



Elements in Mental Health Interventions Associated with Effects on Emotion Regulation in Adolescents: A Meta-Analysis

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Abstract

Purpose Adolescence is a sensitive period for developing mental health problems. Interventions targeting emotion regulation have shown promising transdiagnostic effects for this group, but optimization efforts are called for. In the current study, we used an element-based approach to identify potentially active ingredients in interventions measuring emotion regulation, to guide further optimization.

Methods We coded practice elements in 30 studies based on a systematic review of mental health interventions measuring emotion regulation in adolescents ($N=2,389$ participants, mean age 13–17 years). Using a three-level modeling approach, we then investigated the difference in effect on emotion regulation between studies of interventions with and without these practice elements.

Results We identified 75 practice elements and 15 element categories used in the included interventions. Results showed significantly stronger effects on emotion regulation when interventions included the practice elements *Setting goals for treatment* (difference in $d=0.40$, 95% CI [0.09, 0.70], $p=.012$) and *Psychoeducation about acceptance* (difference in $d=0.58$, 95% CI [0.09, 1.07], $p=.021$). Furthermore, a total of 11 elements and four overall categories were identified as potentially active ingredients, based on an effect size difference of >0.20 between interventions with and without the elements.

Conclusion The results can direct experimental research into the selection of practices that are most likely key to mechanisms of change in interventions addressing emotion regulation for adolescents. The challenge of measuring emotion regulation is discussed.

Keywords Intervention elements · Emotion regulation · Adolescents · Mental health

Adolescents' mental health problems are increasing worldwide, with significant consequences for academic, social, and health development (End the neglect of young people's mental health, 2021; Patton et al., 2016). To prevent later adverse outcomes, a vast number of evidence-based interventions (EBIs) have emerged (Weisz et al., 2019). However, the population-level impact from such interventions appears to be limited (La Greca et al., 2009), and their overall effect

size is moderate and not increasing (Weisz et al., 2017). One reason for the limited effects may be that the EBIs are not accessible to a large part of the population. Meta-analyses show that the effects of adolescent's mental health interventions often drop when they move from research to practice contexts (Santucci et al., 2015), or that they do not necessarily outperform practice as usual (Kazdin, 2015; Weisz et al., 2013). Also, implementation research across mental health contexts documents significant difficulties with sustainable implementation of EBIs at scale (Shelton et al., 2018). The majority of implementation research thus far has focused on *how* and *where* we implement to increase access to EBIs, such as improving implementation strategies (Kirchner et al., 2020) and community readiness for implementation (Chambers et al., 2020). In recent years, *what* we implement has also gained attention as important implementation determinants (Lewis et al., 2021), including the EBIs design, content, and fit with diverse needs across mental

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health workforces. Researchers are calling for approaches to improve the implementability of EBIs, to reduce the total implementation demands on practice settings and make EBIs more usable to practitioners (Lyon et al., 2020; Ginsbrug et al., 2020). Thus, increasing the impact of mental health interventions includes optimizing their effectiveness and implementability. Learning more about active ingredients of potentially transdiagnostic interventions can contribute in the following three respects:

Firstly, mental health interventions typically target one type of mental health problem (e.g., conduct problems or anxiety), while comorbidity is the rule rather than the exception (Kessler et al., 2010). The concurrent and shifting lifespan comorbidity indicates a need for interventions targeting transdiagnostic factors or underlying vulnerabilities for developing mental health problems (Caspi et al., 2020). Accumulating evidence suggests emotion regulation processes are salient targets for making transdiagnostic interventions effective. Secondly, having interventions tailored for a specific type of problem requires training and maintenance of skills in many interventions for practitioners, who typically have jobs characterized by high workload and significant time constraints. Effective transdiagnostic interventions reduce the number of interventions needed, thus the total implementation demands. Thirdly, we know little about what drives the effects of EBIs and which elements (i.e., discrete practices, processes, or principles) contribute most to effective mechanisms. Knowledge about how such elements are associated with effects may help trim EBIs by removing superfluous elements, and/or optimizing effectiveness by replacing content with elements more likely to strengthen effects (Engell et al., 2020). Subsequently, practitioners can learn and retain evidence-informed elements covering a broader range of needs with effective help more implementable.

In the present study, we identified practice elements of interventions targeting mental health problems in adolescents and investigated whether the inclusion of any particular element was associated with positive effects on emotion regulation. These elements are promising candidates as active ingredients in transdiagnostic interventions for adolescent mental health.

Emotion Regulation as a Transdiagnostic Factor

There is accumulating evidence of a common underlying psychopathology factor – also known as the *p*-factor or *p* – that explains the comorbidity observed in many people with mental health problems (Caspi & Moffitt, 2018). Developmental theorists have proposed that *p* may reflect problems

with emotion regulation – a key ability associated with most mental health problems – and that biological, temperamental, or environmental factors in turn influence what type of emotion regulation problems develop (Carver & Johnson, 2017). Correspondingly, emotion regulation has received increased attention as a transdiagnostic target in psychological treatment (Sloan et al., 2017; Moltrecht et al., 2020).

Emotion regulation is the process by which people modify the intensity or duration of their emotions (Aldao et al., 2016). The development of emotion regulation strategies during childhood and adolescence is closely related to biological and cognitive maturation. Children initially learn to cope with stressful situations with external strategies, such as parental support, and gradually develop more internal strategies, such as problem-solving or acceptance (Sanchis-Sanchis et al., 2020). These strategies can be both adaptive and maladaptive, and for some, there is an increase in the use of maladaptive strategies during adolescence, for example, rumination (Theurel & Gentaz, 2018). Some studies have indicated a reduction in the use of adaptive strategies between age 13 and 15 (Zimmermann & Iwaniski, 2014), suggesting that adolescence is a particularly vulnerable period in the development of emotion regulation. Maladaptive emotion regulation strategies are involved both in internalizing problems (e.g., anxiety and depression; Schäfer et al., 2017) and externalizing problems (e.g., conduct disorder, substance abuse, eating disorders, suicide and risky behaviors; Aldao et al., 2016). For example, anxiety is associated with a lack of understanding of emotions and an increased tendency for maladaptive reactions to emotions, such as withdrawal (Mennin et al., 2005), while eating disorders are associated with low awareness of emotions and lacking problem-solving skills (Van Boven & Espelage, 2006). Thus, emotion regulation is significant for adolescents' mental health, and the development of interventions aiming at improving emotion regulation may have transdiagnostic and far-reaching effects.

