & Asmundson, 2017) and appears to be transdiagnostic (Aldao et al., 2010; Bentley et al., 2017).

The Present Study

Aldao et al. (2010) examined the relationships between the habitual use of six ERS (rumination, avoidance, suppression, acceptance, problem-solving, and cognitive reappraisal) and four symptoms of psychopathology (depression, anxiety, eating disorder, and substance abuse) across the lifespan in healthy and mixed samples. They did include, however, only very few studies of children and adolescents. They found a very large effect size for rumination, a large effect size for avoidance, suppression, and problem-solving, a small effect size for cognitive reappraisal, and a nonsignificant effect size for acceptance across psychopathology.

Schäfer et al. (2017) examined the relationships of the same six ERS with depression and anxiety in youth. They found mostly large or very large effects for all of the relationships of ERS with both depression and anxiety (except for suppression, which showed medium effects) in the predicted directions, creating evidence for a similar pattern that Aldao et al. (2010) found in primarily adult samples. However, several effect sizes in Schäfer et al. (2017) comprised less than five studies, a cutoff criterion that is generally recommended for a valid interpretation of effect sizes in meta-analyses (Hedges & Vevea, 1998). Regarding their continuous moderator of age, no significant differences in effect sizes were obtained, suggesting no difference in the size of the relationships across ages in adolescence. However, it is noteworthy that they did not include studies with a M_{age} below 13 years, restricting their results to adolescents alone. Including only healthy samples, they also limited their interpretational extension, as clinical samples are of particular interest to clinical scientists and practitioners. Moreover, Compas et al. (2017) found generally smaller or nonsignificant effect sizes for avoidance, suppression, acceptance, problem-solving, and reappraisal in their meta-analysis than Aldao et al. (2010) and Schäfer et al. (2017) did. They incorporated studies in youth but differed from the other two meta-analyses as they focused on ER as responses to specific stressors instead of on habitual ER—which they suggested as an explanation for the different results (Compas et al., 2017).

The present study sought to complement the findings of Schäfer et al. (2017) by (a) integrating more studies per effect size for depression and anxiety to estimate them more accurately, (b) including mixed and clinical samples to widen the interpretational scope, (c) making no restrictions for the sample M_{age} except to be below 18 to also include children, and (d) additionally examining the relationships of the ERS with *aggression* and *addiction*, two symptoms that are often prevalent and important in youth's mental disorders (Weisz & Kazdin, 2017). Both aggression and addiction have been linked to maladaptive ER in adolescents, especially in relation to conduct disorder and substance use disorders (Thomson et al., 2017; Wills et al., 2017). Note that aggression and addiction were conceptualized as aggressive and addictive *behavior* (as opposed to, for example, mere feelings of anger or cravings).

In accordance with Aldao et al. (2010) and Schäfer et al. (2017), the general hypothesis of this meta-analysis was that the adaptive strategies of ER are negatively related across symptoms and that the maladaptive strategies are positively related across symptoms.

Method

Literature Search

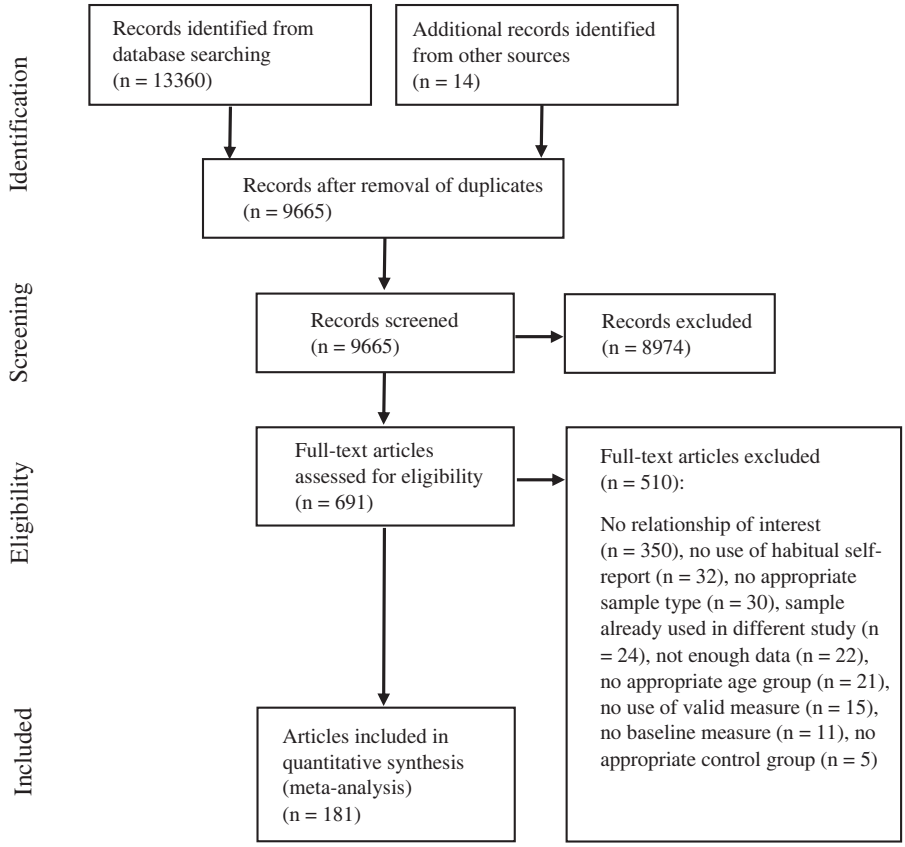
Systematic searches for articles published between January 1990 and January 2021 were conducted between February and May 2021 using PsycINFO and Medline, to cover both journals with a psychological focus and journals with a medical focus, thereby increasing the chance of retrieving all relevant articles (Glanville, 2019). Restricting the time span from 1990 onwards is in line with the analysis of Schäfer et al. (2017) and is based on the fact that ER research has been started in the 1990s, taking off exponentially from the 2000s onwards (Gross, 2015).

