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Abstract

While depression is among the most common comorbidities with ADHD, the precise pathways that underlie this association remain unclear. Emotion regulation has been proposed as a key underlying factor, given its strong links to both ADHD and depression. Although prior research has primarily focused on cognitive and mixed emotion regulation strategies, little work has been done on the role of behavioral emotion regulation strategies. To explore the moderating role of behavioral emotion regulation strategies in comorbid ADHD and depression, we conducted a cross-sectional study including 606 participants (13% with ADHD) and performed moderation analyses. Depressive symptoms were assessed using the PHQ-9 and behavioral emotion regulation strategies were measured with the BERQ. As expected, individuals with ADHD reported significantly higher depression scores compared to those without ADHD. Both adaptive and maladaptive behavioral emotion regulation were found to be related to depression severity. However, these effects were similar for both groups and did not moderate the relationship between ADHD and depression. These findings contribute to the already well-established link between ADHD and depression. A lack of moderation effects suggests that deficits in emotion regulation for ADHD might rather be cognitive than behavioral in nature. Our results emphasize that emotion regulation should be more nuanced and split into cognitive and behavioral components. Since both maladaptive and adaptive behavioral emotion regulation were linked to depression, equipping both ADHD and non-ADHD individuals with adaptive strategies can be a protective factor against the onset of depression and may also enhance treatment outcomes.

Keywords: ADHD, Depression, emotion regulation, behavioral emotion regulation strategies.

Layman's abstract

People with ADHD often struggle with depression, but we still do not fully grasp why these problems often go hand in hand. One possible explanation is emotion regulation; the way people manage their feelings. Past studies primarily focused on how people think about emotions, but not how they act in response to their emotions, which is known as behavioral emotion regulation. The present study explores the specific role of behavioral emotion regulation strategies in the link between ADHD and depression. To explore this, we studied 606 students, of whom 13% reported having ADHD. They answered questions about their mood and how they usually deal with stress or negative feelings. As expected, people with ADHD reported feeling more depressed than others. We also found that how people acted to manage their emotions mattered. Those who used adaptive strategies (like seeking support or doing something distracting) were less likely to feel depressed, while those who withdrew or ignored problems felt worse. However, these emotional behaviors did not explain why people with ADHD were more likely to be depressed. This suggests that the link between ADHD and depression may be more about how people think about their emotions than what they do with them. Even so, the way people regulate their emotions through behavior still matters. Therefore, teaching both ADHD and non-ADHD individuals how to use adaptive emotion regulation strategies could help protect them from developing depression and support their recovery.

Exploring the Moderating Role of Behavioral Emotion Regulation on the Association between ADHD and Depression

Attention-deficit/hyperactivity disorder (ADHD) is a neurodevelopmental condition characterized by pervasive patterns of inattention, hyperactivity, and impulsivity, often leading to functional impairments across the lifespan (American Psychiatric Association, 2013). Approximately 5% of the global population has been diagnosed with ADHD; however, the true prevalence is likely higher, as the disorder often goes unrecognized and undiagnosed (Franke et al., 2018). ADHD was originally seen as a children's disorder that remitted in adolescence. More recent findings, however, show that ADHD symptoms persist into adulthood (Matson, 2023). In addition, ADHD is being increasingly diagnosed for the first time in adulthood, particularly in women (London & Landes, 2021). 3.2% of adults in the Netherlands have been diagnosed with ADHD, whereas ADHD is more prevalent in men (3.7%) than in women (2.7%) (Ten Have et al., 2023). As a prevalent neurodevelopmental condition with functional impairments, ADHD is highly comorbid with other psychiatric disorders (Yoshimasu et al., 2018; Fayyad et al., 2017). This comorbidity complicates diagnosis and treatment, leading to poorer clinical outcomes and greater psychological impact for individuals with ADHD (Sandström et al., 2021).

ADHD and Depression

Mood disorders and especially major depressive disorder (MDD) are among the most prevalent comorbidities with ADHD (Chen et al., 2018; Sandström et al., 2021; Koyüncu et al., 2022). A meta-analysis of 92 cross-sectional and longitudinal studies done by Sandström et al. (2021) concluded that ADHD was 2.5 times more common in people with mood disorders compared to those without. Other longitudinal studies show that youth with ADHD have a higher chance of experiencing at least one depressive episode in adulthood (Meinzer et al., 2013; Meinzer et al., 2017, Riglin et al., 2021). For example, Meinzer et al. (2017) estimated that 44% of individuals with ADHD experience a depressive episode before age 30 compared to 25% of individuals without ADHD. More importantly, there is evidence that co-occurrent ADHD and depression lead to more severe depressive symptoms. According to Chronis-Tuscano et al. (2010), adults with ADHD have significantly greater risk of suicide attempts compared to non-ADHD adults (12% vs 1%). Given the relationship between ADHD and MDD, two highly prevalent disorders, it is essential to try to understand the underlying explanatory factors of this relationship (Mayer et al., 2022).

Since depression typically presents after ADHD, some theories argue that ADHD symptoms cause depression. For instance, the demoralization theory suggests that ADHD-related symptoms lead to stress and demoralization. In turn, more perceived stress elevates the chance of getting a stress induced disorder like depression (Matson, 2023). ADHD related difficulties cause impairments in social and academic functioning, which may further contribute to perceived stress (Björkenstam et al., 2018; Sahmurova et al., 2022). Sahmurova et al. (2022) found that students with ADHD make fewer friends, receive lower grades and are at higher risk of dropping out. Especially due to deficits in attention, problems related to planning, organizing and focusing are more prone to arise in individuals with ADHD (Eadeh et al., 2017). However, several studies indicate that the demoralization model may not fully explain the increased risk for depression (Meinzer et al., 2013; Eadeh et al., 2017). A study from Meinzer et al. (2013) showed that even after controlling for academic and social impairments, individuals with ADHD still have a higher chance of getting a depressive episode.

Alternatively, the shared etiology theory proposes the idea that ADHD and depression have similar risk-factors that interact with environmental factors which lead to the development of both conditions (Mayer et al., 2021). Twin studies found evidence that both ADHD and depression are heritable, with genetic factors accounting for up to 70% of the variance in both conditions (Faraone and Larsson, 2019). Both ADHD and depression exhibit shared endophenotypic traits, linking genetic factors to measurable characteristics. These include neuropsychological deficits as low reward responsiveness; the ability to experience pleasure in the presence of positive stimuli (Meinzer et al., 2012), and difficulties in executive functioning, particularly in goal-directed behavior and difficulties in emotion regulation (Matson, 2023). These traits are associated with abnormalities in the brain, which appear to be consistent across both conditions. fMRI studies have identified impairments within the limbic system, the brain region responsible for emotion regulation and motivation, which may contribute to an over-perception of negative stimuli in ADHD (Plessen et al., 2006). However, similarly to the demoralization model, studies show that after excluding individuals with comorbid disorders, ADHD is still associated with several functional impairments (Bodalski et al., 2019). Moreover, other work showed symptoms related to emotion regulation are rather explained by the severity of ADHD symptoms than the presence of comorbid disorders (Soler-Gutiérrez et al., 2023; Skirrow & Asherson 2013). Together, this implies that both the demoralization theory and the shared etiology theory capture different but complementary aspects of the ADHD-depression relationship.

Emotion Regulation

   Another aspect that might underlie comorbid ADHD and depression is emotion regulation. Emotion regulation is defined as an individual's ability to modulate their emotional state to promote adaptive, goal-oriented behaviors (Thompson, 1994). Emotion regulation plays a crucial role in coping because it enables individuals to manage external and internal stressors by changing the intensity, duration and expression of emotional responses (Gross, 1998). Poor emotion regulation has been linked to a range of negative outcomes, including deficits in physical health, social relationships and worse academic and socioeconomic outcomes (Hsu et al., 2014). Moreover, failures in emotional regulation have been closely associated with stress-induced psychopathologies like depression and anxiety disorders (Aldao et al., 2010; Kato, 2015; Joormann & Stanton, 2016). For instance, the link between emotion regulation strategies such as rumination, suppression and avoidance with depressive symptoms is well established (Kato, 2015; Joormann & Stanton, 2016). Meanwhile, emotion regulation strategies like reappraisal and problem solving have been widely recognized as protective factors against depression and contribute to a higher well-being (Aldao et al, 2010).

   Emotion regulation can occur through cognitive processes or behavioral actions. Many strategies incorporate both elements, but Garnefski et al. (2001) emphasized that cognition and behavior function independently, as thinking and acting engage different mechanisms and occur at different points in time. In response to this distinction, Garnefski and Kraaij (2006) developed the Cognitive Emotion Regulation Questionnaire (CERQ) to assess how individuals mentally process negative or unpleasant experiences. Subsequently, Kraaij and Garnefski (2019) developed the Behavioral Emotion Regulation Questionnaire (BERQ) to measure overt physical actions in those situations. Findings suggest that behavioral and cognitive emotion regulation styles are related, but both have a large amount of unique variance (Kraaij & Garnefski, 2019), reinforcing the view of differentiating emotion regulation into distinct cognitive and behavioral dimensions. Supporting this, a meta-analysis from Augustine and Hemenover (2009) concluded that cognitive and behavioral emotion regulation strategies were equally effective in regulating emotions. From the BERQ, strategies such as Withdrawal and Ignoring were found to correlate positively with depression and can be seen as maladaptive, while Seeking Distraction, Seeking Social Support, and Actively Approaching showed negative correlations with depression and are regarded as typically adaptive behavioral emotion regulation strategies (Kraaij & Garnefski, 2019). These outcomes are consistent with existing meta-analytic literature, suggesting that strategies

closely related to Seeking Distraction, Seeking Social Support and Actively Approaching which are typically more active and aimed at engagement with the stressor, are generally protective against depression. In contrast, strategies resembling Withdrawal and Ignoring, which are more passive and about disengagement with the stressor, are generally regarded as risk factors for depression (Kato, 2015).