Interventions adopt different approaches to improving emotional regulation. Some focus on reducing maladaptive strategies such as rumination (e.g., Rumination focused CBT; Watkins et al., 2007), while others focus on increasing adaptive strategies such as acceptance (e.g., Acceptance and Commitment Therapy, ACT; Hayes et al., 2009). There has also been a shift from predominantly focusing on controlling emotions to using the information from emotions (Tull & Aldao, 2015) and from mainly downregulating negative emotions to increased attention for upregulation of positive emotions and mindfulness (Roemer et al., 2015). The present study capitalizes on this variation in approaches to identify what strategies (i.e., intervention elements) predict stronger intervention effects. Consequently, we use a multi-faceted understanding of emotion regulation in the

current study, including dysregulation (e.g., affect lability) or maladaptive use of strategies (e.g., rumination, worry), emotional awareness (e.g., emotion observation) and use of adaptive strategies, including acceptance or mindfulness concepts (Aldao et al., 2010; Sloan et al., 2017).

Identifying Active Ingredients in Effective Interventions

Concerns with translating EBIs into practice include interventions being excessively complex and resource-intensive for practice contexts (Lyon et al., 2020; Ginsburg et al., 2020). Interventions that are less complex, more implementable, and easier to tailor to individuals may be likely to reach larger portions of the population in need. Currently, however, if program developers, implementers, or practitioners aim to reduce the complexity of an intervention protocol, knowledge is lacking on which elements to keep and which to remove. Similarly, we cannot provide knowledge about which elements, or combinations of elements, to choose when tailoring the intervention to variations in individual needs.

Psychosocial interventions are likely to share core intervention elements (Chorpita et al., 2005). Discrete practice elements, also known as specific factors in the psychotherapy literature (Mulder et al., 2017), are specific activities or actions used to evoke or influence an outcome (e.g., positive reinforcement; Engell et al., 2020). Element-level evidence may facilitate optimization for effectiveness, precision, and implementation of mental health prevention and treatment. For instance, practitioners can be trained in a range of discrete practice elements covering a broad spectrum of domains instead of an ever-increasing number of complex interventions (Okamura et al., 2020). Furthermore, a more complete understanding of how interventions work can help practitioners do more of what is likely effective. Similarly, by removing unnecessary features of complex interventions, we can reduce their implementation demands and thereby increase their implementability.

Common elements methodology is gaining traction as a tool to unpack EBIs and distil the elements that are likely to be ‘active ingredients’ (Okamura et al., 2020). Subsequently, these ingredients can form evidence-informed hypotheses subjected to further experimental testing. Such inquiries can discern the most effective elements and mechanisms across a range of interventions and increase our understanding of how, why, and for whom interventions work. In a scoping review on methods used to identify likely effective intervention elements, Leijten and colleagues (2021) noted expert opinion as the most basic level. On the next level, frequencies of elements are used to determine what elements are

commonly used in effective interventions (also known as ‘common elements’) (e.g. Boustani et al., 2020). In the current study, we move beyond the common element strategy by investigating the association between the presence of elements and intervention effects (Leijten et al., 2021). Doing so can provide knowledge of which elements in mental health interventions are associated with the strongest effects on emotion regulation. Such knowledge can be useful for optimizing implementable transdiagnostic interventions, thus improving the opportunity for more adolescents to receive evidence-based help.

Aims

In the present study, the aims were to (1) identify practice elements used in mental health interventions for adolescents measuring emotion regulation, and (2) estimate to what degree the effectiveness of these interventions on emotion regulation is associated with inclusion of the identified practice elements.

Methods

Literature Search and Selection

The literature search was conducted in PsychINFO, Medline, and the Cochrane Library as part of a systematic review of emotion regulation interventions (Espenes et al., 2021) [Manuscript submitted for publication], initially carried out in July 2018 and updated July 2020. Given the central role of emotion regulation both in development of mental health problems (e.g., Claudius et al., 2020) and as an underlying mechanism in change during intervention (e.g., Berking et al., 2019; Helland et al., 2022), we have included both interventions explicitly targeting emotion regulation and interventions targeting mental health, but measuring change in emotion regulation. Keywords included terms related to psychopathology, emotion regulation, and relevant interventions (see Supplementary material S1 for complete search strategy). Identified titles, abstracts, and full texts were reviewed for eligibility by two independent reviewers. Conflicts were resolved by discussion or a third reviewer. Initial search identified 1344 records, and 7 full-text articles were added from review references. After duplicates were removed, 1087 records were excluded based on screening of abstract and 126 excluded based on full-text screening (e.g., lack of emotion regulation outcome measure, review article, wrong population, or wrong design). The original material included 35 articles describing interventions for children and adolescents between 3 and 23 years ($M=15.5$ years).

From that systematic review, we selected studies of interventions for adolescents with a mean age above 13 years for inclusion in the present study, resulting in 30 articles reporting on the evaluation of 32 interventions.

Eligibility of Studies (PICO)

Eligible populations included children with a mean age of 13 with symptoms of a mental disorder that satisfied DSM-criteria or subclinical levels of symptoms (i.e., identified or indicated mental health problems). Studies of populations with psychosis, intellectual disabilities and autism were excluded. For inclusion, the study needed to have at least one outcome measure of emotion regulation for which the psychometric characteristics of the measure are known. Only studies with a control group (treatment as usual or waitlist control) were included, with both experimental and quasi-experimental designs. Studies investigating the effects of medication treatment only were excluded.

Gathering Study Information

We requested intervention manuals by email from the first authors of the 30 included studies to inform the data extraction, 13 (43%) replied, and six provided a manual that was written in English and could be used. For the remaining interventions, we extracted data from original articles and their supplementary files. In addition, we contacted the first authors to request information about post-intervention measures for studies where data to calculate effect sizes were missing.