The initial search process (see the online supplemental materials for the full search string) yielded 13,360 articles and was complemented through hand-searching in Google Scholar and reference sections of review articles to maximize the probability of finding all relevant articles (Giustini, 2019), which led to the identification of 14 additional articles of potential relevance for this meta-analysis. The overall process led to a final set of 181 articles (see Figure 1 for the full PRISMA flow diagram).

Inclusion/Exclusion Criteria

The following criteria determined the eligibility of studies: (1) The articles were published in peer-reviewed journals; (2) articles were only included if they were reported in English; (3) the studies reported at least one cross-sectional relationship of interest; if a study only compared a healthy control group with a clinical group (with a primary diagnosis of the disorders of interest) on at least one of the ERS of interest, the study could be included if sufficient data for calculating standardized mean differences were available; (4) the *habitual/dispositional use* of ERS was assessed; (5) the measures were valid (if the measure was a translated measure of a validated original measure, the translated version still had to provide validity of its own). Note that measures were considered valid if the overall

Figure 1
PRISMA Flow Diagram



measure showed signs of validity (e.g., construct validity) in a peer-reviewed article. The validity of the specific ERS scales was implicitly assessed by each coder, based on the conceptual overlap with the above characterizations of each ER strategy; (6) only self-report measures; (7) longitudinal studies were only included if the relationship of interest was based on baseline measures; (8) the sample type of the studies was either (a) clinical (with a primary diagnosis of the disorders of interest), (b) healthy, or (c) mixed; (9) samples of the studies did not consist of participants with medical conditions, developmental disorders, or other special characteristics that would threaten the representativeness of the relationships; (10) studies based on the same sample could only be included once; and (11) to exclude college samples, M_{age} of the samples was 18 years at most, and the age range was restricted to 21 years. This combination of the specific M_{age} and an extended age range served to ensure that studies were not excluded if they were comprised of adolescents overall (M_{age} below 18) but had a few older participants (e.g., due to grade retention).

In general, if studies seemed eligible but essential data were missing, the respective authors were contacted. Essential missing data referred to the correlation coefficients for the specific relationships of interest: Some studies either reported correlations on higher scales only (e.g., correlations for maladaptive ER strategy use only as opposed to correlations on the strategy level) or reported only regression coefficients. Note also that *study quality* was indirectly targeted by including only articles from peer-reviewed journals as well as considering only valid measures. The application of the above criteria led to the identification of 181 articles (with 184 single studies) and a total of 386 effect sizes. These effect sizes were comprised of 12 clinical samples, 42 mixed samples, and 332 healthy samples. The M_{age} was $M = 13.40$ ($SD = 2.00$), with an age range from 8.25 to 17.41 years (see the online supplemental materials for more details on study characteristics).

Coding Procedures

Based on meta-analytic theory (Cooper, 2017; Cooper et al., 2019), the following information were coded for each study: article identifier, study identifier, effect size identifier, authors, year of publication, study title, country (of the sample), sample type, clinical comparison group (i.e., one of the four symptom classes; if applicable), M_{age} group (for moderator analysis, see below), mean, *SD* and range for age, percentage of female participants, the ERS, the measure name corresponding to the ERS, validity of the ER measure, the specific symptom, the symptom measure name, validity of the symptom measure, data form (bivariate correlation or group means/*SD*), effect size, and number of participants for the effect size.

If studies used multiple measures for an ER strategy or symptom, the effect sizes were averaged over the different measures/subscales. When necessary, correlations were reverse-coded in such a way that positive scores would indicate a stronger use of the strategy. For the comparison of the clinical and control groups in regards to an ERS,

first, an effect size of the *d*-family was calculated and then transformed into one of the *r*-family (Lipsey & Wilson, 2001). If a study provided both bivariate correlations and group mean differences, the bivariate correlations were favored because the dichotomization involved in the grouping entails a loss of information (Altman & Royston, 2006; Rosenthal & DiMatteo, 2001). The studies' characteristics were double-coded (by the first and second authors), as is strongly recommended (Cooper et al., 2019). The coders achieved high interrater reliability, with kappa coefficients ranging from .87 to .97, which can be interpreted as strong agreement (McHugh, 2012). Coding discrepancies were resolved by consensus (see the online supplemental materials for coding form).