Several studies show a tendency towards emotional dysregulation for individuals with ADHD, approximately half of the adults with ADHD experience difficulties with regulating emotions (Shaw et al., 2014). Challenges in emotion regulation often manifest as struggles with frustration, anger and impulsive emotional responses (Barkley, 2015). Studies indicate that children and adults with ADHD and depression have a low tolerance for frustration, which results often in irritability (Seymour & Miller, 2017; Bodalski et al., 2019) – a trait that is a transdiagnostic construct in the DSM-5 for both ADHD and depression (American Psychiatrist Organization, 2013). Other work has shown that individuals with ADHD tend to engage more in maladaptive emotion regulation strategies than adaptive ones (Liu et al., 2022; Bodalski et al., 2019; Soler-Guttiérrez et al., 2023). ADHD symptoms like attention and impulsiveness are associated with higher engagement in maladaptive strategies. Deficits in attention lead to a tendency to dislike one's current activity and have a desire to do something else. Impulsivity is strongly related to experiential avoidance, which are attempts to suppress, avoid, or escape unwanted internal behaviors such as thoughts, emotions, or psychological sensations, even when doing so leads to actions that are inconsistent with one's values and goals (Ben-Dor Cohen et al., 2024). While avoidance and suppression provide temporary relief, they often are counterproductive when facing the stressor again (Sheppes et al., 2015). This contributes to the idea that individuals with ADHD tend to choose short-term emotion regulation strategies, which demand less cognitive engagement, over long-term strategies (e.g reappraisal) which are more taxing (Ben-Dor Cohen et al., 2024). This idea is further corroborated by studies on reward processing differences in other fields, demonstrating that individuals with ADHD tend to prefer small, immediate gratifications over bigger and delayed ones (Marx et al., 2013; Onandia-Hinchado et al., 2021). Since most individuals with ADHD must already cope with elevated stress levels due to symptom-related difficulties, their inadequacy to regulate emotions might be a crucial factor underlying comorbid ADHD and depression (Soler-Guttiérrez et al., 2023).

Despite the associations between ADHD, depression and poor emotion regulation, the research about the role of emotion regulation strategies in comorbid ADHD and depression for adults remains scarce (Liu et al., 2022). Mayer et al. (2022) found that adolescents and

young adults with ADHD who are at risk for depression engage more in maladaptive, and less frequently in adaptive cognitive emotion regulation strategies. In contrast, Bodalski et al. (2019) examined adults with ADHD and found that those who rely on maladaptive strategies experience more depressive symptoms than those who use adaptive strategies. Only, Bodalski et al. (2019) found these results using measures that incorporated both behavioral and cognitive emotion regulation styles.

Present study

Previous research has acknowledged the role of emotion dysregulation in adult ADHD and in depression. However, only few studies have investigated the role that emotion regulation plays in comorbid ADHD and depression, while none to our knowledge have focused particularly on the role of behavioral emotion regulation in the comorbidity of these conditions. Addressing this gap, the present study investigates the possible moderating role of behavioral emotion regulation strategies on the association between ADHD and depression, using a cross-sectional design. Based on previously named literature, this study hypothesizes that:

> **H1:** Individuals with ADHD exhibit higher levels of depression compared to individuals without ADHD.
>
> **H2:** Individuals with ADHD exhibit higher usage of maladaptive behavioral emotion regulation strategies (like withdrawal or ignoring) compared to individuals without ADHD.
>
> **H3:** Behavioral emotion regulation strategies will moderate the association between ADHD status and depression scores, meaning that:
>
> > **H3.1:** Maladaptive behavioral emotion regulation strategies (like withdrawal or ignoring) will be associated with an increase in depression scores for individuals with ADHD.
> >
> > **H3.2:** Adaptive behavioral emotion regulation strategies (like actively approaching, seeking distraction or seeking social support) will be associated with a decrease in depression scores for people with ADHD.

Methods

Design

The current study utilized a subset of the WARN-D study, a longitudinal multicohort project aimed at developing a personalized predictive model for depression onset. WARN-D

followed university students over two years, collecting data at multiple stages (Fried et al., 2023). The study aimed to recruit 2,000 participants, divided into four cohorts of 500 individuals. Participants completed three phases: (1) a baseline assessment, (2) a three-month Ecological Momentary Assessment (EMA), and (3) follow-ups every three months (Fried et al., 2022). This study focused solely on the cross-sectional baseline data. Ethical approval was granted by the Leiden University Research Ethics Committee on September 6, 2021 (V2-3406). For further methodological details, refer to the protocol paper from Fried et al. (2023).

Participants

Participants were recruited from various educational institutions across the Netherlands, focusing on individuals enrolled in university, HBO (university of applied sciences), or MBO (vocational education) programs. The requirements from the WARN-D stated that participants, (1) needed to be fluent in Dutch or English, (2) have the minimal age of 18, (3) own a smartphone running Android or iOS, (4) live in the Netherlands, Belgium or Germany and (5) needed to have a European bank account.

Exclusion criteria were based on ethical and research considerations. Participants were excluded if they: (1) had a current diagnosis of schizophrenia, psychosis, or thought disorder; moderate to severe major depressive disorder (MDD); (hypo)mania or bipolar disorder; primary substance use disorder; or moderate to severe suicidal ideation; (2) were currently in treatment or on a waiting list for treatment with a licensed psychologist or psychiatrist for any of these conditions; (3) were PhD students; (4) reported significant distress related to viewing daily calorie expenditure estimates, as provided by the smartwatch used during the EMA phase. These exclusion criteria were assessed by validated self-reports, which are further described in the protocol paper (Fried et al., 2023).

The final sample comprised 606 participants aged 18 to 61 years (M = 22.6, SD = 4). 487 (80.3%) participants identified as female, while 96 (15.8%) identified as male. 21 (3.4%) participants identified with another gender and 2 participants (0.3%) chose to not disclose their gender. Based on our classification criteria, 81 participants (13%) from the total sample were identified as having ADHD and 525 participants (87%) as non-ADHD. 60 (74.1%) of the ADHD group identified as female, 15 (18.5%) as male and 6 identified with another gender (7.4%). Regarding educational attainment, 82.7% (n = 501) were pursuing a university degree, 11.6% (n = 70) were enrolled at a university of applied sciences program, 3.6% (n = 21) were pursuing a vocational school diploma and 2.3% (n = 14) pursued a different kind of degree.

Procedure

The WARN-D study was advertised through various online and offline channels, including word-of-mouth, posters, social media, and email newsletters. To enhance participation from non-university institutions, partnerships were formed. Interested individuals received a link to an online form where they selected their preferred language (Dutch or English), reviewed the informed consent materials, and completed a screener to determine eligibility. Eligible participants entered Stage 1 of the study, starting with a 75-minute baseline survey covering topics such as physical and mental health, daily routines, and medical history, including symptoms of major depressive disorder (MDD) and sleep patterns. This was followed by a 3-month Ecological Momentary Assessment (EMA) including 12 weekly and 352 daily measurements and eight follow-up surveys every three months (six short surveys of 15 minutes and two yearly surveys of 30 minutes).

Participants were compensated for their time, receiving €7.50 for the baseline survey, up to €45 for the EMA, and up to €37.50 for follow-ups, with a total possible reimbursement of €90 for completing the full study. Details on additional procedures of the WARN-D study are available at https://osf.io/2jd9h/.

Measures

ADHD

During the baseline assessment participants were asked about their mental health status and history. One question was: "Have you ever in your life had any of the following emotional or mental problems?" Among the multiple-choice options, students could select "Attention Deficit (Hyperactivity) Disorder (AD(H)D)". Later, participants were asked if they currently still have this emotional or mental health problem. The question could be coded in an binary manner, meaning that 0 = no, and 1 = yes. This question was adapted from a questionnaire from Caring Universities (n.d.). Later in the questionnaire participants were asked whether they had a current ADHD diagnosis. Due to the limited number of formally diagnosed cases (n = 44), all participants who reported currently experiencing ADHD symptoms were categorized as having ADHD, regardless of formal diagnosis. Besides statistical reasons, it is shown that adult ADHD frequently goes undiagnosed and that the true prevalence of adult ADHD is much higher (Franke et al., 2018). This approach could potentially help identifying cases that would otherwise go undiagnosed.