Risk of Bias

Using the criteria outlined in the Cochrane Handbook for Systematic Reviews of Interventions (Higgins et al., 2019), three pairs of review authors (BK and JB, AVM and RS, SH and HW) independently assessed the risk of bias in each study meeting the eligibility criteria. Disagreements were resolved by discussion. We rated each study at high, low, or unclear risk of bias across the risk of bias domains. A summary of the overall risk of bias across studies showed that the majority of information came from trials with low or unclear risk of bias (Espenes et al., 2021). An exception was the blinding of participants and personnel where a higher proportion of information (about 20%) was assessed as high risk of bias (Espenes et al., 2021).

Coding Interventions

To distil the discrete practice elements in the included interventions, we developed a coding manual inspired by Engell

and colleagues (2020) and Chorpita and Daleiden's distillation and matching procedure (2009). The manual was developed as a data-driven process until few new elements were discovered. First, all discrete practice elements were listed in SPSS. Second, two clinicians categorized these elements into broader categories ('element category') The categorization was done based on the clinicians' theoretical understanding of the elements. Third, we coded each discrete element and element category in the prepared coding sheet as present or absent, based on information provided in the paper or the intervention manual. Two of the coders had experience from coding elements and effects from similar projects. Coders for this review were trained coding in pair, and coders completed coding of the same sample articles followed by discussions about any discrepancies between their coding.

Although some elements tended to overlap in their content (e.g., *Self-exploration of thoughts and feelings* and *Explore thoughts associated with emotions*), we relied on the definitions from our codebook to identify the element that best captured what the treatment delivered. When the information provided about an element was insufficient to specify its content (e.g., the element was named and mentioned as used, but its discrete content or form was not specified in detail), the element was coded as "unspecified." Each coder (BK and JB, AVM and RS, SH and HW) coded the elements independently before they met up in three pairs to compare. Conflicts were resolved by discussion or a third coder. Coders could add new unanticipated elements that did not fit the prepared coding sheet. The new elements were added if coders agreed they were different from elements in the prepared sheet. Subsequently, one coder (JB) reviewed all studies again to look for the new elements added during the first round of coding. This procedure reduces confirmatory bias and facilitates the discovery of novel elements that may be less popular and less studied, but not necessarily less useful.

Effect Size Calculation

We converted postintervention means and standard deviations into Cohen's d values. When post means and standard deviations were not reported (11 of the 82 effect sizes), we used available information to calculate the Cohen's d using an effect size calculator (Wilson, D. A., 2021 May 2) or the authors' own report of Cohen's d if available. A variance estimate was calculated based on Cohen's d and post n in the control and intervention groups. We included multiple effect sizes per trial if trials included multiple measures of our outcomes of interest. In one paper (Shabani et al., 2019), participants were randomized to one of three conditions: two different interventions or to a control

group (3-armed Randomized Controlled Trial [RCT]). In this study, effect sizes were estimated for each intervention group compared with the control group. Directions of all outcomes were recoded in the same direction; with a higher score indicating more favorable outcome in the intervention group. We also categorized all outcomes as measuring adaptive or maladaptive emotion regulation strategies. In the main analyses, we used all included measures of emotion regulation.

Analyses

First, we estimated overall intervention effects for all the included studies and investigated the differential effect between studies using adaptive and maladaptive emotion regulation as outcomes. Second, we tested for each element whether inclusion was associated with effects. The meta-regression coefficients of this model include differences in effect size between trials that compare an intervention with the target element against a control, and trials that compare an intervention without the target element against a control. The three-level model described in Assink & Wibbelink (2016) based on the function `rma.mv` in the R package `metafor` was used (Viechtbauer, 2010), as implemented in a shiny app (<https://github.com/ToreWentzel-Larsen/threelevel>). The three-level procedure included analyses between studies, between effects within studies, and between participants for the separate outcome measures.

As the aim of the study was to generate hypotheses of active ingredients in treatment, we identified elements according to at least one of two different levels of criteria (the second criterion is less conservative in order to explore elements with potential for beneficial effects):

- Significant difference between studies with and without the element on a 0.05 level.
- Significant effect in studies with the elements and a difference in effect size greater than 0.20 between studies with and without the element.

Results

Descriptive Results

The original literature searches by Espenes et al., (2021) [Manuscript submitted for publication] identified 40 interventions from 35 separate studies that matched the selection criteria. For the current paper, only studies with adolescent samples were included, and studies of children with mean age below 13 were removed (see flow chart

in online supplements Fig. 1 S). The included studies ($N = 30$) used 27 different measures of emotion regulation and provided 82 unique effect sizes as most of the studies used multiple measures (See Supplementary Table 4 for overview of all outcome measures). There was an equal number of measures of general emotion regulation and of specific emotion regulation strategies. The effect sizes included 24 measures of adaptive emotion regulation (e.g., reappraisal, acceptance, and emotional competence) and 58 measures of maladaptive emotion regulation (e.g., rumination, avoidance and suppression). See Table 1 for descriptive information about sample and intervention characteristics.

Table 2 shows all the practice elements that were identified in the included studies. We identified 75 practice elements that were categorized into 15 overall categories. The most frequently included categories of elements were *Psychoeducation* (found in 24 out of 30 studies [$n=24$]), *Training in cognitive skills* ($n=17$), *Training in emotional recognition and differentiation* ($n=16$), *Training in preventing maladaptive behavioral response to emotional stress* ($n=12$), and *Mindfulness* ($n=12$). Caregiver/parenting involvement was not frequent in the included studies. In two of the studies, family members joined the adolescent in skills groups. One study focused on parental support and parenting skills in the intervention.

Meta-analyses

Meta-analyses showed an overall effect for all included studies on emotion regulation of Cohen's $d=0.29$ (95% CI 0.14-0.43, $p < .001$).