Effect Size Calculation and Correction

The aforementioned transformation from effect sizes of the *d*-family to the *r*-family is recommended because transforming from *r*- to the *d*-family results in a loss of information. In addition, the correlation coefficient *r* can be more easily interpreted than the coefficient from the *d*-family (Rosenthal & DiMatteo, 2001). Since the variance of correlation coefficients strongly depends on the magnitude of the correlation (Cooper et al., 2019; Lipsey & Wilson, 2001), the correlations were converted to the Fisher's *z* scale. All analyses were performed using these transformed values. For reporting the results, they were converted back to the original *r*-metric for ease of interpretation. Since larger sample sizes yield more reliable estimates, they were also corrected for sample size (Lipsey & Wilson, 2001). The guidelines of Funder and Ozer (2019) were applied to interpret estimated mean effect sizes as *very small* ($r = .05$), *small* ($r = .10$), *medium* ($r = .20$), *large* ($r = .30$), or *very large* ($r = .40$).

Data Analytic Plan

Random-Effects Models

For the meta-analysis, random-effect models were run, which assume that effect sizes differ from the population by sampling error plus random variability among the studies (Lipsey & Wilson, 2001; Rosenthal & DiMatteo, 2001).

Moderator Analyses

The ability to regulate emotions develops over childhood and adolescence (Eisenberg et al., 2010), and there is evidence that the relationships between ER strategies and symptoms might be smaller for children/adolescents compared to adults (Aldao et al., 2010). Hence, it could be expected that the magnitude of the effect sizes in younger ages differs from older ages. However, Schäfer et al. (2017) did not find any significant amount of variance that age explained as a moderator in adolescence within their meta-analysis. Besides a linear relationship between age and ER skills, potential nonlinear relationships are discussed in the literature as well (e.g., Riediger & Klipker, 2014). There is evidence for an ER-related maladaptive shift in that adaptive ERS are used less often, whereas maladaptive strategies are used more often in 12- to 15-year-old adolescents compared to younger children or older adolescents (Cracco et al., 2017). At the same time, there is evidence for a psychopathology-related maladaptive shift in early adolescence—that is, the prevalence of mental disorders and associated symptoms increase significantly with the onset of puberty and peak for certain anxiety (e.g., social anxiety) and impulse control (e.g., conduct disorder) disorders (Kessler et al., 2005; Mendle, 2014; Riediger & Klipker, 2014). Overall, half of all lifetime cases of mental disorders start by age 14 years (Kessler et al., 2005). Due to the possible links between peaking maladaptive ER strategy use and peaking psychopathology in early adolescence, the moderator age was conceptualized as a categorical variable with three levels: M_{age} below 12 versus 12 to 15 versus above 15, to examine whether the middle age group showed different effect sizes in comparison to one or both of the other groups. Furthermore, sample type was included as a moderator because previous analyses had shown that mixed samples resulted in larger effect sizes for the relationships between ERS and psychopathology (Aldao et al., 2010). Clinical samples would be expected to show smaller effect sizes than mixed or healthy samples because of their restriction in variability. Note that clinical samples were restricted to those with a primary diagnosis of the disorders of interest to draw inferences for this particular population: children and adolescents who suffer from disorders of depression, anxiety, aggression (e.g., conduct disorder), or addiction (e.g., substance use disorders).

For the examination of moderators, *Q* statistics were calculated first (Cooper, 2017) to detect any significance in heterogeneity among the effect sizes. The homogeneity test based on the *Q* statistic examines whether the variability of the effect sizes is larger than would be expected from sampling error (which would indicate that these differences have a source other than subject-level sampling error; Lipsey & Wilson, 2001). The analyses were run in RStudio (Version 1.3.1093) using the *metafor* package (Viechtbauer, 2010). The data set is available online (Kraft, 2022).

Results

Main Effect Sizes of the Emotion Regulation Strategies

First, the random-effects model of the correlation coefficients was calculated for each ERS with each symptom, as well as with factors of internalizing (anxiety and depression) and externalizing (aggression and addiction) symptoms combined (see Table 1).

Rumination was positively correlated with depression ($r = .48$, $k = 83$, 95% confidence interval [CI] [.44, .51]), anxiety ($r = .45$, $k = 31$, [.41, .49]), aggression ($r = .24$, $k = 7$, 95% CI [.13, .35]), and addiction ($r = .22$, $k = 8$, [.08, .35]). The magnitudes of the effect sizes for both depression and anxiety were therefore very large, whereas the ones for aggression and addiction were both medium.

Avoidance showed very large, positive effects for the relationships with depression ($r = .46$, $k = 15$, 95% CI [.37, .54]) and anxiety ($r = .45$, $k = 13$, [.36, .53], a large effect for addiction ($r = .30$, $k = 5$, [.17, .42]), and a small effect for the correlation with aggression ($r = .15$, $k = 7$, [.07, .24]).