Depression

Depression scores were measured at baseline. An adapted Patient Health Questionnaire-9 (PHQ-9; Kroenke & Spitzer, 2002) was used to measure depression severity over the previous 2 weeks. The PHQ-9 asks participants how often in the last two weeks they were bothered by different symptoms relating to depression. Response options were on an ordinal scale, meaning that 0 = not at all; 1 = several days; 2 = more than half the days; 3 = nearly every day. In the adapted version they separated distinct and/or opposing symptoms (e.g. sad mood and hopelessness; hypersomnia and insomnia; reduced and increased appetite; psychomotor retardation and agitation). Moreover, a question about reading the newspaper was removed due to limited relevance. The final adapted PHQ-9 comprised 9 items, yielding a total score range of 0 to 27. Depression severity was categorized as none (0–4), mild (5–9), moderate (10–14), moderately severe (15–19), and severe (20–27). The original PHQ-9 exhibits high levels of internal consistency, with Cronbach's alpha ranging from .86 to .89 (Kroenke et al., 2001). In the sample the internal consistency was also deemed high, with Cronbach's alpha ranging from .81 to .85.

Emotion Regulation

The Behavioral Emotion Regulation Questionnaire (BERQ; Kraaij & Garneski, 2019) was used to measure behavioral emotion regulation strategies. The BERQ consists of five scales, which are described as follows: Withdrawal, refers to drawing yourself back from situations and social contacts to deal with the stressful event. Ignoring, refers to ignoring and behaving like nothing has happened in order to deal with the stressful event. Seeking Distraction, refers to distracting yourself from your emotions by doing something else, to cope with the stressful event. Seeking Social Support, refers to actively sharing emotions and asking for support and advice to cope with the stressful event. At last, Actively Approaching refers to one's own active behavior to deal with the stressful event. In the BERQ, the participants were asked what they generally do when experiencing negative or unpleasant events. The questionnaire comprised 20 statements (e.g., "I isolate myself" or "I share my feelings with someone"), which participants rated based on how often each statement applied to them. Responses were given on a 5-point scale: 1 = (almost) never, 2 = sometimes, 3 = regularly, 4 = often, and 5 = (almost) always. Each subscale consisted of four items, with total scores ranging from 4 to 20. For the maladaptive emotion regulation strategies Withdrawal and Ignoring, component scores were calculated by summing the relevant item responses, resulting in total scores ranging from 8 to 40. Similarly, for the

adaptive strategies Seeking Distraction, Seeking Social Support, and Actively Approaching, total scores ranged from 12 to 60. To facilitate interpretation, the composite scores for maladaptive strategies were divided by 8, and those for adaptive strategies by 12, corresponding to the original 5-point scale. The BERQ demonstrates high internal consistency, with Cronbach's alpha coefficients ranging from .86 to .93 (Kraaij & Garnefski, 2019). The subscales also exhibited good internal consistency within the sample with Cronbach's alpha ranging from .75 to .93. For further details on the used measures, please refer to Appendix A.

Analysis

All analyses were conducted using JASP on MacOS Ventura (JASP Team, 2024). Independent samples t-tests were conducted for the first two hypotheses, while a simple regression model was used for our third hypothesis. Dependent variables were Depression, measured by the adapted PHQ-9 (Kroenke & Spitzer, 2002) and behavioral emotion regulation, measured by BERQ (Kraaij & Garnefski, 2019). The independent variable was ADHD. Based on previous literature we expected for H1: a positive association between ADHD and depression, such that individuals with ADHD exhibit higher depression scores than those without ADHD. For H2: A positive association between ADHD and the use of maladaptive behavioral emotion regulation strategies. For H3.1 a negative interaction effect, meaning that adaptive behavioral emotion regulation strategies weaken the relationship between ADHD and Depression, and for H3.2 a significant positive interaction effect, meaning that maladaptive behavioral emotion regulation strategies strengthen the relationship between ADHD and Depression. To correct for multiple corrections, we used the Benjamini-Hochberg procedure, which controls the False Discovery Rate (FDR). In this method each p-value was multiplied by the total number of tests and divided by its rank among the sorted p-values. An a priori power analysis revealed that the study achieved high power of .994 to detect a medium-sized effect ($d = 0.5$) at an alpha level of .05. All data were captured at the baseline phase of the WARN-D project.

Results

Demographics

The sample comprised 606 participants, of whom 81 (13%) were classified as individuals with ADHD and 505 (87%) as individuals without ADHD. An independent samples *t*-test revealed no significant differences in age between the groups ($t = 1.390$, $p =$

.165). A series of chi-square tests were conducted to assess between-group differences for educational level and gender. No significant differences between groups were found regarding gender and enrollment for university, university of applied sciences and other education categories. Regarding education level, results revealed a significant between-group difference in vocational education enrollment (X^2(1) = 5.81, p = .016). An overview of the demographics for the variables of both study groups is presented in table 1.

Table 1

Descriptive statistics for study variables for both study groups

| Characteristic | ADHD (n = 81) | | | | No ADHD (n = 525) | | | | |
	M	SD	n	$\%$	M	SD	n	$\%$	p
Age	23.2	3.9			22.5	4			.165[a]
Female			60	74.1			427	15.4	.643[b]
Male			15	18.5			81	81.3	.256[b]
Other gender			6	7.4			17	2.9	.841[b]
Voc. edu.			7	8.6			14	2.7	.016[b]
Appl. uni.			10	12.3			60	11.4	.957[b]
University			62	76.5			439	84	.154[b]
Other edu.			2	2.5			12	2.3	1[b]

Note. Voc. Edu. = Vocational education; Appl. uni. = university of applied Sciences university; Other edu. = Other type of education.
[a]*Independent samples t-test used*
[b]*Chi-square test used*

ADHD Associated with Higher Depression Scores

We first examined the associations between ADHD and depression. Levene's test indicated that the assumption of homogeneity of variances was met (F(1, 604) = .36, p = .548). As displayed in table 2, the mean PHQ-9 based depression severity for ADHD group was deemed as moderate (M = 10; SD = 4.8), compared to mild severity in the non-ADHD group (M = 7.2; SD = 4.6). Accordingly, after applying a false discovery rate (FDR) correction for multiple comparisons (t (604) = 5.18, p_{adj} < .004), an independent-samples t-test was conducted and revealed that individuals with ADHD exhibit higher levels of depression, with a medium-to-large effect size (d = .62).

No Between-group Differences in Behavioral Emotion Regulation

An independent-samples t-test was used to examine whether individuals with ADHD exhibited higher usage of maladaptive behavioral emotion regulation strategies compared to individuals without ADHD. The assumption of homogeneity was met for the composite maladaptive behavioral emotion regulation scores, as indicated by Levene's test ($F(1, 604) = .01$, $p = .919$). Based on the BERQ sum score, the ADHD group (M = 21.2, SD = 7.2) and the non-ADHD group (M = 19.4, SD = 7.2) did not significantly differ in their use of maladaptive emotion regulation strategies ($t(604) = 2.12$, $p_{adj} = .068$), and the effect size was considered small ($d = .25$).

Follow-up analyses of individual strategy types revealed that individuals with ADHD did not engage significantly more in Ignoring ($t(604) = 1.37$, $p_{adj} = 0.170$), nor reported higher engagement in Withdrawal after correcting for multiple comparisons ($t(604) = 2.21$, $p_{adj} = 0.056$).

This study conducted an exploratory analysis to detect possible differences in engagement in adaptive behavioral emotion regulation strategies between the ADHD and non-ADHD groups. According to the BERQ, both the ADHD group (M = 37.3, SD = 7.6) and the non-ADHD group (M = 36.7, SD = 7.6) reported regular engagement in adaptive behavioral emotion regulation strategies. The difference between the groups in level of engagement in the adaptive emotion regulation styles was not significant ($t(604) = .70$, $p = .484$) with a very small effect size ($d = .084$). After controlling for multiple comparisons no significant group differences were found for individual adaptive behavioral emotion regulation strategy types like Seeking Support ($t(604) = .30$, $p_{adj} = .767$), Actively Approaching ($t(604) = .80$, $p_{adj} = .639$) and Seeking Distraction ($t(604) = 2.08$, $p_{adj} = .114$). More information about the descriptive statistics of the study variables for both study groups can be found in table 2.

We also found a moderate negative correlation between sum scores on adaptive emotion regulation and maladaptive emotion regulation ($r(604) = -.308$, $p < .001$) and found similar results within the ADHD group ($r(79) = -.330$, $p = .003$). Indicating that if adaptive behavioral emotion regulation increases, maladaptive behavioral emotion regulation tends to decrease. A full overview of the correlations of the individual behavioral emotion regulation strategies with each other can be found in Appendix C.

Table 2

Descriptive statistics of study variables for both study groups

Characteristic	ADHD ($n = 81$)		No ADHD ($n = 525$)		
	M	*SD*	*M*	*SD*	p_{adj}
PHQ-9	10.1	4.8	7.2	4.6	< .001
Sum maladaptive BER	21.2	7.2	19.4	7.2	.068
Sum adaptive BER	37.3	7.1	36.7	7.6	.484
Ignoring	9.9	4.4	9.2	4.2	.170
Withdrawal	11.3	4.5	10.2	4.2	.056
Seek. Support	12.1	4.3	12	4.5	.767
Act. Approaching	11.9	3.8	12.2	3.6	.639
Seek. Distraction	13.3	3.3	12.5	3.3	.114

Note. Sum maladaptive BER = cumulated score of Withdrawal and Ignoring; Sum adaptive BER = cumulated score of Seeking Distraction, Seeking Support and Actively Approaching; Seek. Support = Seeking Support; Act. Approaching = Actively Approaching; Seek. Distraction = Seeking Distraction.

