

# Emotional Dysregulation And Quality of Life In Young Adults With ADHD- A Cross Sectional Study

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## Research

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# Abstract

**Objective:** Attention Deficit Hyperactivity Disorder (ADHD) is associated with emotional dysregulation (ED) and impaired quality of life (QoL). However, the role of ED in explaining the relationship between ADHD and QoL is unclear. The purpose of the present study was to do so in a sample of non-referred young adults with and without ADHD.

**Method:** The study design was cross-sectional. A non-clinical sample of 62 young adults with ADHD (mean age = 24.86 years, SD = 3.25) and 69 controls (mean age = 23.84 years, SD = 2.59) were recruited. The Adult ADHD Quality-of-Life scale was used to measure QoL; The Adult ADHD Self-Report Scale was used to measure ADHD symptoms. The Self-Report Wender-Reimherr Adult Attention Deficit Disorder Scale and the Difficulties in Emotion Regulation Scale were used to measure ED. Group differences on all measures were tested using univariate and multivariate analyses of covariance, while controlling for age. Univariate analyses of variance were conducted to investigate the possible effect of medication on all outcome measures in the ADHD group. Finally, a moderation analysis was used in order to examine the impact of ED on QoL beyond that accounted for by ADHD symptoms.

**Results:** Both QoL and ED were significantly worse for the ADHD group compared to the control group. The medication status of the ADHD group participants had no significant effect on the level of ADHD symptoms, ED or QoL. ED moderated the effect of ADHD symptoms on QoL for the ADHD group.

**Conclusion:** The findings support the centrality of ED in ADHD and its crucial influence on QoL. Young adults with ADHD and high levels of ED are at risk for aversive impact on their well-being regardless of their ADHD symptoms level.

## Background

Quality of Life (QoL) is a multidimensional concept that reflects one's subjective perception of his/her position in life in relation to their goals, expectations, standards, and concerns (1, 2). Different health conditions could negatively affect one's ability to live a fulfilling life, as a consequence of specific symptoms, impairments, and changes in functional state (3). At the same time, QoL is distinct from the symptoms and objective functional outcomes of different health conditions. Thus, any symptom can lead to multiple impairments in different life roles, leading to a synergistic negative impact on daily life. As a result, the overall long-term burden of a chronic health condition is often greater than the simple sum of individual functional impairments (4). This places QoL as a significantly important clinical outcome in the assessment of the impact of health conditions on an individual's meaningful occupations and well-being (2, 5–10).

Attention Deficit Hyperactivity Disorder (ADHD) is a neurodevelopmental disorder, characterized by core symptoms of inattention, impulsivity, and hyperactivity (11). The worldwide prevalence of ADHD in young adults is estimated to be 5% (12). QoL has been shown to be significantly compromised in the heterogenic population of adults with ADHD (4, 9, 13, 14). Specifically, previous studies that examined

QoL in college students with and without an ADHD diagnosis found that young adults with ADHD reported low QoL compared to their non-ADHD peers (5, 15). In addition, ADHD symptom severity and functional impairment have been shown to predict lower QoL in adults with ADHD (16–21). Yet, the relatively moderate effect sizes of the associations between ADHD symptoms and QoL imply that there may be additional factors contributing to QoL in adult ADHD (22). Specifically, pharmacological and psychosocial treatments, comorbid psychopathology, and drug use did not moderate the relationship between ADHD and QoL (15). Further investigation is therefore needed in order to better understand which ADHD-associated factors significantly impact QoL in young adults with ADHD.

Emotion dysregulation (ED), an individual's inability to modify one's emotional state to promote adaptive, goal-oriented behaviors (23) has been hypothesized as a factor which may impact QoL in ADHD (2, 24). ED is highly prevalent in adults with ADHD, with recent clinic-based studies reporting impaired ED in 32%-86% of adults with ADHD (25–30). The definition and measurement of ED are in substantial disarray in general, and specifically in ADHD, reflecting different perspectives on the relationship between ED and ADHD (31). On the one hand, ED was suggested to be an additional core symptom specific to ADHD or at least to a subtype of ADHD with which certain facets of ED are uniquely associated (such as temper control, affective lability, emotional over reactivity, emotional impulsivity and deficient emotional self-regulation) (31–35). This perspective is supported by the high prevalence of ED in ADHD, regardless of comorbidities (27, 34). Moreover, ED is associated with ADHD symptom severity and respond to pharmacological and psychotherapeutic treatments in adults, similarly to ADHD core symptoms (29, 36–40). On the other hand, however, ED is proposed as another dimensional key factor within the Research Domain Criteria Initiative (RDoc) that could distinguish between people with and without many mental disorders (18). This may imply that ADHD-associated ED is not specific to ADHD; instead, it has transdiagnostic mechanisms and etiology which are shared with other clinical conditions (such as the ability to monitor and accept one's emotional state, to control impulsive reaction and to use effective strategies in order to engage in goal-directed behaviors) (41). This ongoing debate regarding the ADHD-specific vs. transdiagnostic nature of ED in ADHD, and the lack of agreed upon measurement approaches, warrants combining different measures to capture both perspectives on ED.