Suppression showed a medium effect regarding symptoms of anxiety ($r = .29$, $k = 19$, 95% CI [.22, .36]) and depression ($r = .24$, $k = 26$, [.19, .29]), and a small effect size regarding addiction ($r = .16$, $k = 3$, [.08, .23]) and aggression ($r = .11$, $k = 5$, [.00, .22])

Acceptance showed negative associations across all symptoms: a very large effect for the relationships with anxiety ($r = -.42$, $k = 15$, 95% CI [−.45, −.35]) and depression ($r = -.40$, $k = 19$, [−.45, −.34]), and medium effects for addiction ($r = -.23$, $k = 13$, [−.28, −.18]) and aggression ($r = -.20$, $k = 6$, [−.24, −.16]).

Table 1
Emotion Regulation Strategies Across Psychopathology

Emotion regulation strategy	Symptoms	Mean ES	95% CI	*p*-Value	*k*	*Q*-Statistics *p*-value
Rumination	Int	.47	[.44, .50]	<.0001	114	<.0001
	Ext	.23	[.15, .31]	<.0001	15	<.0001
	Depression	.48	[.44, .51]	<.0001	83	<.0001
	Anxiety	.45	[.41, .49]	<.0001	31	<.0001
	Aggression	.24	[.13, .35]	<.0001	7	<.0001
	Addiction	.22	[.08, .35]	<.001	8	<.0001
Avoidance	Int	.46	[.40, 52]	<.0001	28	<.0001
	Ext	.22	[.14, .30]	<.0001	12	<.0001
	Depression	.46	[.37, .54]	<.0001	15	<.0001
	Anxiety	.45	[.36, .53]	<.0001	13	<.0001
	Aggression	.15	[.07, .24]	<.0001	7	<.001
	Addiction	.30	[.17, .42]	<.0001	5	<.0001
Suppression	Int	.26	[.22, .30]	<.0001	45	<.0001
	Ext	.13	[.06, .20]	<.001	8	<.0001
	Depression	.24	[.19, .29]	<.0001	26	<.0001
	Anxiety	.29	[.22, .36]	<.0001	19	<.0001
	Aggression	.11	[.00, .22]	<.05	5	<.001
	Addiction	.16	[.08, .23]	<.0001	3	<.05
Acceptance	Int	−.41	[−.45, −.37]	<.0001	34	<.0001
	Ext	−.22	[−.25, −.18]	<.0001	19	<.05
	Depression	−.40	[−.45, −.34]	<.0001	19	<.0001
	Anxiety	−.42	[−.48, −.36]	<.0001	15	<.0001
	Aggression	−.20	[−.24, −.16]	<.0001	6	n.s.
	Addiction	−.23	[−.28, −.18]	<.0001	13	<.05
Problem-solving	Int	−.16	[−.21, −.11]	<.0001	29	<.0001
	Ext	−.16	[−.24, −.08]	<.0001	11	<.0001
	Depression	−.17	[−.24, −.11]	<.001	19	<.0001
	Anxiety	−.13	[−.22, −.03]	<.001	10	<.0001
	Aggression	−.21	[−.30, −.12]	<.001	7	<.0001
	Addiction	−.08	[−.20, .05]	n.s.	4	<.05
Cognitive reappraisal	Int	−.14	[−.18, −.10]	<.0001	62	<.0001
	Ext	−.05	[−.13, .02]	n.s.	9	<.0001
	Depression	−.17	[−.21, −.13]	<.0001	41	<.0001
	Anxiety	−.07	[−.15, .01]	n.s.	21	<.0001
	Aggression	−.12	[−.20, −.03]	<.001	5	<.0001
	Addiction	.03	[−.05, .12]	n.s.	4	<.01

Note. ES = effect size; CI = confidence interval; *k* = number of effect sizes; Int = internalizing symptoms (depression and anxiety); Ext = externalizing symptoms (aggression and addiction).

Problem-solving was negatively correlated with aggression, showing a medium effect size ($r = -.21$, $k = 7$, 95% CI [−.30, −.12]), while the associations with depression ($r = -.17$, $k = 19$, [−.24, −.11]) and anxiety ($r = -.13$, $k = 10$, [−.22, −.03]) showed small effect sizes. Relations with addiction ($r = -.08$, $k = 4$, 95% CI [−.20, .05]) did not show a significant effect size.

Cognitive reappraisal showed negative relationships with small effect sizes for depression ($r = -.17$, k= 41, 95% CI [−.21, −.13]) and aggression ($r = -.12$, $k = 5$, [−.20, −.03]). The effect sizes for the relationships with anxiety ($r = -.07$, $k = 21$, 95% CI [−.15, 01]) and addiction ($r = .03$, $k = 4$, [−.05, .12]) were not significant.

Moderator Analyses

Tests of heterogeneity were significant in all but one relationship (acceptance and aggression), which suggests important moderating influences. Moderator analyses for sample type and age (categorical as described above and post hoc as a continuous moderator) were restricted due to the limited availability of cases per cell. The remaining analyses that could be run did not show consistent trends in moderating these effects (see the online supplemental materials for the analyses).