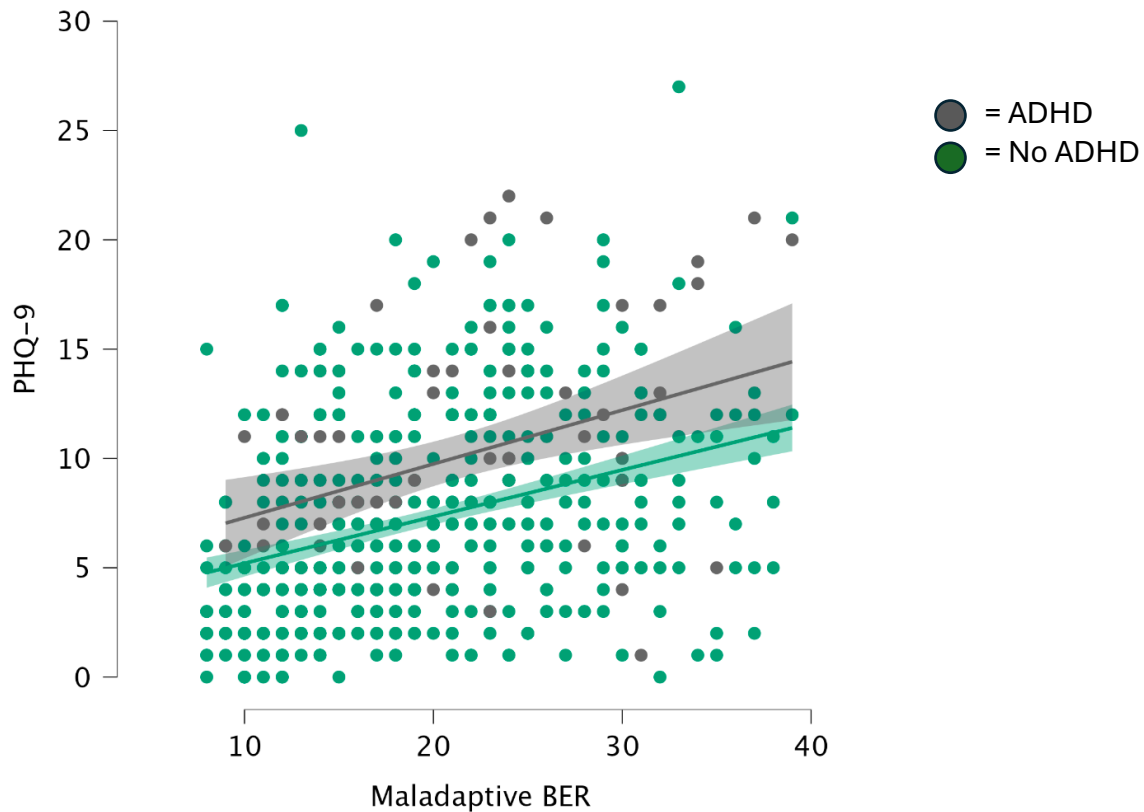**No Moderating Effect of Maladaptive Behavioral Strategies on Depression in ADHD**

A moderation analysis was conducted to examine whether maladaptive behavioral emotion regulation strategies moderated the relationship between ADHD status and depression scores. The overall model was significant ($F(3, 602) = 36.73$, $p < .001$, $R2 = .155$). No significant main effect for ADHD on depression ($t = 1.1$ $p = .270$), meaning that when controlling for maladaptive behavioral emotion regulation there was no longer a significant difference in depression scores between the individuals with or without ADHD.

A significant main association was found between depression scores and maladaptive behavioral emotion regulation strategies ($t = 8.14$, $p < .001$). Individuals who reported higher scores on maladaptive behavioral emotion regulation strategies tended to have higher depression scores, regardless of ADHD status. As displayed in figure 1, results did not show a significant ADHD status x maladaptive behavioral emotion regulation strategies interaction ($t = .46$, $p_{adj} = .650$). Implying that while emotion regulation influenced depression, there was no ADHD interaction. This finding indicated that greater use of maladaptive emotion regulation strategies was associated with higher depression scores overall, however, this relationship did not differ between individuals with and without ADHD.

Follow-up analyses for associations between individual maladaptive regulation strategies and depression revealed significant associations for Withdrawal ($t = 10.69$, $p < .001$) and Ignoring ($t = 3.77$, $p < .001$). Suggesting that higher engagement in Withdrawal or Ignoring was related to higher depression scores for both ADHD and non-ADHD individuals.

Figure 1

Scatterplot depicting the correlation for depression score with the maladaptive behavioral emotion regulation score for individuals with and without ADHD

Note: PHQ-9 = depression severity score; Maladaptive BER = Maladaptive behavioral emotion regulation sum score. The sum score for maladaptive behavioral emotional regulation strategies ranged from 8 – 40 and existed out of the subsets Withdrawal and Ignoring.

**No Moderating Effect of Adaptive Behavioral Strategies on Depression in ADHD**

A second moderation analysis examined whether adaptive behavioral emotion regulation strategies moderated the relationship between ADHD status and depression scores. The overall model was significant ($F(3, 602) = 17.92$, $p < .001$, $R2 = .082$). No significant main effect was found for ADHD on depression ($t = .34$, $p = .738$), meaning that after accounting for adaptive emotion regulation strategies, ADHD status was not significantly associated with depression scores.

Once more, a significant main association was found between depression scores and adaptive behavioral emotion regulation (t = -4.97, p < .001). This finding indicated that regardless of ADHD status, greater usage of adaptive behavioral emotion regulation strategies was linked to lower depression scores. Additionally, as displayed in figure 2, results did not show a significant ADHD status x adaptive behavioral emotion regulation strategies interaction (t = .70, p_{adj} = .653). Suggesting that greater use of adaptive emotion regulation strategies was associated with lower depression scores overall, but effects were similar for both the ADHD and non-ADHD group.

Follow-up analyses for associations between individual adaptive regulation strategies and depression revealed significant associations for Seeking Distraction (t = -2.66, p = .008), Seeking Support (t = -2.88, p = .004) and Actively Approaching (t = -4.52, p < .001). These findings indicated that higher engagement in Seeking Distraction, Seeking Support and Actively Approaching is related to lower depression scores for both ADHD and non-ADHD individuals.

Figure 2

Scatterplot depicting the correlation for depression severity score with the adaptive behavioral emotion regulation score for individuals with and without ADHD
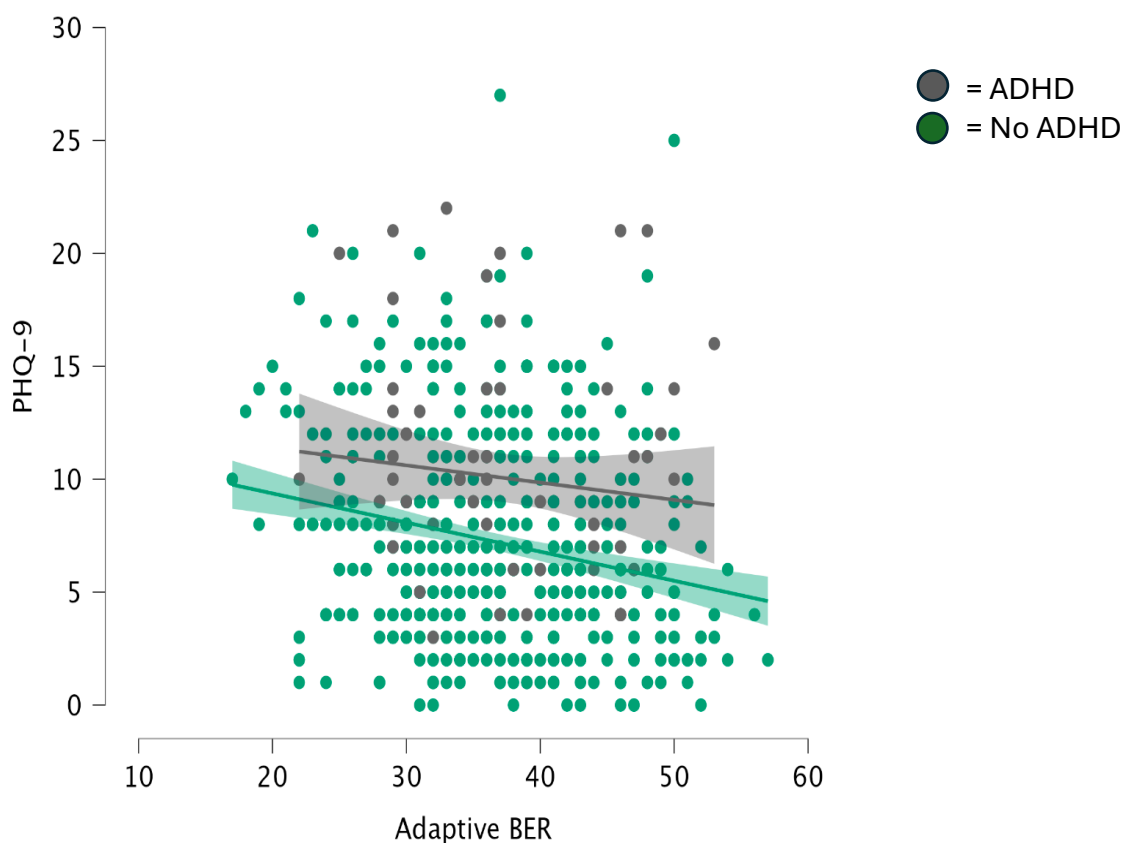
Note: PHQ-9 = depression severity score; Adaptive BER = adaptive behavioral emotion regulation sum score. The sum score for adaptive behavioral emotional regulation strategies ranged from 12 – 60 and existed out of the subsets Actively Approaching, Seeking Support and Seeking Distraction.