Regardless of the exact definition of ED in the context of ADHD, the presence of ED in ADHD is associated with multiple functional impairments (such as, social participation, marital status, driving, money management and arrests). ED, as measured by ADHD-related instruments, is associated with higher levels of impairment in clinical samples of adults and young adults with ADHD, beyond what could be predicted by ADHD symptoms and comorbidity (25, 34, 42). Using a general transdiagnostic assessment tool, ED was found to mediate the relationship between ADHD and functional impairment in adults with ADHD (43). Also, the negative effect of ADHD symptoms level on the quality of romantic relationships was no longer significant when ED was added as a mediator in a sample of college students (44).

Interestingly, only a handful of studies have examined the direct contribution of ED to QoL in ADHD, yielding mixed results. Using a clinical sample of adults with ADHD, two studies reported that ED severity was significantly associated with ADHD symptoms severity and with QoL, regardless of medication

status (42, 45). On the other hand, in a study which examined the neuropsychological factors in a general population of young adults, ED was not found to be a unique contributor to QoL beyond other neuropsychological deficits (46). No study to date, to the best of our knowledge, has directly examined the impact of ED on QoL in a sample of young adults with ADHD beyond that of ADHD symptoms. Understanding the unique impact of ED on QoL is expected to deepen our understanding of the highly varied clinical picture of young adults with ADHD and its effects on one's daily living experiences and well-being.

In the current study, we examined the potential moderating effect of ED on the relationship between ADHD symptoms and QoL in non-referred young adults with ADHD. We first examined the differences in ED between adults with and without ADHD using two different self-report measures, collectively reflecting both the transdiagnostic and the ADHD-related nature of ED. Next, we examined the moderating role of ED in explaining QoL in young adults with ADHD beyond the scope of ADHD symptoms. This study should contribute to understanding of the variance of QoL among the heterogenic population of young adults with ADHD.

## Methods

### Participants

Over a period of 1 year (from January 2018 to January 2019) 159 young adults were recruited for the study. Inclusion criteria for the ADHD group were a valid medical diagnosis of ADHD and a score above the clinical cutoff ( $\geq 51$ ) on the Adult ADHD Self-Report Scale (ASRS) (47, 48). Inclusion criterion for the healthy comparison group was an ASRS score below the clinical cutoff. Exclusion criteria for both groups were a diagnosis of a psychiatric or neurological disorder or other major health conditions as determined by self-report. Twenty-eight participants were excluded: in the control group, two participants reported a diagnosis of a psychiatric disorder and eight participants scored above the clinical cutoff of the ASRS. In the ADHD group, 13 participants scored below the clinical cutoff of the ASRS. 132 young adults (ages 18–33) were included in the current study: sixty-two adults with ADHD and 69 gender-matched (at the group level) controls. Inclusion criteria for the ADHD group were a valid medical diagnosis of ADHD and a score above the clinical cutoff ( $\geq 51$ ) on the Adult ADHD Self-Report Scale (ASRS) (47, 48). Inclusion criterion for the healthy comparison group was an ASRS score below the clinical cutoff. Exclusion criteria for both groups were a diagnosis of a psychiatric or neurological disorder or other major health conditions as determined by self-report. The sample was balanced across the two groups with respect to gender. However, since the ADHD group was slightly older, age was entered as a covariate in group comparison analyses (see Table 1). Medication status for ADHD group participants was recorded and controlled for in data analyses (see Table 2).