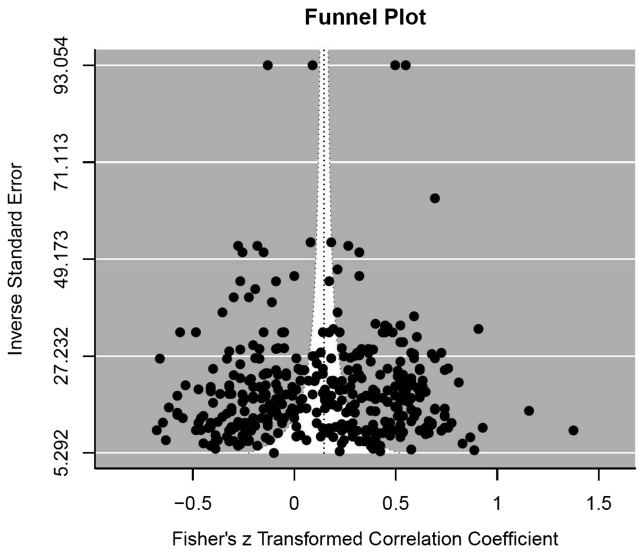
Publication Bias

A funnel plot was created (Figure 2), which is useful for detecting potential publication bias (Vevea et al., 2019). Visually, the plot appears to be in the desired symmetrical funnel shape. To exclude publication bias reliably, the asymmetry was tested statistically with the rank correlation test, which was not significant ($\tau_b = -.00$, $p = .99$). To more comprehensively test for publication bias, Orwin's (1983) fail-safe *N* was calculated for adaptive and maladaptive strategies across the symptoms of psychopathology. These analyses indicate that there would have to be 164 effect sizes of 0 for the adaptive and 222 effect sizes of 0 for the maladaptive ER to make the results we found nonsignificant. Thus, the risk of publication bias in the present study can be considered low.

Discussion

This meta-analysis and systematic review examined the relationship between six ERS commonly regarded as either adaptive (acceptance, problem-solving, and cognitive reappraisal) or maladaptive (rumination, avoidance, and suppression) and four symptoms of

Figure 2
Funnel Plot



psychopathology (depression, anxiety, aggression, and addiction) in children and adolescents. The relationships between the maladaptive strategies and symptoms of psychopathology all showed significant effect sizes in the predicted positive direction, meaning that a more frequent habitual use of these strategies was associated with more severe symptoms. The magnitudes of the effect sizes did, however, reveal interesting patterns: While rumination and avoidance showed very large effect sizes for anxiety and depression, suppression only yielded a medium effect size for both. Concerning externalizing symptoms, rumination showed a medium effect size for both aggression and addiction. Avoidance showed a small effect size for aggression but a large effect size for addiction, while suppression showed small effect sizes for both (although the effect size of suppression and addiction should be considered with caution due to the small number of studies included). These results are in line with Aldao et al. (2010), who examined the same six ERS with the same two internalizing symptoms (anxiety and depression), one related externalizing symptom (substance use), and another externalizing symptom (eating disorder) with studies comprised largely of adult samples. They also showed that rumination and avoidance had very large effect sizes and that suppression had lower effect sizes for anxiety and depression. In addition, they also showed that rumination and avoidance had lower effect sizes for the externalizing symptoms compared to the internalizing ones. In their study, suppression could also not be analyzed with the addiction-related substance use symptom, and they showed a large effect size for eating disorder. These results for the maladaptive strategies are also in line with Schäfer et al. (2017) who reported similar magnitudes for the effect sizes of rumination, avoidance, and suppression with depression and anxiety. However, many of their effect sizes had to be interpreted with caution due to the insufficient number of studies they included.

In regards to the adaptive strategies, acceptance showed relationships in the predicted negative direction for each symptom, with very large effect sizes for depression and anxiety and medium effect sizes for aggression and addiction. Problem-solving was significantly related in the predicted negative direction with small effect sizes for both depression and anxiety, while the association with aggression was medium and the relationship with addiction was not significant. Cognitive reappraisal showed significant associations in the predicted negative direction for depression and aggression (with small effect sizes for both), but no significant relationship with anxiety and addiction.

Although problem-solving is more consistently related to the symptoms than cognitive reappraisal, its effect sizes are mostly in the small range. Concerning acceptance, the present results underscore the finding of Schäfer et al. (2017), who also found very large effect sizes for acceptance with anxiety and depression. This vindicates the assumption of Aldao et al. (2010) that the reason why the associations of acceptance became nonsignificant in their study was due to the low number of studies entailed in their effect size estimation.