Discussion

The aim of this study was to investigate the possible moderating role of behavioral emotion regulation strategies on ADHD and depression. First, we tested whether individuals with ADHD exhibited higher levels of depression compared to individuals without ADHD. Our results showed higher depression scores for the ADHD group, adding to previous literature linking ADHD to depression (Sandström et al., 2021; Riglin et al., 2019; Meinzer et al., 2017). Second, we expected individuals with ADHD to exhibit higher usage of maladaptive behavioral emotion regulation strategies compared to individuals without ADHD. In contrast to previous studies (Bodalski et al., 2019; Liu et al., 2022; Soler-Guttiérrez et al., 2023; Mayer et al., 2022), individuals with ADHD did not display a higher engagement in maladaptive emotion regulation strategies. Finally, we found no evidence for the moderating role of behavioral emotion regulation strategies between ADHD status and depression scores. Our novel results showed that maladaptive and adaptive behavioral emotion regulation strategies were associated with depression, but did not moderate the relationship between ADHD and depression.

Interpretation of Findings
ADHD and Depression

Our study found compelling evidence that individuals with ADHD had higher levels of depression compared to those without, thereby reinforcing a well-documented association reported in prior research identifying ADHD as a risk factor for depression across the lifespan (Sandström et al., 2021; Riglin et al., 2019; Meinzer et al., 2017). Our findings contribute to the growing idea that ADHD's comorbid problems often persist into adulthood. The ADHD-depression comorbidity might even be more common in students as they are already vulnerable to mood disorders due to elevated levels of perceived stress and academic pressure (Sahmurova et al., 2020). In addition, ADHD frequently remains untreated in people with depression, due to the clinicians' focus on mood symptoms (Bond et al., 2012). Notably, Oddo et al. (2018) and Meinzer et al. (2017) found that treating ADHD symptoms has protective effects against a later onset of comorbid depression. These findings amplify the need for enhanced screening and treatment of ADHD symptoms in co-occurring ADHD and

depression, especially with the increased risk of suicide for this comorbidity in mind (Chronis-Tuscano et al., 2010).

ADHD and Emotion Regulation

After controlling for multiple comparisons, our results did not show a significant difference in the usage of maladaptive behavioral emotion regulation strategies between the ADHD and non-ADHD group. This finding diverges from other studies that reported greater use of maladaptive emotion regulation strategies and lesser use of adaptive ones (Bodalski et al., 2019; Liu et al., 2022, Soler-Guttiérrez et al., 2023; Mayer et al., 2022). However, these studies did not solely focus on behavioral emotion regulation strategies but used measures like the Cognitive Emotion Regulation Questionnaire (CERQ; Garnefski et al., 2001) or the Emotion Regulation Questionnaire (ERQ; Gross & John, 2003). Mayer et al. (2022) found by using the CERQ that individuals with ADHD engage more frequently in maladaptive cognitive strategies (e.g., rumination). Bodalski et al. (2019), Liu et al. (2022), and Soler-Guttiérrez et al. (2023) reported similar findings using mixed measures of cognitive and behavioral emotion regulation like the ERQ. Our conflicting results suggest that individuals with ADHD may be more prone to using maladaptive cognitive emotion regulation strategies, but not necessarily maladaptive behavioral ones. One possible explanation is that due to deficits in executive functioning, individuals with ADHD tend to choose less cognitively demanding strategies (Ben-Dor Cohen et al., 2024). According to a meta-analysis from Augustine and Hemenover (2009), adaptive behavioral emotion regulation strategies cost less cognitive resources than adaptive cognitive emotion regulation strategies like reappraisal. That is, an adaptive behavioral emotion regulation strategy like seeking distraction (for example playing basketball when faced with a negative affect) demands less cognitive energy than reappraising the negative emotion. Studies like Liu et al. (2022) and Soler-Guttiérrez et al. (2023) that used the ERQ show that the link between ADHD and deficits in emotion regulation strategies was typically more evident for cognitively demanding strategies. ADHD individuals had a higher engagement in catastrophizing, rumination and blaming others and a lower engagement in adaptive strategies like reappraisal. Thus, ADHD individuals might still have the cognitive resources to engage in adaptive behavioral emotion regulation strategies but not enough to engage in adaptive cognitive strategies. The absence of differences in the usage of adaptive behavioral emotion regulation strategies between ADHD and non-ADHD individuals in our results underscore this. Therefore, our findings strengthen Garnefski et al.'s (2001) claim that cognition and behavior are distinct components of emotion regulation

because they engage different neuropsychological mechanisms and occur at different stages of emotional processing.

Moderation Analysis

We did not find a moderating effect for either adaptive or maladaptive behavioral emotion regulation strategies between ADHD status and depression scores. This finding is somewhat conflicting with Mayer et al. (2022), who found that youth with ADHD who are at risk for depression engage more frequently in maladaptive, and less frequently in adaptive cognitive emotion regulation strategies. It also contrasts with Bodalski et al. (2019) who found that an overreliance on maladaptive emotion regulation strategies for ADHD individuals led to more depressive symptoms in comparison to non-ADHD individuals. However, Mayer et al. (2022) used the Cognitive Emotion Regulation Questionnaire (CERQ) and Bodalski et al. (2019) used mixed behavioral and cognitive emotion regulation questionnaires (like the ERQ and the Cognitive-Behavioral Avoidance Scale) to measure these strategies. Since this is the first study to investigate the role of behavioral emotion regulation strategies, this may indicate that depression for ADHD individuals is rather explained by deficits with implementing cognitive emotion regulation strategies or other factors. This aligns with earlier studies suggesting that individuals with ADHD have less cognitive resources and therefore struggle more with cognitive emotion regulation (Augustine & Hemenover, 2009; Ben-Dor Cohen et al., 2024).

In our main analyses we did find that behavioral emotion regulation strategies, rather than ADHD status alone were associated with different depression scores. Meaning that greater usage of adaptive behavioral emotion regulation strategies was linked to lower depression scores and greater usage of maladaptive behavioral emotion regulation strategies to higher depression scores. These findings emphasise the importance of behavioral emotion regulation in both ADHD and non-ADHD individuals. This pattern is consistent with other studies that investigated the associations of maladaptive and adaptive emotion regulation strategies (Bodalski et al., 2019; Kato, 2015; Joormann & Stanton, 2016) with depression. It also aligns with study of Kraaij and Garnefski (2019), who reported similar findings using cognitive emotion regulation. Like Kraaij and Garnefski, our findings suggest that maladaptive strategies were more strongly related to depression than the adaptive ones, as indicated by the t-values. This aligns with meta-analytic evidence from Aldao et al. (2010), which highlighted that maladaptive strategies are more harmful than a lack of adaptive strategies is protective.

Limitations of Measures

The findings of our study should be interpreted in light of several potential limitations of our used measures. For instance, ADHD status in our non-clinical sample was determined using a self-report item whether participants had ever encountered problems related to ADHD. This approach did not capture the severity of ADHD symptoms, which may have led to an underrepresentation of individuals with more severe ADHD symptomatology due to our broad inclusion criteria. Prior research indicates that greater ADHD severity has been associated with increased depressive symptoms and more deficits in emotion regulation (Sandström et al., 2021; Bodalski et al., 2019; Soler-Guttiérrez et al., 2023). Some studies even argue that maladaptive emotion regulation is more closely linked to symptom severity than to diagnostic status alone (Soler-Gutiérrez et al., 2023; Skirrow & Asherson 2013). This suggests that the small effect we observed of higher scores in maladaptive behavioral emotion regulation strategies (particularly in Withdrawal) for ADHD individuals, may underestimate the true strength of this relationship. This could mean that behavioral emotion regulation strategies might still moderate the relationship between ADHD and depression, but only for individuals with more severe ADHD.

Furthermore, Sheppes (2020) argued that emotion regulation strategies should not directly be seen as maladaptive or adaptive, but rather as tools whose effectiveness depends on contextual demands. For instance, when individuals face high-intensity emotional situations, emotions may become overwhelming and disengagement strategies can offer accessible and immediate relief by shifting attention away from the stressor (Shafir et al., 2016). In the BERQ a disengagement strategy could be typically adaptive like Seeking Distraction but could also take the shape of a typically maladaptive behavioral emotion regulation strategy like Withdrawal or Ignoring. Conversely, typically adaptive strategies like Actively Approaching, which involve engagement with the stressor require cognitive effort and can be distressing when facing an intense emotional moment which is already cognitively taxing. In addition, Troy et al. (2013) found when facing an uncontrollable stressor, emotion regulation strategies that require engagement, like Actively Approaching, can have adverse psychological effects. Meanwhile, engagement strategies like Actively Approaching are more suitable with controllable contexts that are emotionally less demanding. The BERQ only captures general tendencies and might overlook important situational factors that influence when and how emotion regulation strategies are used.