Table 1  
Demographics Characteristics of Study Sample

	ADHD (N = 63)	Controls (N = 69)	<i>t</i> or $\chi^2$	<i>P</i> Value
Characteristics	N (%)	N (%)		
<b>Gender</b>				
Female	33 (52.4)	38 (55.1)	.096	.757
Male	30 (47.6)	31 (44.9)		
<b>Age, M (SD)</b>	24.86 (3.25)	23.84 (2.59)	1.997	.048*
<b>Education</b>				
High school graduate	14 (21.2)	4 (5.7)	7.544	.006**
University or post graduate degree	49 (77.8)	66 (94.3)		
<b>Current productive role</b>				
Student	35 (55.6)	43 (62.3)	3.550 <sup>a</sup>	.299
Working	11 (17.5)	7 (11.5)		
Both	14 (22.2)	18 (26.2)		
Unemployed	3 (4.8)	-		
<b>Family status</b>				
Single	38 (60.3)	41 (59.4)	.011	.916
Married/ partnered	25 (39.7)	28 (40.6)		
<b>ADHD Symptoms<sup>b</sup>, M (SD)</b>	60.79 (6.35)	39.84 (6.62)	18.524	.000***
<b>Medication status</b>				
Daily	14 (22.2)	-		
Irregular use	31 (49.2)	-		
None	18 (28.6)	-		
Note. <i>M</i> = mean; <i>SD</i> = standard deviation; <sup>a</sup> Fisher's Exact Test; <sup>b</sup> adult ADHD Self Report Scale (ASRS) total score.				
* <i>p</i> < .05; ** <i>p</i> < .01; *** <i>p</i> < .001.				

Table 2. The effect of medication status on outcomes in the ADHD group

	Daily	Irregular use	None			
	M (SD)	M (SD)	M (SD)	F	p	$\eta^2$
				(2,60)		
ASRS	60.01 (6.55)	61.68 (6.37)	59.83 (6.33)	.588	.559	.019*
WRAADS ED	19.71 (10.29)	18.81 (10.43)	19.17 (10.56)	.037	.964	.001**
DERS	84.07 (24.48)	89.23 (22.85)	89.89 (30.35)	.247	.782	.008**
AAQoL	60.24 (16.89)	56.30 (14.15)	60.04 (17.78)	.459	.634	.015*

Note. *M* = mean; *SD* = standard deviation; ASRS= adult ADHD Self Report Scale total score; WRAADS ED = Emotional Dysregulation total score derived from the Wender-Reimherr Adult Attention Deficit Disorder Rating Scale; DERS= Difficulties in Emotion Regulation Scale total score; QoL= The adult ADHD quality of life questionnaire total score.

\*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$ .

## Study design

The current study is a part of a larger cross-sectional study which included ecological momentary assessments for 5 days in addition to baseline assessments. Here we report the results of the baseline data. Participants were recruited for the study via online advertisements in student organization groups and via posts in social media. Eligible participants were invited to the Computerized Neurotherapy Laboratory at the Hebrew university where baseline assessments took place. All participants signed an informed consent form prior to participation in any study-related activities. Participants were compensated for their participation in the study, receiving US\$100 for completion of the entire study. The study was approved by the Institutional Review Board (IRB) Ethics Committee of the Hebrew University of Jerusalem (reference ID: 08112017).

## Measures

ASRS (version 1.1) Symptom Checklist (48) is an instrument designed to measure current ADHD symptoms. The scale consists of 18 items based on the DSM-IV (American Psychiatric Association, 2000) criteria for ADHD that are measured on a 5-point scale (0 = never and 4 = very often), yielding a total score which is comprised of the sum of all items and ranging from 0 to 72. A screener score of 51 and over was found to be the most predictive of symptoms consistent with ADHD (47). In the current study we used the ASRS Hebrew version which has high test–retest reliability ( $r = .60-.90$ ), a significant discriminant validity and good internal consistency ( $\alpha = .82-.89$ ), (Zohar, Gonen, & Yemini, 2007 in stern 2017), which was found also in the current study ( $\alpha = .89$ ).

WRAADS ED, ED severity was assessed using 3 sub-scales from the Self-Report Wender-Reimherr Adult Attention Deficit Disorder Scale (SR-WRAADS; (32)): temper, affective lability, and emotional over-reactivity. Collectively, the 11 items within the 3 subscales assess emotional symptoms in adult ADHD.