Sample and intervention characteristics

There was no significant difference in effect (differential $d = -0.03$, 95% CI [-0.19, 0.12], $p = .663$) between the studies using measures of adaptive emotion regulation ($d = 0.26$, 95% CI [0.08, 0.44], $p = .006$) and studies using measures of maladaptive emotion regulation as outcomes ($d = 0.30$, 95% CI [0.14, 0.45], $p < .001$). In our results, there was no significant or meaningful difference in effect size between studies with and without an indicated sample (symptoms without diagnosis) (differential $d = -0.17$, 95% CI [0.14, -0.46], $p = .112$) or with or without an identified sample (met diagnostic criteria) (differential $d = 0.19$, 95% CI [0.14, -0.10], $p = .473$). There was no significant or meaningful difference in effect size between studies including group interaction and studies not including this element (differential $d = 0.07$, CI -95% CI [0.14-0.27], $p = .520$) or between interventions including psychoeducation or not (differential $d = 0.10$, 95% CI [-0.24, 0.43], $p = .566$).

Table 1 Sample and intervention characteristics for the included studies ($N=30$)

Sample characteristics		
Sample sizes	Total 2,389 (range 19 to 436)	
Age	Mean 16 years (range 13–17 years)	
Gender	Both boys and girls	84%
	Girls only	15%
	Non-binary	Not reported
Indicated problems	55%	
Identified problems	51%	
Country	US	50%
	UK	13%
	Netherlands	10%
	Iran	7%
	Nordic	7%
	Other European	10%
	Asian	7%
Intervention characteristics		
Delivered by ^a	Clinician	20%
	Psychologists	13%
	PhD	1%
	Paraprofessional	6%
	Professional	13%
	Doc student	24%
	Computer	28%
	Audio	7%
Type of interventions ^b	CBT	17%
	ACT	17%
	DBT	13%
	Cognitive training	17%
	Mindfulness focused therapy	13%
	Intervention format	Group
	Psychoeducation	73%
Intervention intensity	One session a week	50%
	Two or more sessions a week	27%
	Intervention length	6 months or less
Intervention target ^c	Direct target on emotion regulation	57%
	No direct target on emotion regulation	43%

Notes. ^a Multiple answers were possible, ^b CBT = Cognitive Behavioral Therapy, ACT = Acceptance and Commitment Therapy, DBT = Dialectic Behavior Therapy), ^c Target emotion regulation = targeting emotions directly, e.g., Unified Protocol (UP), Mindfulness-based intervention, Acceptance and Commitment Therapy (ACT), Not direct target on emotion regulation = Cognitive Behavioral Therapy (CBT), Working Memory based training, Neurofeedback

Practice elements

Table 2 provides estimates of effect size for each group (i.e., with and without element) and differences in effect sizes between groups. Moderation analyses revealed significant differences between studies with the elements compared to studies without for: *Setting goals for treatment* (difference in $d=0.40$, 95% CI [0.09, 0.70], $p=.012$) and *Psychoeducation about acceptance* (difference in $d=0.58$, 95% CI [0.09, 1.07], $p=.021$). Setting goals for treatment involves setting goals for the overall contact with the adolescent, setting goals from session to session and help the youth to state realistic goals. Psychoeducation about accept involves discussion of what it is to accept thoughts and feelings and how accept may be an alternative strategy to control or avoidance. We also found that studies with the element *Social skills training, unspecified* had significantly lower effect than studies without this element (difference in $d=-0.43$, 95% CI [-0.83, -0.03], $p=.034$). When using our second criterion for identifying active ingredients, as described in the methods (a differential intervention effect of at least $d=0.20$, even if no significant difference), we identified four overall categories of practice elements: *Training in preventing maladaptive behavioral response to emotional distress, Mindfulness, Organization skills, and Psychoeducation* and 11 discrete practice elements in addition to the elements identified using the significance criteria above: *Discussion of challenging emotional situations, Alternative actions to emotional avoidance, Downregulation of negative emotions, Exposure to emotions, Self-exploration/self-monitoring of thoughts and feelings, unspecified, Teach cognitive flexibility reappraisal, Psychoeducation about treatment/treatment element/technique, Psychoeducation about self-esteem and self-worth, Psychoeducation about stress, Evaluating consequence of behaviors, and Lifestyle, unspecified* (see Table 2 for effect sizes and supplementary Table S2 for description of the content of the elements).

Discussion

This study aimed to identify elements in mental health interventions for adolescents associated with effects on emotion regulation - a transdiagnostic factor in adolescent mental health problems (Moltrecht et al., 2020). We found that interventions that included elements pertaining to *setting goals for treatment* and providing *psychoeducation about acceptance* had significantly higher effects on emotion regulation compared to interventions not including these elements. The effect on emotion regulation was significantly lower for interventions that included *unspecified social skills training*. In addition, we identified four overall categories of practice

Table 2 Frequencies of intervention elements and effect of studies with and without elements