Limitations of Design

Some limitations of our design need to be highlighted. First, our study was cross-sectional, which inherently restricts the ability to draw conclusions about causality or the temporal sequence of effects. While significant relationships were found for ADHD and behavioral emotion regulation strategies with depressive symptoms, it remains unclear whether maladaptive behavioral emotion regulation strategies contribute to the development of depression in individuals with ADHD or whether depressive symptoms lead to increased use of such strategies.

Second, in our study we did not control for confounding variables like perceived stress, anxiety symptoms, medication use and socioeconomic status, which all have been proven to be strongly connected to psychopathology (Sahmurova et al., 2022; Watson et al., 2023). For instance, perceived stress has been identified to be a predictor for both higher engagement in maladaptive emotion regulation and depression (Vitulíc et al., 2016). The current sample consisted predominantly of university students, a group known to experience relatively high levels of perceived stress (Sahmurova et al., 2020). Therefore, it can be that perceived stress, rather than ADHD-status, might be underlying for the link between emotion regulation and depression. Since elevated stress levels can lead to more engagement in maladaptive emotion regulation strategies, it may have diluted ADHD-status related effects. Conversely, since the predominant part of our participants attained higher education, the higher cognitive functioning of our sample may have mitigated the influence of ADHD-related emotion regulation difficulties. High educational attainment has been linked to more self-efficacy in dealing with stress due to more developed coping resources and executive functioning (Vitulíc et al., 2016; Soler-Gutiérrez et al., 2023). These enhanced coping resources are associated with higher engagement in adaptive emotion regulation strategies, because those strategies typically require more cognitive energy. Taken together, confounding factors could independently have affected both behavioral emotion regulation and depressive symptomology, thus potentially inflating or obscuring the true nature of the associations.

Third, our study utilized a subset from the baseline phase of the WARN-D study. This baseline phase consisted of a 75-minute survey covering plenty topics such as physical and mental health, daily routines, and medical history, including symptoms of major depressive disorder and sleep patterns. Due to the length of the survey, instrumentation effects may have influenced the responses. As the survey continued, participants may have experienced fatigue or decreased attention, potentially leading to rushed answers and reduced data quality.

Fourth, in addition to earlier mentioned struggles with the representativeness of using a well-educated student sample, our sample had an overrepresentation of people that identified as female (74.1%). Gender differences have been proven in the expression and prevalence for ADHD, depression and emotion regulation. For example, ADHD related symptoms are typically more common in males than in females, while depression is typically more prevalent in females (Watson, 2023). Therefore, extra caution is warranted in generalizing these findings.

Strengths

The present study had several strengths. First, this is the first to investigate the moderation role of behavioral rather than cognitive emotion regulation strategies in comorbid ADHD and depression. Therefore, it provides a novel contribution to the existing literature about emotion regulation dysfunction in individuals with ADHD. Second, this study achieved high statistical power, and the assumptions of homogeneity were met for the hypotheses. We also corrected for multiple comparisons via the False Discovery Rate and made use of reliable instruments like the PHQ-9 and the BERQ, meaning that our study was well-equipped to detect meaningful group differences or associations. Third, this study contained a large, non-clinical adult sample, which enhances ecological validity. This allows for insights into how emotion regulation functions in everyday contexts, which contrasts with the clinical populations that are more typically examined in this field.

Implications

In contrast to previous findings of emotional regulation with ADHD (Liu et al., 2022; Soler-Guttiérrez et al., 2023; Bodalski et al., 2019; Mayer et al., 2022), our results showed that individuals with ADHD did not engage more in maladaptive behavioral emotion regulation, nor that behavioral emotion regulation did moderate the ADHD-depression link. Our divergent findings highlight the importance of differentiating between behavioral and cognitive emotion regulation, supporting the separation between thinking and doing proposed by Garnefski and Kraaij (2006). This is particularly important because it is estimated that 34-70% of the adults with ADHD experience problems with emotion regulation (Shaw et al., 2014). Since emotion dysregulation is so common in this disorder, several studies have suggested that emotion regulation should be a core symptom in ADHD (Hirsch et al., 2018; Barkley, 2015). This study rather argues that emotion regulation is a transdiagnostic construct

and should be further nuanced before being incorporated as one of the main symptoms for ADHD.

Nevertheless, our findings underscore the importance of learning adaptive behavioral emotion regulation strategies in general. Although we did not find a moderating effect for behavioral emotion regulation strategies, adaptive and especially maladaptive strategies were strongly associated with depression for all participants regardless of ADHD presence. Equipping individuals with adaptive behavioral emotion regulation strategies can thus be a protective factor against a potential onset of depression and can also enhance treatment outcomes. Previous studies have shown that Cognitive Behavior Therapy (CBT) helps treat ADHD symptoms and that emotion regulation skill training helped to improve the effectiveness of CBT (Berking et al., 2013). Since learning adaptive behavioral emotion regulation strategies is cognitively less demanding than cognitive strategies, learning this more adaptive, behavioral approach can be easier to implement for individuals with comorbid ADHD and depression (Meinzer et al., 2017). Meinzer et al. (2023) already found promising results testing this as a preventive measure for adolescents with ADHD. In this program participants with ADHD completed four in-vivo sessions involving pleasant activity scheduling, social skills refinement, breath work, and positive self-talk exercises. As a result, participants acquired skills to engage in adaptive behavioral emotion regulation and reported lower depressive symptoms. However, these findings remain preliminary due to absence of a control group and the small sample size (n = 6).

Future Research

Previous emotion regulation intervention studies like Meinzer et al. (2023) and Berking et al. (2013) have all been conducted in a youth population. It would be interesting to see how the effective behavioral emotion regulation training would be in an adult population, particularly among adults in the workplace. Ideally, this study would be part of an ecological momentary assessment (EMA), which requires near-real time responses. EMA could capture context-specific differences in for example emotion regulation, typical self-report problems like fatigue and memory bias and could suggest temporal precedence. In an exploratory study, Alawadhi et al. (2023) found promising results with an adaptive version of the CERQ (Kraaij & Garnefski, 2001), supporting EMA as a valuable method for assessing the relationship between depression and cognitive emotion regulation strategies. Ideally, a more developed EMA would capture both the BERQ and CERQ separately to explore the interactive or complementary roles of both strategies. In this design, we recommend including ADHD

severity, because ADHD severity, rather than just the diagnosis of ADHD is associated with emotion regulation and depression (Soler-Gutiérrez et al., 2023; Skirrow & Asherson 2013). Furthermore, our study detected a significant between group difference in attainment for vocational education. Although the subgroup size was small (n = 21), this difference warrants attention for further research on students with ADHD.

Conclusion

This study represents a first step in understanding the role of behavioral emotion regulation strategies in comorbid ADHD and depression. Our findings reaffirm the already well-established link between ADHD and depression within a student population. Contrary to previous literature on emotion regulation, we did not find a higher engagement in maladaptive behavioral emotion regulation strategies among ADHD individuals, nor a moderating effect of adaptive or maladaptive strategies on the relationship between ADHD and depression. The lack of moderation effects may indicate that emotion regulation deficits in ADHD are more cognitive than behavioral in nature. Overall, this study contributes to a more nuanced understanding of emotion regulation in ADHD by emphasizing the need to treat cognitive and behavioral emotion regulation as separate constructs. Moreover, both adaptive and maladaptive behavioral emotion regulation strategies were found to be strongly related to depression for both groups, highlighting the clinical relevance of behavioral emotion regulation. Thus, our findings emphasize the need for early identification of depression and behavioral emotion regulation training for individuals with ADHD, especially with the heightened risk of depression and suicidality for this population in mind.

References

American Psychiatric Association. (2013). *Diagnostic and Statistical Manual of Mental Disorders*. American Psychiatric Publishing.

Augustine, A. A., & Hemenover, S. H. (2009). On the relative effectiveness of affect regulation strategies: A meta-analysis. *Cognition and Emotion, 23*(6), 1181-1220. https://doi.org/10.1080/02699930802396556

Alawadhi, Y. T., Smith, M. R., & King, K. M. (2023). The relations between real-time use of emotion regulation strategies and anxiety and depression symptoms. *Journal of clinical psychology*, *79*(4), 1082–1098. https://doi.org/10.1002/jclp.23458

Aldao, A., Nolen-Hoeksema, S., & Schweizer, S. (2010). Emotion-regulation strategies across psychopathology: A meta-analytic review. *Clinical Psychology Review, 30*(2), 217-237. https://doi.org/10.1016/j.cpr.2009.11.004

Barkley, R. A. (2015). *Attention-deficit hyperactivity disorder: A handbook for diagnosis and treatment*, (4, 81–115). The Guilford Press.