Each item is measured on a 5-point scale (0 = None or slightly, 4 = very much), yielding scores that may range from 0 to 44. The scale calculation is based on Wender's theoretical definition (1995), resulting ED cutoff achieved with a sum  $\geq 11$  (50). The SR-WRAADDS is based on the interviewer-administered Wender Reimberr Adult Attention Deficit Disorder Scale (WRAADDS; (51)). Similar ED scale based on the WRAADS has been used in several previous studies (27, 28, 36, 37, 52). The internal consistency reflected the homogeneity of all the WRAADDS subscales, including ED. Cronbach's  $\alpha$  for the entire WRAADDS was .88. ED indicated the highest internal consistency (Cronbach's  $\alpha = .78$ ) compared to the other WRAADDS subscales ( $\alpha = .65-.73$ ) (27). The SR-WRAADDS was translated to Hebrew by our study team with permission from the scale's authors. In the current study the internal consistency (i.e., coefficient  $\alpha$ ) for the ED subscales ranged from .80 to .91 and .92 for the total score.

The Difficulties in Emotion Regulation Scale (DERS; (41)) was developed to assess ED more comprehensively than existing measures. The DERS 36 items were chosen to reflect difficulties within the following dimensions of emotion regulation: (a) lack of awareness of emotional responses (awareness), (b) lack of clarity of emotional responses (clarity), (c) non-acceptance of emotional responses (non-acceptance), (d) limited access to emotion regulation strategies perceived as effective (strategies), (e) difficulties controlling impulses when experiencing negative emotions (impulse), and (f) difficulties engaging in goal-directed behaviors when experiencing negative emotions (goals). Each item is measured on a 5-point scale (1 = almost never, 5 = almost always), yielding scores that may range from 36 to 180, with higher scores indicating greater difficulties in emotion regulation (i.e., greater ED). The DERS has high internal consistency ( $\alpha = .93$ ) (41). Here we used the validated Hebrew version (53). The scale's internal consistency for the current study ranged from .70 to .89 for the various subscales and .95 for the total score.

The Adult ADHD Quality-of-Life scale (AAQoL; (4)) is one of the most commonly used disease-specific instruments to measure QoL in adults with ADHD in both research and clinical practice (54, 55). The AAQoL consists of 29 items rated on a five-point scale describing frequency of occurrence, yielding a total score and four subscale scores: productivity, life outlook, relationships and psychological health. Total and subscale raw scores are transformed to a 0- to 100-point scale with higher scores indicating better QoL. The AAQoL has good internal consistency (Cronbach alpha = .93) and good test-retest reliability (ICC alpha = .86) and is able to discriminate between groups with and without ADHD (4, 13). The Hebrew version used here has demonstrated validity in Israeli adults with ADHD (7). The internal consistency for the current study ranged from .74 to .90 and .94 for the total score.

## Statistical Analysis

All analyses were conducted using the IBM SPSS software Version 25.0 (56). Group differences in demographic variables were examined using chi-square, Fisher's exact tests or independent samples t tests. Univariate analyses of variance (ANOVA) were conducted to investigate the possible effect of medication on the level of ADHD symptoms, ED and QoL in the ADHD group. We first assessed the differences between ADHD and controls on WRAADS ED, DERS and AAQoL total scores using univariate analyses of covariance (ANCOVA), while controlling for age. Next, the differences between groups in ED,

DERS and QoL subscales were examined using multivariate analyses of covariance (MANCOVA), while controlling for age. Finally, we conducted moderation analysis using PROCESS analysis by Hayes (2017; 58). The distributions of all study variables met normality criteria of Kolmogorov Smirnov test. The significance level for general hypothesis testing was set at  $\alpha = .05$ .

## Results

### *Participants' Characteristics*

A total of 155 participants were considered for eligibility, but the final study sample included 132 participants. Thirteen ( $n = 13$ ) participants were excluded from the ADHD group due to an ASRS score below the clinical cutoff. In addition, ten participants were excluded from the control group: 2 due to a psychiatric diagnosis and 8 due to an ASRS score above the cutoff. The final study sample therefore included a total of 132 participants: 63 in the ADHD group and 69 participants in the healthy comparison group.

The demographic characteristics of the study sample are shown in Table 1. Gender, current productive role and family status were comparable in the two groups. However, the average age in the ADHD group was slightly higher than that of the comparison group ( $24.86 \pm 3.25$  vs.  $23.84 \pm 2.59$  for ADHD and comparison groups, respectively;  $p = .048$ ). As expected, the ASRS scores and the ED scores were significantly worse for the ADHD group, and participants in the ADHD group were less educated. The medication status of the ADHD group participants had no significant effect on the level of ADHD symptoms, ED or QoL (see Table 2).