	Number of studies with element ^a (Number of effect sizes)	A. Effect of studies with element (95% CI) <i>p</i>	B. Effect of studies without element (95% CI) <i>p</i>	Difference between A and B (95%CI) <i>p</i>
Training in emotional recognition and differentiation	16 (40)	0.30 (0.10, 0.51) <i>p</i> = .004	0.27 (0.05, 0.48) <i>p</i> = .015	0.04 (-0.26, 0.80) <i>p</i> = .789
Enhance own emotion recognition, insight into emotions	6 (15)	0.41 (0.08, 0.74) <i>p</i> = .016	0.26 (0.09, 0.42) <i>p</i> = .003	0.15 (-0.22, 0.51) <i>p</i> = .421
Awareness of emotions at physiological level	6 (14)	0.34 (-0.01, 0.68) <i>p</i> = .057	0.27 (0.11, 0.44) <i>p</i> = .001	0.06 (-0.32, 0.45) <i>p</i> = .746
Training in emotional recognition and differentiation, unspecified	4 (10)	0.25 (-0.14, 0.65) <i>p</i> = .202	0.29 (0.13, 0.45) <i>p</i> < .001	-0.04 (-0.46, 0.39) <i>p</i> = .861
^ <i>Discussion of challenging emotional situations</i>	3 (3)	0.50 (0.06, 0.94) <i>p</i> = .025	0.26 (0.11, 0.41) <i>p</i> = .001	0.24 (-0.23, 0.70) <i>p</i> = .305
Identify feelings	2 (6)	0.40 (-0.18, 0.98) <i>p</i> = .175	0.28 (0.13, 0.43) <i>p</i> < .001	0.12 (-0.48, 0.69) <i>p</i> = .686
Teach and practice to distinguish alarm driven versus adaptive emotions	1 (1)			
Training in recognition and differentiation between adaptive and alarm driven goals and behavior	4 (12)	0.22 (-0.19, 0.60) <i>p</i> = .284	0.30 (0.14, 0.46) <i>p</i> < .001	-0.07 (-0.19, 0.63) <i>p</i> = .739
Recognize triggers to rumination	4 (8)	0.26 (-0.20, 0.72) <i>p</i> = .260	0.29 (0.13, 0.45) <i>p</i> < .001	-0.03 (-0.51, 0.46) <i>p</i> = .910
Distinguish alarm driven versus adaptive behavior, goals, or options	1 (1)			
^ <i>Training in preventing maladaptive behavioral response to emotional distress</i>	12 (27)	0.46 (0.23, 0.69) <i>p</i> < .001	0.19 (0.01, 0.36) <i>p</i> = .04	0.27 (-0.02, 0.57) <i>p</i> = .066
Emotional management, not specified	5 (11)	0.39 (0.04, 0.75) <i>p</i> = .031	0.27 (0.11, 0.43) <i>p</i> = .001	0.13 (-0.26, 0.50) <i>p</i> = .516
^ <i>Alternative actions to emotional avoidance</i>	4 (11)	0.55 (0.19, 0.91) <i>p</i> = .003	0.24 (0.09, 0.39) <i>p</i> = .003	0.32 (-0.08, 0.70) <i>p</i> = .112
^ <i>Exposure to emotions</i>	3 (9)	0.58 (0.21, 0.15) <i>p</i> = .008	0.26 (0.12, 0.04) <i>p</i> < .001	0.32 (-0.12, 0.78) <i>p</i> = .153
Taking distance and stepping back	2 (8)	0.46 (-0.06, 0.99) <i>p</i> = .083	0.27 (0.12, 0.42) <i>p</i> < .001	0.19 (-0.36, 0.74) <i>p</i> = .486
^ <i>Downregulation of negative emotions</i>	2 (3)	0.61 (0.05, 1.18) <i>p</i> = .034	0.26 (0.12, 0.41) <i>p</i> < .001	0.35 (-0.24, 0.94) <i>p</i> = .238
Upregulation of positive emotions	1 (6)			
Training in preventing maladaptive behavioral response to emotional distress, unspecified	1 (6)			
Self-exploration/self-monitoring of thoughts and feeling	8 (22)	0.38 (0.11, 0.65) <i>p</i> = .007	0.24 (0.08, 0.42) <i>p</i> = .005	0.13 (-0.19, 0.45) <i>p</i> = .428
Self-monitoring of thoughts and feelings and behaviors	4 (16)	0.42 (0.05, 0.78) <i>p</i> = .027	0.26 (0.10, 0.42) <i>p</i> = .002	0.16 (-0.25, 0.56) <i>p</i> = .444
Complete mood rating scale	3 (9)	0.26 (-0.17, 0.69) <i>p</i> = .241	0.29 (0.13, 0.48) <i>p</i> < .001	-0.03 (-0.49, 0.42) <i>p</i> = .882

Table 2 (continued)

	Number of studies with element ^a (Number of effect sizes)	A. Effect of studies with element (95% CI) <i>p</i>	B. Effect of studies without element (95% CI) <i>p</i>	Difference between A and B (95%CI) <i>p</i>
^ <i>Self-exploration, unspecified</i>	3 (5)	0.53 (0.06, 1.00) <i>p</i> = .027	0.26 (0.11, 0.41) <i>p</i> < .001	0.27 (-0.22, 0.77) <i>p</i> = .278
Explore own temperament and character	1 (2)			
Training in behavior regulation	10 (28)	0.23 (-0.01, 0.48) <i>p</i> = .056	0.31 (0.13, 0.49) <i>p</i> < .001	-0.08 (-0.37, 0.21) <i>p</i> = .594
Physical relaxation/relaxation techniques	6 (19)	0.35 (0.06, 0.65) <i>p</i> = .021	0.27 (0.10, 0.43) <i>p</i> = .002	0.09 (-0.25, 0.42) <i>p</i> = .609
Behavioral activation	5 (11)	0.16 (-0.18, 0.51) <i>p</i> = .349	0.31 (0.15, 0.47) <i>p</i> < .001	-0.15 (-0.18, 0.51) <i>p</i> = .431
S low breathing	4 (12)	0.24 (-0.14, 0.62) <i>p</i> = .208	0.29 (0.13, 0.45) <i>p</i> < .001	-0.05 (-0.46, 0.36) <i>p</i> = .802
Training in behavior regulation, unspecified	1 (4)			
^ Mindfulness	12 (30)	0.41 (0.19, 0.63) <i>p</i> < .001	0.21 (0.04, 0.39) <i>p</i> = .016	0.20 (-0.07, 0.46) <i>p</i> = .139
Mindfulness exercise	10 (23)	0.36 (0.11, 0.61) <i>p</i> = .005	0.26 (0.09, 0.42) <i>p</i> = .004	0.11 (-0.18, 0.39) <i>p</i> = .468
Practice awareness	6 (20)	0.43 (0.13, 0.74) <i>p</i> = .006	0.25 (0.09, 0.41) <i>p</i> = .002	0.18 (-0.15, 0.52) <i>p</i> = .275
Training in cognitive skills: Flexibility and alternative appraisals	17 (39)	0.31 (0.11, 0.52) <i>p</i> = .003	0.26 (0.04, 0.47) <i>p</i> = .019	0.05 (-0.24, 0.35) <i>p</i> = .722
Training in cognitive skills, unspecified	7 (16)	0.09 (-0.20, 0.37) <i>p</i> = .554	0.35 (0.19, 0.50) <i>p</i> < .001	-0.26 (-0.58, 0.06) <i>p</i> = .109
Challenge negative assumptions	5 (12)	0.34 (-0.04, 0.71) <i>p</i> = .077	0.28 (0.12, 0.44) <i>p</i> < .001	0.06 (-0.35, 0.47) <i>p</i> = .766
Train how thoughts can be used to change emotional response	3 (12)	0.38 (-0.04, 0.81) <i>p</i> = .075	0.27 (0.12, 0.43) <i>p</i> < .001	0.11 (-0.34, 0.56) <i>p</i> = .624
Explore thoughts associated with emotions	3 (12)	0.38 (-0.03, 0.80) <i>p</i> = .071	0.27 (0.11, 0.42) <i>p</i> < .001	0.11 (-0.33, .56) <i>p</i> = .620
^ <i>Teach cognitive flexibility reappraisal</i>	3 (10)	0.51 (0.07, 0.95) <i>p</i> = .023	0.26 (0.11, 0.41) <i>p</i> = .001	0.26 (-0.21, 0.72) <i>p</i> = .279
Identify and restructure faulty attributions	3 (10)	0.47 (-0.08, 1.03) <i>p</i> = .093	0.28 (0.13, 0.42) <i>p</i> < .001	0.20 (-0.36, 0.76) <i>p</i> = .487
Affective Working Memory Training	1 (2)			
^ Psychoeducation	24 (61)	0.33 (0.17, 0.49) <i>p</i> < .001	0.13 (-0.16, 0.43) <i>p</i> = .368	0.20 (-0.14, 0.53) <i>p</i> = .247
Psychoeducation, unspecified	9 (22)	0.21 (-0.04, 0.47) <i>p</i> = .102	0.32 (0.15, 0.49) <i>p</i> < .001	-0.11 (-0.41, 0.19) <i>p</i> = .480
^ <i>About treatment/ treatment element/techniques</i>	6 (13)	0.56 (0.23, 0.88) <i>p</i> = .001	0.24 (0.09, 0.38) <i>p</i> = .002	0.32 (-0.03, 0.67) <i>p</i> = .076