An important finding of the present study is that cognitive reappraisal and problem-solving did not reveal such large effect sizes for anxiety and depression which Schäfer et al. (2017) had reported. Due to the incorporation of a larger amount of studies, the estimates of this meta-analysis seem to reliably state that cognitive reappraisal and problem-solving are not as strongly associated with depression and anxiety as acceptance, or, indeed, rumination and avoidance. The present results are also partly echoing the findings of Aldao et al. (2010), who found only small effect sizes for cognitive reappraisal with anxiety and depression. Problem-solving in their meta-analysis did, however, reveal medium-to-large effect sizes for anxiety and depression, suggesting that problem-solving is less strongly associated with internalizing symptoms in children and adolescents compared to adults.

Overall, rumination and avoidance show larger effect sizes for both internalizing and externalizing symptoms compared to suppression, while acceptance shows larger effect sizes for internalizing and externalizing symptoms compared to problem-solving and cognitive reappraisal. On the level of maladaptive and adaptive strategies, the findings also echo Aldao et al. (2010) by suggesting that, in general, maladaptive strategies are stronger associated with symptoms of psychopathology than adaptive strategies. One reason for these relatively weak associations of adaptive strategies might be that their effectiveness is more context-dependent than the influences of maladaptive strategies (Aldao & Nolen-Hoeksema, 2012a). Aldao and Nolen-Hoeksema (2012b) found support for a *compensatory hypothesis* (in an adult sample): The relationships between adaptive strategies and symptoms of psychopathology (depression, anxiety, and alcohol problems) was, in their study, moderated by the use of maladaptive strategies. Only when maladaptive strategies were high, a negative relationship between adaptive strategies and symptoms was found. These findings underscore the potential benefits of teaching adaptive strategies in therapy when maladaptive strategy use is high.

In general, strategies were associated stronger with internalizing symptoms compared to externalizing symptoms. A reason for this may be that addictive and aggressive behavior can both be regarded as forms of ER in themselves (Grob & Smolenski, 2005; Kober, 2014). Externalizing symptoms may also be only indirectly influenced by ER since the emotion to be regulated appears prior to the externally expressed behavior (anger or frustration precedes aggressive behavior; craving precedes addictive behavior). This may also account for weaker associations.

The main results of the present study broadly echo the findings of Aldao et al. (2010) and to a large extent the ones of Schäfer et al.

(2017). They differ from the findings of Compas et al. (2017), who reported no significant effect sizes for problem-solving, cognitive reappraisal, and acceptance, and only small effect sizes for avoidance and suppression (rumination was not examined). Compas et al. (2017) suggested that their discrepancies to the results of Aldao et al. (2010) and Schäfer et al. (2017) are due to their focus on ERS as responses to specific stressors as opposed to the habitual use of ERS that was the focus of the other two (and this) meta-analyses. Future studies should examine why and in what way these two approaches to ER and psychopathology vary.

It is noteworthy that the authors of the present meta-analysis disregarded the "acceptance" scale of the *Cognitive Emotion Regulation Questionnaire (CERQ)* because acceptance in the CERQ is defined as "thoughts of accepting what you have experienced and resigning yourself to what has happened" (Garnefski & Kraaij, 2006, p. 1662). The authors suggest that "[…] a distinction can be made between Acceptance as an active process of self-affirmation and Acceptance as a passive form of resignation […] It might be argued that the present study refers rather to the latter form of Acceptance, which has typically been identified as a negative adjustment style associated with poor outcomes […]" (Garnefski & Kraaij, 2006, p. 1667). In the present study, acceptance is captured as an adaptive form that is explicated, for example, in ACT (Hayes et al., 2011). In addition to the low number of studies, the observation of a nonadaptive type of acceptance might be another reason why acceptance did not reach significance in the meta-analysis of Aldao et al. (2010): They included the acceptance scale of the CERQ in their analysis although they intended to capture the adaptive form of acceptance.

Moderators

Concerning sample type as a moderator, the nonsignificant analyses (see the online supplemental materials) did not reflect the findings of Aldao et al. (2010). This suggests that the relationships between dispositional ERS and psychopathology are not different when more extreme groups are compared. However, due to the small number of studies with clinical and mixed samples, and also because only three relationships could be analyzed, these results should be interpreted with caution. The age moderator produced mixed findings, with a few relationships indicating stronger associations in early adolescence compared to childhood, but several others with no significant relationship. These findings underscore the unclarity regarding the complex question of whether, and in what way, nonlinear or linear associations and changes in ER and psychopathology are present in children and adolescents (Aldao et al., 2010; Cracco et al., 2017; Riediger & Klipker, 2014; Schäfer et al., 2017). It should also be noted that the implementation of the moderator of age in a meta-analysis can be criticized due to the loss of information given by M_{age} scores for whole samples (whose respective age ranges may vary vastly from the mean).