### *ADHD, ED and QoL*

Total scores for the WRAADS ED, DERS and AAQoL in the two groups are presented in Table 3. A one-way ANCOVA, controlling for age, showed significantly higher (i.e., worse) scores in WRAADS ED and in DERS and significantly lower (i.e., worse) scores in the AAQoL in the ADHD compared with the comparison group. Specifically, 73% of ADHD group participants scored above WRAADS ED cutoff (a total score sum  $\geq 11$ ) compared to 37.7% in the control group [ $\chi^2(1, N=63) = 16.584, p = .000$ ]. To further investigate where the differences lie, one-way MANCOVAs were performed. Results show significantly higher (worse) scores in all WRAADS ED and DERS subscales and significantly lower (worse) scores in all AAQoL scales in the ADHD group (see Table 3), with overall effects for WRAADS ED [ $F(3,127) = 23.434, p = .000, \eta^2 = .356$ ], DERS [ $F(6,124) = 6.235, p = .000, \eta^2 = .232$ ], and AAQoL [ $F(4,126) = 13.048, p = .000, \eta^2 = .293$ ]. The WRAADS ED scales *temper control* and *over reactivity* showed a large effect size ( $\eta^2 = .155 - .150$ ) and the *affective lability* scale showed the largest effect size ( $\eta^2 = .324$ ). Among the DERS scales, *awareness* showed a small effect size ( $\eta^2 = .033$ ), *clarity*, *non-acceptance*, *impulse*, and *strategies* showed a medium effect size ( $\eta^2 = .066 - .133$ ), and *goals* showed a large effect size ( $\eta^2 = .249$ ). Finally, the effect size of the AAQoL scales were small for *life outlook* ( $\eta^2 = .053$ ), medium for *relationships* and *psychological health* ( $\eta^2 = .097 - .106$ ), and large for *life productivity* ( $\eta^2 = .288$ ).

**Table 3. Group differences on ED and QoL scales and subscales**

	ADHD	Control		
	M (SD)	M (SD)	F (df, df error)	$\eta^2$
<b>DERS</b>				
Non acceptance	14.52 (5.99)	11.20 (3.96)	14.103***	.113
Goals	16.22 (4.47)	12.35 (3.44)	34.972***	.249
Impulse	12.05 (5.73)	9.16 (3.09)	15.476***	.122
Awareness	15.59 (4.41)	13.88 (3.92)	4.378**	.033
Strategies	18.52 (7.61)	13.94 (4.66)	19.577***	.133
Clarity	11.37 (4.60)	9.47 (3.01)	8.981**	.066
Total	89.28 (26.30)	69.38 (14.06)	29.78***	.190
<b>WRAADS ED</b>				
Temper control	1.23 (1.16)	0.45 (0.68)	23.289***	.155
Affective lability	2.07 (0.92)	1.07 (0.57)	60.947***	.324
Over reactivity	1.79 (1.21)	0.99 (0.79)	22.368***	.150
Total sum	19.22 (10.62)	9.28 (6.05)	44.05***	.258
	1.75 (0.97)	0.84 (0.55)		
<b>AAQoL</b>				
Life productivity	55.18 (18.92)	76.75 (13.94)	52.201***	.288
Life outlook	60.87 (17.06)	68.94 (13.93)	7.267**	.053
Psychological health	56.26 (23.65)	69.38 (17.40)	15.225***	.106
Relationships	63.97 (19.60)	75.15 (13.28)	13.926***	.097
Total	58.38 (16.18)	73.30 (15.70)	37.21***	.227
<p>Note. <i>M</i> = mean; <i>SD</i> = standard deviation; DERS= Difficulties in Emotion Regulation Scale total score; WRAADS ED = Emotional Dysregulation subscales derived from the Wender-Reimherr Adult Attention Deficit Disorder Rating Scale; AAQoL= The adult ADHD quality of life questionnaire total score.</p> <p>* <math>p &lt; .05</math>; ** <math>p &lt; .01</math>; *** <math>p &lt; .001</math>.</p>				

To test the hypothesis that ED moderates the relationship between ADHD symptoms and QoL for individuals with ADHD, we used moderating model 1 of the PROCESS analysis by Hayes (2013). We found a significant interaction ( $B = .045$ ,  $SE = .022$ ,  $t = 2.076$ ,  $p = .042$ ) between ASRS total score and WRAADS ED total score, indicating that the effect of ADHD symptoms on QoL (AAQoL total score) is moderated by ED (see Table 4). As can be seen in Fig. 1, as the level of ED gets higher, the relationship between ADHD symptoms and QoL is weakened. The interaction was significant also for the DERS as a measure of ED ( $B = .027$ ,  $SE = .009$ ,  $t = 2.958$ ,  $p = .004$ ).