Table 2 (continued)

	Number of studies with element ^a (Number of effect sizes)	A. Effect of studies with element (95% CI) <i>p</i>	B. Effect of studies without element (95% CI) <i>p</i>	Difference between A and B (95%CI) <i>p</i>
About a diagnosis and specific symptoms, not specified	5 (8)	0.17 (-0.20, 0.54) <i>p</i> = .369	0.30 (0.15, 0.46) <i>p</i> < .001	-0.14 (-0.53, 0.26) <i>p</i> = .492
^ <i>Self-esteem and self-worth</i>	4 (14)	0.55 (0.17, 0.93) <i>p</i> = .005	0.24 (0.09, 0.39) <i>p</i> = .002	0.31 (-0.10, 0.14) <i>p</i> = .138
Functional/ adaptive emotions	4 (11)	0.27 (-0.11, 0.64) <i>p</i> = .161	0.29 (0.13, 0.45) <i>p</i> < .001	-0.02 (-0.43, 0.38) <i>p</i> = .910
Mindfulness	4 (11)	0.41 (0.04, 0.78) <i>p</i> = .031	0.27 (0.11, 0.42) <i>p</i> < .001	0.14 (-0.25, 0.54) <i>p</i> = .470
Emotional dysregulation	4 (5)	0.15 (-0.33, 0.62) <i>p</i> = .535	0.30 (0.15, 0.46) <i>p</i> < .001	-0.15 (-0.65, 0.35) <i>p</i> = .545
Cognitive flexibility	3 (10)	0.39 (-0.05, 0.82) <i>p</i> = .079	0.27 (0.12, 0.43) <i>p</i> < .001	0.12 (-0.35, 0.62) <i>p</i> = .618
Depression	3 (5)	0.33 (-0.10, 0.77) <i>p</i> = .133	0.28 (0.13, 0.43) <i>p</i> < .001	0.05 (-0.40, 0.50) <i>p</i> = .829
*Acceptance	3 (4)	0.83 (0.35, 1.31) <i>p</i> < .001	0.27 (0.13, 0.40) <i>p</i> < .001	0.58 (0.09, 1.07) <i>p</i> = .021
^ <i>Stress</i>	2 (10)	0.62 (0.11, 1.13) <i>p</i> = .019	0.26 (0.11, 0.41) <i>p</i> < .001	0.36 (-0.17, 0.90) <i>p</i> = .182
PTSD symptoms	2 (5)	0.20 (-0.29, 0.77) <i>p</i> = .492	0.29 (0.14, 0.45) <i>p</i> < .001	-0.09 (-0.67, 0.75) <i>p</i> = .751
Mental health skills	1 (6)			
Cognitive distortion and disputing them	1 (1)			
Validation training	1 (1)			
Parent skills training	1 (1)			
Teach parent to build family interpersonal support	1 (1)			
Coaching parents to use a skillset that validates and tolerates emotions	1 (1)			
Parent skills, unspecified	1 (1)			
Parent's support group	1 (1)			
Discuss dilemmas, concerns, frustrations or parent practice with other parents	1 (1)			
Problem solving skills	10 (26)	0.27 (0.01, 0.52) <i>p</i> = .040	0.30 (0.11, 0.48) <i>p</i> = .002	-0.03 (-0.34, 0.29) <i>p</i> = .864
Problem solving skills, unspecified	5 (10)	0.21 (-0.15, 0.56) <i>p</i> = .248	0.30 (0.14, 0.46) <i>p</i> < .001	-0.10 (-0.48, 0.29) <i>p</i> = .614
^ <i>Evaluate consequences of behaviors</i>	2 (8)	0.65 (0.17, 1.14) <i>p</i> = .01	0.25 (0.11, 0.40) <i>p</i> < .001	0.40 (-0.11, 0.91) <i>p</i> = .125
Discussing self-control	2 (5)	0.54 (-0.18, 1.25) <i>p</i> = .137	0.28 (0.13, 0.42) <i>p</i> < .001	0.26 (-0.47, 0.99) <i>p</i> = .475
Consider potential behaviors in response to a dilemma	1 (6)			