Berking, M., Ebert, D., Cuijpers, P., & Hofmann, S. G. (2013). Emotion regulation skills training enhances the efficacy of inpatient cognitive behavioral therapy for major depressive disorder: a randomized controlled trial. *Psychotherapy and psychosomatics*, *82*(4), 234–245. https://doi.org/10.1159/000348448

Ben-Dor Cohen, M., Nahum, M., Traub Bar-Ilan, R., Eldar, E., & Maeir, A. (2024). Coping with emotional dysregulation among young adults with ADHD: A mixed-method study of self-awareness and strategies in daily life. *Neuropsychological rehabilitation*, *34*(8), 1161–1185. https://doi.org/10.1080/09602011.2023.2279181

Bodalski, E. A., Knouse, L. E. & Kovalev, D. (2019). Adult ADHD, Emotion Dysregulation, and Functional Outcomes: Examining the Role of Emotion Regulation Strategies. *J Psychopathol Behav Assess, 41*, 81–92. https://doi.org/10.1007/s10862-018-9695-1

Bond, D. J., Hadjipavlou, G., Lam, R. W., McIntyre, R. S., Beaulieu, S., Schaffer, A., Weiss, M., &

    Canadian Network for Mood and Anxiety Treatments (CANMAT) Task Force (2012). The

    Canadian Network for Mood and Anxiety Treatments (CANMAT) task force

    recommendations for the management of patients with mood disorders and comorbid

    attention-deficit/hyperactivity disorder. *Annals of clinical psychiatry: official journal of the*

    American Academy of Clinical Psychiatrists, *24*(1), 23–37.

Björkenstam, E., Björkenstam, C., Jablonska, B., & Kosidou, K. (2018). Cumulative exposure to

    childhood adversity, and treated attention deficit/hyperactivity disorder: a cohort study of 543

    650 adolescents and young adults in Sweden. *Psychological medicine*, *48*(3), 498–507.

    https://doi.org/10.1017/S0033291717001933

Caring Universities. (n.d.). *MoodLift*. Retrieved April 14, 2025, from https://moodlift.nl/mind-health-

    check/

Chen, Q., Hartman, C. A., Haavik, J., Harro, J., Klungsøyr, K., Hegvik, T., Wanders, R., Ottosen, C.,

    Dalsgaard, S., Faraone, S.V., Larsson, H., (2018). Common psychiatric and metabolic

    comorbidity of adult attention-deficit/hyperactivity disorder: a population-based

    cross-sectional study. *PLoS One*. *13*(9). https://doi.org/10.1371/journal.pone.0204516

Chronis-Tuscano, A., Molina, B. S. G., Pelham, W. E., Applegate, B., Dahlke, A., Overmyer, M., &

    Lahey, B. B. (2010). Very early predictors of adolescent depression and suicide attempts in

    children with attention-deficit/hyperactivity disorder. *Archives of General Psychiatry, 67*(10),

    1044-1051. https://doi.org/10.1001/archgenpsychiatry.2010.127

Eadeh, H. M., Bourchtein, E., Langberg, J. M., Eddy, L. D., Oddo, L., Molitor, S. J., & Evans, S. W.

    (2017). Longitudinal evaluation of the role of academic and social impairment and parent-

    adolescent conflict in the development of depression in adolescents with ADHD. *Journal of*

    child and family studies, *26*, 2374-2385. https://doi.org/10.1007/s10826-017-0768-7

Fayyad, J., Sampson, N. A., Hwang, I., Adamowski, T., Aguilar-Gaxiola, S., Al-Hamzawi, A., Andrade, L. H., Borges, G., de Girolamo, G., Florescu, S., Gureje, O., Haro, J. M., Hu, C., Karam, E. G., Lee, S., Navarro-Mateu, F., O'Neill, S., Pennell, B. E., Piazza, M., Posada-Villa, J., et al. (2017). WHO World Mental Health Survey Collaborators The descriptive epidemiology of DSM-IV Adult ADHD in the World Health Organization World Mental Health Surveys. *Attention deficit and hyperactivity disorders*, *9*(1), 47–65. https://doi.org/10.1007/s12402-016-0208-3

Faraone, S. V., & Larsson, H. (2019). Genetics of attention de cit hyperactivity disorder. *Molecular Psychiatry*, *24*(4), 562–575. https://doi.org/10.1038/s41380-018-0070-0

Franke, B., Faraone, S. V., Asherson, P., Buitelaar, J., Bau, C. H., Ramos-Quiroga, J. A., Mick, E., Grevet, E. H., Johansson, S., Haavik, J., Lesch, K. P., Cormand, B., Reif, A., & International Multicentre persistent ADHD Collaboration (2012). The genetics of attention deficit/hyperactivity disorder in adults, a review. *Molecular psychiatry*, *17*(10), 960–987. https://doi.org/10.1038/mp.2011.138

Fried, E. I., Proppert, R. K. K., & Rieble, C. L. (2023). Building an Early Warning System for Depression: Rationale, Objectives, and Methods of the WARN-D Study. *Clinical psychology in Europe*, *5*(3), 10075. https://doi.org/10.32872/cpe.10075

Garnefski, N., Kraaij, V., & Spinhoven, P. (2001). Negative life events, cognitive emotion regulation and emotional problems. *Personality and Individual Differences*, *30*, 1311–1327. https://doi.org/10.1016/S0191-8869(00)00113-6

Garnefski, N., & Kraaij, V. (2006). Cognitive emotion regulation questionnaire - development of a short 18-item version (CERQ-short). *Personality And Individual Differences*, *41*, 1045-1053. Retrieved from https://hdl.handle.net/1887/14233

Gross, J. J., & John, O. P. (2003). Individual differences in two emotion regulation processes: Implications for affect, relationships, and well-being. *Journal of Personality and Social Psychology*, *85*(2), 348–362. https://doi.org/10.1037/0022-3514.85.2.348.

Hartman, C. A., Rommelse, N., van der Klugt, C. L., Wanders, R. B. K., & Timmerman, M. E. (2019). Stress Exposure and the Course of ADHD from Childhood to Young Adulthood: Comorbid Severe Emotion Dysregulation or Mood and Anxiety Problems. *Journal of clinical medicine*, *8*(11), 1824. https://doi.org/10.3390/jcm8111824

Hirsch, O., Chavanon, M., Riechmann, E., & Christiansen, H. (2018). Emotional dysregulation is a primary symptom in adult Attention-Deficit/Hyperactivity Disorder (ADHD). *Journal of affective disorders*, *232*, 41–47. https://doi.org/10.1016/j.jad.2018.02.007

Hsu, C. F., Eastwood, J. D., & Toplak, M. E. (2017). Differences in Perceived Mental Effort Required and Discomfort during a Working Memory Task between Individuals At-risk And Not At-risk for ADHD. *Frontiers in psychology*, *8*, 407. https://doi.org/10.3389/fpsyg.2017.00407

JASP Team (2024). JASP (Version 0.19.3)[MacOS Ventura].

Joormann, J., & Stanton, C. H. (2016). Examining emotion regulation in depression: A review and future directions. *Behaviour research and therapy*, *86*, 35–49. https://doi.org/10.1016/j.brat.2016.07.007

Kato T. (2015). Frequently Used Coping Scales: A Meta-Analysis. *Stress and health : journal of the International Society for the Investigation of Stress*, *31*(4), 315–323. https://doi.org/10.1002/smi.2557

Kraaij, V., & Garnefski, N. (2019). The Behavioral Emotion Regulation Questionnaire: Development, psychometric properties and relationships with emotional problems and the Cognitive Emotion Regulation Questionnaire. *Personality and Individual Differences, 137,* 56–61. https://doi.org/10.1016/j.paid.2018.07.036

Kroenke, K., Spitzer, R. L., & Williams, J. B. (2001). The PHQ-9: validity of a brief depression severity measure. *Journal of general internal medicine*, *16*(9), 606–613. https://doi.org/10.1046/j.1525-1497.2001.016009606.x

Kroenke, K., & Spitzer, R. L. (2002). The PHQ-9: A New Depression Diagnostic and Severity Measure. *Psychiatric Annals*, *32*(9), 509–515. https://doi.org/10.3928/0048-5713-20020901-06

Koyuncu, A., Ayan, T., Ince Guliyev, E., Erbilgin, S., & Deveci, E. (2022). ADHD and Anxiety Disorder Comorbidity in Children and Adults: Diagnostic and Therapeutic Challenges. *Current psychiatry reports*, *24*(2), 129–140. https://doi.org/10.1007/s11920-022-01324-5

Liu, Q., Chen, W., Preece, D. A., Xu, D., Li, H., Liu, N., Fu, G., Wang, Y., Qian, Q., Gross, J. J., & Liu, L. (2022). Emotion dysregulation in adults with ADHD: The role of cognitive reappraisal and expressive suppression. *Journal of Affective Disorders*, *319*, 267–276. https://doi.org/10.1016/j.jad.2022.09.058

London, A. S., & Landes, S. D. (2021). Cohort change in the prevalence of ADHD among U.S. adults: Evidence of a gender-specific historical period effect. *Journal of Attention Disorders*, *25*(6), 771–782. https://doi.org/10.1177/1087054719855689

Marx, I., Höpcke, C., Berger, C., Wandschneider, R., & Herpertz, S. C. (2013). The impact of financial reward contingencies on cognitive function profiles in adult ADHD. *PLoS ONE*, *8*(6), https://doi.org/10.1371/JOURNAL.PONE.0067002

Mayer, J. S., Bernhard, A., Fann, N., Boxhoorn, S., Hartman, C. A., Reif, A., & Freitag, C. M. (2021). Cognitive mechanisms underlying depressive disorders in ADHD: A systematic review. *Neuroscience and Biobehavioral Reviews*, *121*, 307-345. https://doi.org/10.1016/j.neubiorev.2020.12.018