Table 4  
Moderation model

Dependent variable = QoL total					
Predictors	$\beta$	B	SE	t	P
ASRS	-.245	-.607	.230	-2.630	.011*
WRAADS ED	-.652	-.998	.145	-6.884	.000***
ASRS × WRAADS ED	.188	.045	.022	2.076	.042*

Note. B = unstandardized coefficients; SE = Standard Error; ASRS = adult ADHD Self Report Scale total score; WRAADS ED = Emotional Dysregulation total score derived from the Wender-Reimherr Adult Attention Deficit Disorder Rating Scale; QoL = The adult ADHD quality of life questionnaire total score.

## Discussion

The present study had two main goals: to assess the severity of ED among young adults with and without ADHD, and to measure the potential moderating role of ED on the association between ADHD symptoms and QoL in young adults with ADHD. Our results show that young adults with ADHD are twice more likely to suffer from ED and that their QoL is significantly worse than that of matched non-ADHD controls. In addition, for the ADHD group, ED significantly moderated the relationship between ADHD symptoms and QoL, suggesting that high ED levels can overshadow the impact that ADHD symptoms have on QoL. These findings support the centrality of ED in ADHD and their crucial influence on everyday QoL.

Our study provides novel findings regarding the likelihood of young adults with ADHD to experience ED. The high prevalence of self-reported ED found in our sample (73%) is noteworthy, particularly given the non-clinical nature of the sample. Thus far, clinic-based studies have reported a wide range (34%-86%) of ED in adults with ADHD (25–30). A recent study conducted in a clinical sample of adults with ADHD (aged 18–75) reported a similar prevalence of ED as was found in our study (70.5%) using the WRAADS scale (27). The disparity between the lower expected prevalence in a non-clinical sample and the actual high prevalence that was found, might be attributed to the younger age of our sample. Indeed, younger age was associated with higher ED severity on the sub-scales of temper control and affective lability in a recent study on adults with ADHD using the WRAADS-SR scale (32). The prominence of ED in young

adults with ADHD in the current study adds to the existing literature which favors the inclusion of ED as a central dimension in ADHD (2, 25, 33–35, 42, 45).

The significant impairments in all domains of QoL (productivity, life outlook, psychological health and relationships) in ADHD are in line with the large body of literature emphasizing the negative impact of ADHD on daily health outcomes (2, 4, 13, 14). So far, studies on adults with ADHD focused mainly on the adverse impact that ED has on functional impairments in ADHD, which goes well beyond ADHD symptoms (25, 34, 42). In contrast to the measurement of functional impairment, which measures individual performance parameters in a specific task or context, such as work or driving performance, QoL assessment allows for a wider perspective on productivity, relationships and well-being. However, only two studies to date reported significant associations between QoL in ADHD and a subset of ED constructs, namely emotional impulsivity and deficient emotional self-regulation (42, 45). The current study adds an additional component by showing the unique contribution of multiple ED aspects to QoL, beyond the contribution of ADHD symptoms.

The significant moderating role of ED as measured by both an ADHD-specific tool and a general transdiagnostic tool provides a broader perspective of the impact of different aspects of ED on QoL in young adults with ADHD. The impact of the basic characteristics of the emotional experience and expression of ED, specifically in ADHD as reflected by the WRAADS ED subscales on QoL, should be noted. The frequent shifts between emotional states, the disproportional over-reactivity to daily triggers, and the lack of control in face of intense negative emotions causes constant unpredicted interferences in daily life. In addition, the resulted sense of lack of control and coherence regarding the ability of an individual to react as expected might explain the harmful impact of ED on all aspects of QoL. The DERS, focusing on the cognitive and behavioral responses to negative emotional states may further explain the negative impact of ED on QoL. The difficulties in monitoring one's emotional state might obscure the identification of the need to detect and implement effective regulatory strategies and control the reaction to negative stimuli. All of these taken together might explain the severe impact of ED on goal-directed behavior. This in turn, resonates with theories of ADHD emphasizing inherent contribution of ED to the executive failure, suggesting constructs such as emotional impulsivity as another core symptom of the disorder (31, 33). Moreover, the non-acceptance of one's emotional state may point to a secondary mechanism which further exacerbates of the impact of ED on QoL, by impeding an adaptive coping process. This notion is supported by a moderating role of non-acceptance that was found in the relationship between ADHD, depressive symptoms and suicidal ideation (58). To conclude, the significant moderating role of ED found in both DERS and WRAADS ED represents the joint contribution of multiple emotional, cognitive, and behavioral ED aspects to the impaired QoL in young adults with ADHD.