Table 2 (continued)

	Number of studies with element ^a (Number of effect sizes)	A. Effect of studies with element (95% CI)	B. Effect of studies without element (95% CI)	Difference between A and B (95%CI)
Learn to make behavior modification plan	1 (2)			
Focusing the mind on one thought at a time	1 (1)			
Learn how to avoid self-harm and other forms of self-destructive behavior	1 (2)			
Stress management	1 (4)			
Stress-inoculation training	1 (4)			
Social skills training	6 (13)	0.12 (-0.20, 0.44) <i>p</i> = .464	0.33 (0.17, 0.49) <i>p</i> < .001	-0.21 (-0.57, 0.16) <i>p</i> = .258
Social skills training, unspecified	4 (7)	-0.08 (-0.45, 0.28) <i>p</i> = .656	0.35 (0.20, 0.50) <i>p</i> < .001	-0.43 (-0.83, -0.33) <i>p</i> = .034
Communication skills training	2 (3)	0.22 (-0.34, 0.79) <i>p</i> = .822	0.29 (0.14, 0.44) <i>p</i> = .001	-0.07 (0.65, 0.52) <i>p</i> = .822
Social support/Personal relationships	1 (4)			
Following group rules	1 (4)			
Organizational skills	9 (25)	0.49 (0.23, 0.75) <i>p</i> < .001	0.20 (0.04, 0.37) <i>p</i> = .019	0.29 (0.59, 0.07) <i>p</i> = .067
*Set goals for treatment	8 (24)	0.58 (0.32, 0.84) <i>p</i> < .001	0.18 (0.03, 0.34) <i>p</i> = .022	0.40 (0.09, 0.70) <i>p</i> = .012
Learning to develop activity monitoring	4 (7)	0.32 (-0.17, 0.80) <i>p</i> = .196	0.28 (0.13, 0.44) <i>p</i> < .001	0.04 (-0.47, 0.54) <i>p</i> = .891
Learning to assess goals	3 (7)	0.22 (-0.19, 0.63) <i>p</i> = .289	0.29 (0.14, 0.45) <i>p</i> < .001	-0.07 (-0.50, 0.35) <i>p</i> = .730
Establishing coping-plan	2 (5)	0.08 (-0.41, 0.58) <i>p</i> = .736	0.31 (0.15, 0.46) <i>p</i> < .001	-0.22 (-0.74, 0.30) <i>p</i> = .401
Lifestyle	6 (15)	0.28 (-0.04, 0.59) <i>p</i> = .085	0.29 (0.13, 0.45) <i>p</i> < .001	-0.01 (-0.36, 0.34) <i>p</i> = .956
[^] <i>Lifestyle, unspecified</i>	4 (11)	0.50 (0.15, 0.86) <i>p</i> = .006	0.25 (0.10, 0.40) <i>p</i> = .001	0.25 (-0.13, 0.63) <i>p</i> = .189
Focusing on eating better	2 (3)	-0.08 (-0.69, 0.52) <i>p</i> = .788	0.31 (0.16, 0.46) <i>p</i> < .001	-0.39 (-1.01, 0.23) <i>p</i> = .217
Focusing on sleeping better	2 (3)	-0.08 (-0.69, 0.52) <i>p</i> = .788	0.31 (0.16, 0.46) <i>p</i> < .001	-0.39 (-1.01, 0.23) <i>p</i> = .217
Learning about personal finances	2 (3)	-0.08 (-0.69, 0.52) <i>p</i> = .788	0.31 (0.16, 0.46) <i>p</i> < .001	-0.39 (-1.01, 0.23) <i>p</i> = .217
Making a balance in school/recreation	1 (1)			
Physical exercise	1 (3)			

Note.^aNumber of studies with element present out of a total of 30 studies and number of effect sizes within the studies out of a total of 82 effect sizes. The elements are sorted according to frequency in each element category. *Significant difference between studies with and without element, *p* < .05 (bold). [^] non-significant difference in effect size greater than 0.20 between studies with and without the element (italic)

elements including 11 discrete practice elements as candidates for further exploration.

In the current study we found that interventions that included *setting goals for treatment* were significantly more effective than interventions without this element. This element was found in diverse types of interventions such as CBT, ACT, rumination-focused interventions, and mindfulness-focused interventions. Setting goals for treatment could include setting goals for the session as a part of reviewing the previous session and assigning homework between sessions (Shabani et al., 2019). In other interventions the focus was on teaching adolescents to set realistic goals for themselves (Ettelson, 2003) or use goal setting as a motivational exercise to explore expectations and discuss the pros and cons of changing (McIndoo, 2016). By actively involving adolescents in setting goals about their health, the health care professional shows respect for their needs and opinions (Viksveen et al., 2021), which, in turn, can lead to an enhanced sense of control and empower the adolescent. A consequence of this may be better clinical outcomes and higher satisfaction with care (Langer & Jensen-Doss, 2018). In addition, adolescents often want to be involved in decisions affecting their mental healthcare (Dogra, 2005; Gros et al., 2017). However, involvement can take many forms ranging from just being heard about their opinion to being involved in setting goals for treatment and further in the decision-making process about treatment (Viksveen et al., 2021). Although user involvement is generally seen as beneficial, research on outcomes of individual user involvement is scarce (Viksveen et al., 2021).

Our results showed that *psychoeducation about acceptance* was associated with effects on emotion regulation. Previous research has found unspecified psychoeducation to be effective for mental health literacy and cognitive skills in mental health interventions, but not for emotion regulation (de Pablo et al., 2020). The estimate of effect in our study depended on the type of psychoeducation and outcome measure applied, which may explain why our results differ from those of de Pablo et al., (2020). Our results add to the literature by finding that psychoeducation about acceptance, a specific type of psychoeducation, may be particularly potent for improving emotion regulation. The aim of using acceptance as an emotion regulation strategy is not to change the experienced emotions, but to receive them with openness and without attempting to control them (Hayes, 2004; Kohl et al., 2012). Thus, acceptance is quite distinct from other emotion regulation strategies that most often entail active modification of the emotional states in terms of quality, strength, length, or frequency of emotion (Gross, 2015).