Meinzer, M. C., & Chronis-Tuscano, A. (2017). ADHD and the Development of Depression: Commentary on the Prevalence, Proposed Mechanisms, and Promising Interventions. *Current developmental disorders reports*, *4*(1), 1–4. https://doi.org/10.1007/s40474-017-0106-1

Meinzer, M. C., Lewinsohn, P. M., Pettit, J. W., Seeley, J. R., Gau, J. M., Chronis-Tuscano, A., & Waxmonsky, J. G. (2013). Attention-deficit/hyperactivity disorder in adolescence predicts onset of major depressive disorder through early adulthood. *Depression and anxiety*, *30*(6), 546–553. https://doi.org/10.1002/da.22082

Meinzer, M. C., Pettit, J. W., Leventhal, A. M., & Hill, R. M. (2012). Explaining the covariance between attention-de cit hyperactivity disorder symptoms and depressive symptoms: The role of hedonic responsivity. *Journal of Clinical Psychology*, *68*(10), 1111–1121. https://doi.org/10.1002/jclp.21884

Meinzer, M. C., Schwartz, K. T. G., Triece, P., Horn, S. R. & Chronis-Tuscano, A. (2023). From the clinic to the schools: Iterative development of a prevention program for adolescents with ADHD within an urban school system. *Cognitive and Behavioral Practice, 30*(1). 116-132. https://doi.org/10.1016/j.cbpra.2021.10.008

Onandia-Hinchado, I., Pardo-Palenzuela, N., & Diaz-Orueta, U. (2021). Cognitive characterization of adult attention deficit hyperactivity disorder by domains: a systematic review. *Journal of neural transmission*, *128*(7), 893–937. https://doi.org/10.1007/s00702-021-02302-6

Plessen, K. J., Bansal, R., Zhu, H., Whiteman, R., Amat, J., Quackenbush, G. A., Martin, L., Durkin, K., Blair, C., Royal, J., Hugdahl, K., & Peterson, B. S. (2006). Hippocampus and amygdala morphology in attention-14 ADHD and Depression 399 de cit/hyperactivity disorder. *Archives of General Psychiatry, 63*(7), 795–807. https://doi.org/10.1001/archpsyc.63.7.795

Riglin, L., Leppert, B., Dardani, C., Thapar, A. K., Rice, F., O'Donovan, M. C., Davey Smith, G., Stergiakouli, E., Tilling, K., & Thapar, A. (2021). ADHD and depression: Investigating a

causal explanation. *Psychological Medicine, 51*(11), 1890–

1897. https://doi.org/10.1017/S0033291720000665

Sahmurova, A., Arikan, S., Gursesli, M. C., & Duradoni, M. (2022). ADHD Symptoms as a Stressor

Leading to Depressive Symptoms among University Students: The Mediating Role of

Perceived Stress between ADHD and Depression. *International Journal of Environmental

Research and Public Health*, *19*(17), 11091. https://doi.org/10.3390/ijerph191711091

Shafir T. (2016). Using Movement to Regulate Emotion: Neurophysiological Findings and Their

Application in Psychotherapy. *Frontiers in psychology*, *7*, 1451.

https://doi.org/10.3389/fpsyg.2016.01451

Sheppes, G., Suri, G., & Gross, J. J. (2015). Emotion regulation and psychopathology. *Annual review

of clinical psychology*, *11*, 379–405. https://doi.org/10.1146/annurev-clinpsy-032814-112739

Sheppes, G. (2020). Transcending the "good & bad" and "here & now" in emotion regulation: Costs

and benefits of strategies across regulatory stages. *Advances in experimental social

psychology*, *61*, 185–236. https://doi.org/10.1016/bs.aesp.2019.09.003

Skirrow, C., & Asherson, P. (2013). Emotional lability, comorbidity and impairment in adults with

attention-deficit hyperactivity disorder. *Journal of Affective Disorders, 147*(1), 80–86.

https://doi.org/10.1016/j.jad.2012.10.011.

Solberg, B. S., Halmøy, A., Engeland, A., Igland, J., Haavik, J., & Klungsøyr, K. (2018). Gender

differences in psychiatric comorbidity: a population-based study of 40 000 adults with

attention deficit hyperactivity disorder. *Acta psychiatrica Scandinavica*, *137*(3), 176–186.

https://doi.org/10.1111/acps.12845

Ten Have, M., Tuithof, M., van Dorsselaer, S., Schouten, F., Luik, A. I., & de Graaf, R. (2023).

Prevalence and trends of common mental disorders from 2007-2009 to 2019-2022: results

from the Netherlands Mental Health Survey and Incidence Studies (NEMESIS), including

comparison of prevalence rates before vs. during the COVID-19 pandemic. *World psychiatry :*

official journal of the World Psychiatric Association (WPA), *22*(2), 275–285. https://doi.org/10.1002/wps.21087

Thompson, R. A. (1994). Emotion regulation: A theme in search of definition. *Monographs of the Society for Research in Child Development, 59*(2), 25–52, 250– 283. https://doi.org/10.2307/1166137

Seymour, K. E., & Miller, L. (2017). ADHD and Depression: the Role of Poor Frustration Tolerance. *Current developmental disorders reports*, *4*(1), 14–18. https://doi.org/10.1007/s40474-017-0105-2

Shaw, P., Stringaris, A., Nigg, J., & Leibenluft, E. (2014). Emotion dysregulation in attention deficit hyperactivity disorder. *The American journal of psychiatry*, *171*(3), 276–293. https://doi.org/10.1176/appi.ajp.2013.13070966

Soler-Gutiérrez, A. M., Pérez-González, J. C., & Mayas, J. (2023). Evidence of emotion dysregulation as a core symptom of adult ADHD: A systematic review. *Plos one*, *18(*1), e0280131. https://doi.org/10.1371/journal.pone.0280131

Vitulić, H. S., & Prosen, S. (2016). Coping and emotion regulation strategies in adulthood: Specificities regarding age, gender and level of education. *Društvena istraživanja*, *25*(1), 43- 62. https://doi.org/10.5559/di.25.1.03

Watson, J. L. (2023). *Clinical handbook of ADHD assessment and treatment across the lifespan*. Springer.

Yoshimasu, K., Barbaresi, W. J., Colligan, R. C., Voigt, R. G., Killian, J. M., Weaver, A. L., & Katusic, S. K. (2018). Adults With Persistent ADHD: Gender and Psychiatric Comorbidities—A Population-Based Longitudinal Study. *Journal of Attention Disorders*, *22*(6), 535-546. https://doi.org/10.1177/1087054716676342

Appendix A

Patient Health Questionnaire-9 (adapted version)

Over the past 2 weeks, how often have you been bothered by the following problems?

1. Little interest or pleasure in doing things,

2. Feeling down or depressed,

3. Feeling hopeless,

4. Trouble falling asleep or staying asleep,

5. Sleeping too much,

6. Feeling tired or having little energy,

7. Poor appetite,

8. Overeating,

9. Feeling bad about yourself – or that you're a failure or have let yourself or your family

down,

10. Trouble concentrating on things, such as reading or watching television,

11. Moving or speaking so slowly that other people could have noticed,

12. Being so fidgety or restless that you have been moving around a lot more than usual,

13. Thoughts that you would be better off dead or of hurting yourself in some way,

14. Little interest in sex.

Appendix B

Behavioral Emotion Regulation Questionnaire

How do you cope with events? Everyone gets confronted with negative or unpleasant events now and then and everyone responds to them in their own way. What do you generally do when you experience negative or unpleasant events? Read the sentences below and indicate how often they apply to you.

1. I engage in other, unrelated activities.

2. I avoid other people.

3. I try to do something about it.

4. I look for someone to comfort me.

5. I move on and pretend that nothing happened.

6. I set my worries aside by doing something else.

7. I withdraw.

8. I get to work on it.

9. I ask someone for advice.

10. I repress it and pretend it never happened.

11. I do other things to distract myself.

12. I isolate myself.

13. I take action to deal with it.

14. I share my feelings with someone.

15. I behave as if nothing is going on.

16. I engage in an activity which makes me feel good.

17. I close myself off to others.

18. I do whatever is required to deal with it.

19. I look for someone who can support me.

20. I block it out

Appendix C

Correlations of Individual Behavioral Emotion Regulation Strategies

Table 3

Correlations of behavioral emotion regulation strategies.

Variable	n	1	2	3	4	5
1. Ignoring	626	-				
2. Withdrawal	626	.43**	-			
3. Seeking Support	626	-.4**	-.32**	-		
4. Actively Approaching	626	-.27**	-.31**	.36**	-	
5. Seeking Distraction	626	-.33**	.11*	-.03	-.01	-

Note. * = p < .05; ** = p < .001.

Table 4

Correlations of behavioral emotion regulation strategies within the ADHD group.

Variable	n	1	2	3	4	5
1. Ignoring	81	-				
2. Withdrawal	81	.33*	-			
3. Seeking Support	81	-.44**	-.4**	-		
4. Actively Approaching	81	-.265*	-.32*	.37**	-	
5. Seeking Distraction	81	-.31*	.28*	-.05	-.12	-

Note. * = p < .05; ** = p < .001.