The broader perspective on ED in the current study can also be discussed in light of the question whether there are facets of ED that are uniquely associated with ADHD (23, 31, 33, 35, 59). Here, we used two different tools to assess ED in ADHD: an ADHD-specific tool (WRAADS ED) and a general transdiagnostic tool (DERS) and show substantial ED in ADHD compared to controls using both scales. However, a slightly different picture emerges for the unique ED deficits characterizing ADHD from each tool. For the

ADHD-specific ED scale, the subscales of temper control, affective lability and emotional over-reactivity have all yielded large effect sizes for the between-group difference. These findings are consistent with a recent meta-analysis which found large effect sizes for ED severity of ADHD vs. controls (60), specifically in the domains of temper control, affective lability, emotional over reactivity, emotional impulsivity and deficient emotional self-regulation (31–35, 45). In comparison, the more general, transdiagnostic measure of ED (DERS) yielded a more varied picture, wherein only the *goals* subscale showed a large effect size for group differences; the *awareness* subscale showed a small effect size and the remaining subscales of *clarity*, *non-acceptance*, *impulse*, and *strategies* showed medium effect sizes. These findings may reflect a unique profile of ED in young adults with ADHD. Yet, they require further replication and examination in a larger sample, testing whether there are facets of ED that are uniquely associated with ADHD.

The debate regarding the specificity of ED to ADHD vs its transdiagnostic nature could also be addressed by our findings of significant interaction between ED and ADHD in explaining QoL. Our findings show that the strength of association between ADHD symptoms and QoL depends on the severity of ED. Thus, higher levels of ED account for the reduced QoL seen in individuals who posit lower levels of ADHD symptoms. The high prevalence of ED in the ADHD group and the large effect size compared to the control group might support the positioning of ED as a central core symptom in ADHD (27, 31, 33). Yet, the different pattern of clinical outcomes that depends on ED severity in young adults with ADHD might support the notion that those that have both ADHD *and* high levels of ED form a distinct entity or sub-type (35, 45, 61).

The results of our study have a few clinical implications which underscore the need for the inclusion of a broader assessment addressing ED (among other impairing factors associated with ADHD) (24) and QoL in adults with ADHD. Neglecting the potentially harmful impact of ED on the well-being of young adults with ADHD in clinical practice may lead to an inaccurate appraisal of the global clinical severity among young adults. Moreover, this understanding, in turn, should encourage further research targeting the underlying mechanisms of ED and the development of effective interventions aimed to improve ED and QoL among individuals with ADHD. Specifically, the inclusion of self-compassion might serve as a protective mechanism from the possible negative effect of heightened awareness and non-acceptance, reducing the secondary effect of ED on QoL (62–65).

Despite its strengths, which included the use of multiple ED assessments and the non-referred sample of young adults with and without ADHD, in contrast to the majority of studies in this field which sample participants from clinics, our study had a few limitations that should be noted. First, the ADHD diagnosis was based on a self-reported valid medical diagnosis of ADHD confirmed by ASRS scores above clinical cutoff, rather than on a clinical interview based on DSM-5 criteria. In addition, our study included only self-report measures of ED and QoL, whereas more objective measures might have yielded different outcomes and should be considered in future studies. Finally, university students in Israel are typically older than elsewhere, due to the obligatory 2- or 3-year national service, potentially limiting this study's external validity.

## Conclusion

Our results point to the high prevalence of ED in non-referred young adults with ADHD, and to the importance of ED in moderating the association between ADHD symptoms and QoL. Thus, high levels of ED explain the significant burden on QoL in ADHD beyond symptomatology. Our study is consistent with the literature which found a more severe clinical picture in adults with ADHD who also have high levels of ED (35, 45, 61). These results stress the significance of ED in everyday life of those struggling with ADHD and call for a more systematic evaluation of ED in the ADHD population.

## Abbreviations

QoL: Quality of Life

ADHD: Attention Deficit Hyperactivity Disorder

ED: Emotion dysregulation

ASRS: Adult ADHD Self-Report Scale

SR-WRAADS: Self-Report Wender-Reimherr Adult Attention Deficit Disorder Scale

DERS: The Difficulties in Emotion Regulation Scale

AAQoL: The Adult ADHD Quality-of-Life scale

## Declarations

Ethical approval and consent to participate: The study was approved by the Institutional Review Board (IRB) Ethics Committee of the Hebrew University of Jerusalem (reference ID: 08112017).