There are several reasons why acceptance may be an adaptive strategy. Experimental studies show that acceptance is not associated with less physiological arousal

related to the elicited reaction (Eifert & Heffner, 2003; Feldner et al., 2003; Karekla et al., 2004), but associated with lower levels of subjective distress. This may be because acceptance strategies are associated with higher tolerance of aversive emotional states, and therefore individuals who use acceptance strategies may be less likely to avoid these experiences (Wolgast et al., 2011). Consequently, acceptance may reduce anxiety that is maintained by avoidant behavior.

Our finding is consistent with a meta-analysis showing that strategies using acceptance are on average effective ($d=0.30$) on emotional outcomes in an experimental setting (Webb et al., 2012). For individuals presenting with mild emotional symptoms, psychoeducation about the highly acceptance-focused therapy program ACT has been found effective for reducing symptoms (Cartwright & Hooper, 2017) – which corroborates our findings.

Our results also showed that when the element *social skills training* was included in treatment, there was a negative effect on emotion regulation (locus of control and ruminative thinking) compared to when the element was not included. However, there were only two studies that included this element, and one of them had noteworthy limitations and risks of bias (Schuppert, 2009). This result is, however, in line with other studies failing to find effective reduction of mental health symptoms from interventions focusing on social skills training (Kavale et al., 1997; Kjøbli & Ogden, 2014). Nevertheless, this result should be interpreted with caution.

Strengths and Limitations

To our knowledge, this is the first three-level meta-analysis that identifies practice elements associated with change in emotion regulation in interventions for adolescents. A strength of the current study is the focus on the magnitude of the differential effect size between interventions with (versus without) the target elements, rather than only with significance tests of differential effect sizes, as we want to ensure that any elements identified as potentially active ingredients have value for real-world practice. Furthermore, we included a wide range of therapies, settings, and outcomes, which increases the likelihood of the usability of the elements in diverse settings (Leijten et al., 2021).

A main limitation of the current study is that our results are highly dependent on which intervention elements are common in the literature, which has been coined *popularity bias* (Engell et al., 2020). Consequently, interventions and their associated elements that have not been frequent subject of controlled studies will not appear in our results. Also, elements that are infrequently used will be largely influenced by the effect in the few studies included. Therefore,

there is a higher probability that the effect of an element will be overestimated or underestimated when it is included in few studies. To limit this bias, we excluded effect sizes estimated for elements that only appeared in one study. However, elements included in few studies should be interpreted with caution.

Another limitation is that the identification of an association between the inclusion of elements and study outcomes does not allow for causal inference. We do not know if the elements we identified drive the effects, or if other factors (e.g., treatment fidelity confounding with intervention elements) may explain the increased effect in these studies. A related limitation is that the coding of intervention and sample characteristics was not exhaustive (e.g., treatment versus prevention and ethnic origins of samples were not coded), so we were unable to include these as potential moderators of the effect. Most of the practice elements identified in more effective studies were, however, found across different types of interventions, delivered by diverse professionals, and targeting different groups of youth, reducing the number of potential confounding factors.

Criteria for inclusion in the literature search were studies of interventions that addressed psychological symptoms and included an outcome measure of emotion regulation. Consequently, studies of interventions that aim to improve emotion regulation specifically but only have other outcomes measures than emotion regulation, such as mental health symptoms, are not included in the present study. Related to this, the current study is limited by the large variation in measurement instruments for emotion regulation used in this field, indicating an uncertainty of what construct is being measured. In a recent systematic review, 87 different measures of emotion regulation were identified as being used in the literature (Mazefsky et al., 2021). In our study, there were 27 measures of emotion regulation, reflecting the current lack of unity in the conceptualization of this construct. Future studies of how intervention elements affect change in emotion regulation may in turn advance our scientific understanding of what emotion regulation is. Such inquiries need clear theoretical conceptions of the assumed associations between intervention elements and specific areas of emotion regulation outcomes.

Recommendations for Future Research

A next step for research can be to experimentally test and optimize psychoeducation about acceptance and goal setting in isolation and in conjunction with other prominent discrete practice elements with transdiagnostic potentials (e.g., exposure to emotions and mindfulness). We encourage a

mix of population-based methods to learn about population-based effects (e.g., randomized factorial trials), ideographic methods to learn about personalized tailoring (e.g., time-series designs and phenomenological studies), and dynamic systems methods (e.g., realist evaluation) to learn about how different configurations of practice elements, contexts, and mechanisms influence outcomes. We also encourage collecting real-time process data on emotion regulation from adolescents and intervention fidelity from practitioners (e.g., using ecological momentary assessment and feedback from devices and wearables [Bettis et al., 2022]). Such data will help facilitate more precise inferences about elements and mechanisms.

Conclusion

Adolescence is a sensitive period for developing mental health problems and combined with the increase in mental health problems following the covid-19 pandemic, the need for improving interventions for young people is urgent. The results in this review can direct experimental research into the selection of practices that are most likely key to be mechanisms of change in interventions addressing emotion regulation. Subsequently, such inquiries can ultimately provide practitioners with a toolbox of effective, precise, and usable practices for improving mental health in adolescents.

Protocol

This meta-analysis is based on a systematic review by Espenes et al., (2021) [Manuscript submitted for publication]. The review protocol for the original systematic review was prospectively registered in October 2018 with the International Prospective Register of Systematic Reviews (<http://www.crd.york.ac.uk/prospero>; identifier CRD42018103480).

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Author Contributions All authors contributed to the study design. Coding and data collection were performed by SSH, BK and AVM. SSH performed the data analysis and interpretation under the supervision of TWL. SSH, BK, AVM, JK, and TE drafted the paper, and all authors provided critical revisions. All authors approved the final version of the paper for submission.

Data Availability Data are available at: https://github.com/ToreWentzel-Larsen/threellevel/blob/main/Ung13_emoreg_share.csv.

Declarations

Conflict of Interest The authors report there are no competing interests to declare.

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*References are included in the meta-analysis (see Supplementary material for all studies included in the meta-analysis)

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