Implications and Future Directions

In line with previous meta-analyses (Aldao et al., 2010; Schäfer et al., 2017), rumination, avoidance, and, to a lesser extent, suppression can be regarded as important factors in contributing to children's and adolescents' psychopathology. In terms of adaptive strategies, acceptance stood out as the most promising strategy due to its very large effect size for the internalizing symptoms and medium effect sizes for externalizing symptoms. The success of ACT (A-Tjak et al., 2015; Hayes et al., 2011) across a variety of psychopathology supports this view. However, it is very important to acknowledge that the nonadaptive form of acceptance from the CERQ is still regarded as the adaptive form of acceptance in many studies (e.g., Domínguez-Sánchez et al., 2013), which stands to reason, as in their original formulation, Garnefski et al. (2001) labeled their acceptance construct *adaptive*. Unfortunately, studies that label this resignation type of acceptance as an adaptive strategy are doomed to make false inferences, likely undermining the real potential of acceptance, the adaptive strategy. Future research should distinguish the two forms by labeling them differently: for example, as *active acceptance* (an adaptive form; as in accepting difficult thoughts or emotions with the conjunction of values- or goal-based action, Hayes et al., 2011) and *passive acceptance*, as a nonadaptive or even maladaptive form of passively accepting situations with a flavor of resignation (Garnefski & Kraaij, 2006). Given this distinction between adaptive and maladaptive acceptance, one could imagine that there are adaptive and maladaptive conceptualizations for the other ER strategies as well. However, the authors could not identify studies in which other ER strategies had such drastically different meanings in different questionnaires. For problem-solving, however, we did only include measures that emphasized the behavioral part of it—"cognitive problem-solving," that is, merely thinking about what one could do in the face of an emotionally difficult situation, was not coded as (behavioral) problem-solving because of its overlap with rumination (Treynor et al., 2003). This useful distinction of cognitive versus behavioral problem-solving is, for instance, made in the FEEL-KJ questionnaire (Cracco et al., 2015). It is also important to keep in mind that the issue of adaptivity of single ER strategies as such (due to their context dependence) is different from this issue of conceptual divergence, where two measures label two different constructs the same—with the extreme case here of one falling into the adaptive and one into the maladaptive category (active vs. passive acceptance). Note, however, that the adaptivity of both active and passive acceptance could still be context-dependent, just as it is being discussed for the other ERS (see below).

The relatively small effect sizes for cognitive reappraisal and problem-solving seem counterintuitive in light of their prominence in cognitive behavioral therapy (CBT). There is evidence that cognitive reappraisal ability increases linearly with age (McRae et al., 2012), which the moderator analyses of this study only partly support (stronger negative associations with anxiety for older youth; but not with depression; see the online supplemental materials for analyses). This may help to explain the nonsignificant effect size for anxiety. Regarding the relatively small effect sizes for problem-solving, one could speculate that the rudimentary development of executive functions in especially younger children (Steinberg et al., 2006) might be the reason for rare usage and thus small associations in the analysis. However, the few moderator analyses of age and problem-solving were not significant in the present study. Strong context dependence and ensuing strategy use in wrong circumstances could also account for the relatively small associations in cognitive reappraisal and problem-solving. Emotion-regulation flexibility (Aldao et al., 2015) seems, after all, a very important factor in regulating emotions successfully. It could provide explanations for these rather small associations—if, for example, problem-solving only works when there is a problem to be solved or one has the necessary means to execute the problem-solving behavior, or when the

success of cognitive reappraisal is bound to certain conditions (e.g., the timing of implementation; as shown in Sheppes et al., 2009).

One could certainly imagine some strategies as emerging not only prior to but also (or exclusively) *after* having psychological problems: For example, if one experiences intense negative emotions, it may be natural to struggle with accepting associated feelings. Likewise, it could be relatively easy to reframe situations via cognitive reappraisal if the problems are not that pronounced. This would be in line with the finding that cognitive reappraisal seems to work better if the emotion to be regulated is of relatively low intensity (Sheppes et al., 2009). Similarly, one could imagine how psychological problems *lead to* rumination or avoidance (*of those problems*). Evidence of bidirectional relationships between rumination and both depression and anxiety (Jose & Weir, 2013; Krause et al., 2018; Nolen-Hoeksema et al., 2007) exemplifies how causal influences can go in both directions, potentially creating vicious cycles. Thus, it remains very important to shed further light on the causality of the matter. The present meta-analysis estimated various effect sizes of relationships and their directions—but not in a causal sense. Well-designed longitudinal and experimental studies are needed to clarify the complex dynamics underlying these relationships, implementing not only unidirectional but also bidirectional models.

Given the stronger associations of acceptance with psychopathology in youth compared to problem-solving and cognitive reappraisal, one could be inclined to argue that ACT (Hayes et al., 2011) might be especially promising for children and adolescents. A recent meta-analysis on the effectiveness of ACT in children and adolescents concluded that ACT appears as effective as CBT (Fang & Ding, 2020). Their meta-analysis could, however, only include 14 randomized controlled trials, which calls for a broader implementation of ACT in therapy and research in youth.

Emotion regulation as a single, potentially transdiagnostic construct remains a promising area of investigation. All strategies showed various significant effect sizes across psychopathology. Some were larger than others, but bearing in mind that all strategies can be neatly gathered under the umbrella term of ER, it is easy to see the potential which lies in explicating and implementing ER training in therapy. Children and adolescents could learn about various strategies and thus build a more flexible repertoire fit for purpose. A *combination of strategies* (cf., *polyregulation*; Ford et al., 2019) and *context-dependent implementation* may then be the key to successful ER. These assumptions are supported by recent advances in ER research, spinning off fruitful concepts like ER flexibility (Aldao et al., 2015; Pruessner et al., 2020), ER effectiveness (Denny, 2020; Sheppes & Gross, 2012), ER choice (Sheppes et al., 2014), and polyregulation (Ford et al., 2019).