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Authors' contributions: MBDC, MN, AM designed the experiment, MBDC ran the experiment and analyzed the data. All authors discussed the results and contributed to the manuscript. All authors read and approved the final manuscript.

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## Figures

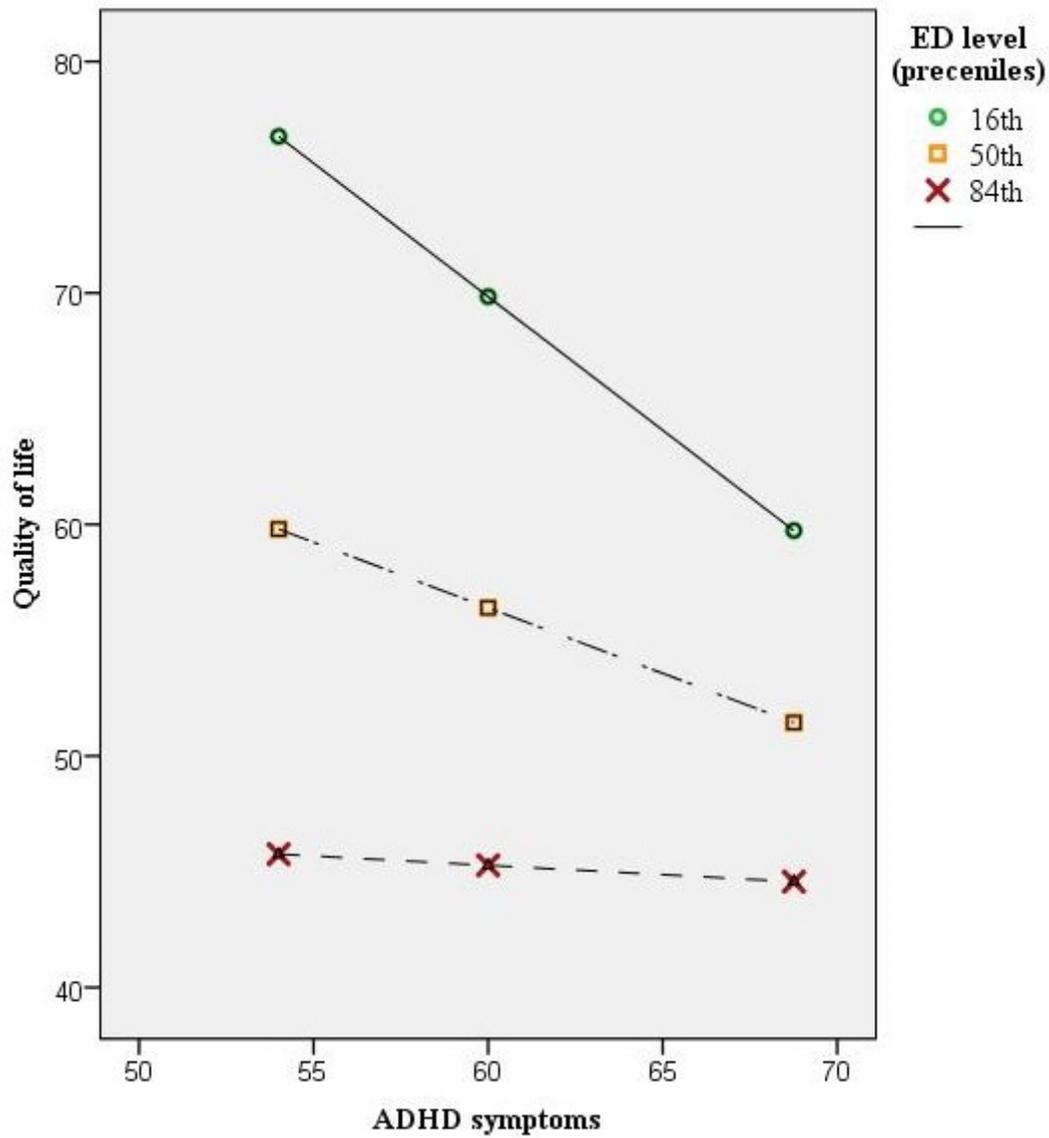


Figure 1

Interactions of ED and ADHD symptoms predicting QoL