With these extensions of the ER concept, an important meta-level is at hand, which might be coined "emotion regulation–regulation" or "meta-emotion–regulation." It represents a skill an individual needs to practice *in itself* to master efficient and effective ER. Effective meta-emotion–regulation could thus be regarded as thinking about, regulating, monitoring, and fine-tuning processes of ER. This may translate into informed decisions on which strategies to choose in which context and at which specific point in time, for what duration and intensity—with a monitoring eye on the success and the potential need for adaptations. Of course, this would also entail deciding when (i.e., in which contexts) not to implement an ERS and rather *let emotions regulate* the own behavior and use them for one's goals—often for good, evolutionary, reasons (Nesse, 2019).

Limitations

Although only three of the possible 24 relationships between single ERS and single symptoms did not reach the mandatory five studies per effect size, it is important to note that there were still several relationships in this meta-analysis that were below 10 studies per effect size estimate. Moreover, concerning almost all moderator analyses, the lack of sufficient numbers of studies restricted the analyses to just a few, limiting the interpretational value across strategies and symptoms. Even in analyzable relations, the studies per level were sometimes quite unevenly balanced, especially for sample type. Future investigations should thus also look more into the associations of ER and psychopathology in both mixed and clinical samples. Furthermore, future research should investigate other samples composed of, for example, participants with developmental disorders or medical conditions to potentially extend the generalizability of the results.

While there is general evidence for some gender differences in ER use and relations with psychopathology (Nolen-Hoeksema, 2012), the present study did not include gender as a moderator due to the apparent lack of studies differentiating between males and females. Further research is needed for an encompassing picture of the moderating effects of gender for ER use and psychopathology in children and adolescents.

The study only included self-report data on youth's ER and symptoms because of the apparent discrepancies between parents' and children's reports of the child's ER strategies and symptoms, especially for internalizing strategies and symptoms (Hourigan et al., 2011). There are several disadvantages to using self-reports, for example, response tendencies and social desirability (Zeman et al., 2007). One has also to keep in mind that younger children in particular can have difficulties in executing the explicit meta-cognition needed to accurately provide information on their habitual regulatory behavior and symptoms (Zeman et al., 2007). However, there may also be some underestimation of meta-cognitive abilities in children (Whitebread & Neale, 2020). Future studies could focus on the moderating effect of informant type on ER and psychopathology, although Compas et al. (2017) found no significant effect for any of these relationships. As this study examined overarching ERS, it could be argued that there is a loss of information regarding more fine-grained subcategories among strategies. Future studies could examine whether the effect sizes of, for example, thought suppression differ from those of expressive suppression, or examine the differences in effect sizes for behavioral avoidance versus experiential avoidance.

As mentioned earlier, the results of this study only partly uncover the transdiagnostic nature of ER in youth. As the effect sizes are based on correlations, they lack a *causal* explanation that would be needed for a strict categorization as a (mechanistically) transdiagnostic process (Sauer-Zavala et al., 2017). More research is needed with designs that can shed light on causal explanations (e.g., longitudinal, experimental) to provide clearer statements in this regard. After all, the question of causality is most important, as clinical science relies on it to understand, prevent, and tackle mental health problems effectively.

Conclusion

This meta-analysis supports the assumption that ER functions as a transdiagnostic process in children and adolescents. Rumination, avoidance, and acceptance showed medium to very large effect sizes across psychopathology in the predicted directions. Suppression showed smaller effect sizes, but still across psychopathology. Cognitive reappraisal and problem-solving showed mixed results, implying they might be difficult to implement, relatively ineffective or largely context-dependent in children and adolescents. More research is needed, especially for clarification of moderating effects. In the present study, the moderators of age and sample type showed no effects in the majority of cases. The debate of age-related "maladaptive shifts" versus more linear relationships between age, ER skills, and psychopathological symptoms (Aldao et al., 2010; Cracco et al., 2017; Riediger & Klipker, 2014; Schäfer et al., 2017) will thus likely continue. The question of causality of the effects is generally also still open to debate, and more longitudinal and experimental studies are needed to better understand the causal nature of the relationships between ER strategies and symptoms of psychopathology in children and adolescents. Moreover, a future differentiation of active acceptance versus passive acceptance may be of crucial importance to unleash the full potential of acceptance-based therapy in youth (and adulthood). Likewise, future studies should examine whether there are contexts within which maladaptive strategies could be regarded as useful and adaptive strategies as ineffective or even harmful. Future research should also focus on the effectiveness of ER interventions in psychotherapy in youth. The potential context dependence of ERS stresses the importance of not only training ERS, but also emotion regulation–regulation, that is, meta-emotion–regulation.

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