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Emotion Regulation in the Associations of Inattention/Hyperactivity with Distress

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Objectives: In this paper, we explore how emotion regulation strategies mediated in the associations between inattention/hyperactivity and psychological distress (including anxiety and depression) among young adults who sought mental health services. **Methods:** Students with mental health issues (N=83; age = 19.98 years [SD = 2.11]) completed measures assessing ADHD, emotion regulation, and psychological distress. We analyzed the data mainly using parallel mediation models. **Results:** There were direct positive associations between inattention and self-blame, blaming-others, anxiety, and depression. Similarly, hyperactivity positively affected self-blame, blaming-others, and depression but not anxiety. Moreover, self-blame and blaming-others served as mediators between inattention and depression (but not anxiety). However, only self-blame mediated the association between hyperactivity and anxiety, and depression. **Conclusions:** Inattention and hyperactivity could use different paths to trigger other mental health illnesses when maladaptive emotion regulation strategies are used. Clinicians and other health experts should address the most effective ways of mitigating emotional issues among young adults.

Keywords: Blaming-others, Self-blame, Hyperactivity, Attention Deficit, Anxiety, Depression.

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ADHD (i.e., attention deficit hyperactivity disorder), being one common neurodevelopmental disorder, is usually diagnosed in childhood and may last into adulthood.[1] Its main feature contains a persistent pattern of hyperactivity-impulsivity and/or inattention that interferes with several important areas of functioning or development.[1,2] ADHD manifests behaviorally as inattention (e.g., lack of focus and disorganization or not being able to keep focus), hyperactivity (e.g., excessive, inappropriate motor activity or movement that is not fitting to the setting), and impulsivity (e.g., rash actions without forethought). These characteristics vary among individuals and across life stages.[1,2] The prevalence of ADHD globally among the pediatric population is 8.0%.[3] Moreover, prevalence was 2.58% for persistent adult ADHD and 6.76% for symptomatic adult ADHD.[4] This indicates the pervasiveness of those with symptomatic ADHD in the community. However, of much more importance is the debilitative effect of ADHD on the mental health, social or interpersonal, and

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academic or professional life of the affected individual.[1,5-9]

One of the main problems of ADHD is the co-occurrence of other symptoms or diagnoses, such as substance use disorders, anxiety, and depression[8,10] For example, university students with symptomatic ADHD were found to have the following issues: (1) are unable to cope with repeatedly worries with negative thoughts, (2) having troubles in time management that leads to irregular lifestyles, (3) are unsatisfied with their academic performance and social interactions that contribute to reduced self-esteem and self-dissatisfaction.[11] In part, these problems are due to the struggle and maintenance of relationships among neurotypical individuals with stigma and communication difficulties which may promote the use of masking to conceal their symptoms.[12] One can argue that some of the challenges experienced by individuals with ADHD can be avoided because a majority of these individuals reportedly use maladaptive coping strategies including emotion dysregulation which triggers the mental health, social or interpersonal, and academic or professional life challenges.[1,5-8]

Several emotion regulation strategies can be used by individuals to deal with their emotions.[13,14] Based on how these are applied, these strategies can be adaptive (i.e., functional; strategies that help to achieve the desired emotional state) or maladaptive (i.e., dysfunctional; strategies that are unhelpful in achieving the desired emotional state or found to be related to subsequent emotional or psychological challenges).[13-15] Specifically for cognitive emotion regulation (i.e., managing emotionally arousing information using cognitive methods), 9 strategies for dealing with an individual's emotions can be used either adaptively (i.e., acceptance, putting into perspective, positive reappraisal, positive refocusing, and refocus on planning) or maladaptively (i.e., catastrophizing, rumination, self-blame, and blaming others).[13,15] Gross[16] and Gross and Ford[17] provide extensive reviews on emotion regulation and its strategies.

Individuals with ADHD have been found to have emotion regulation dysfunction. Emotion regulation dysfunction causes severe problems across various life domains of 34%-70% of adults with ADHD.[18] That is, individuals with ADHD find it challenging to deal with emotions effectively, which in turn, leads to more challenges with their mental health, occupational, academic, and/or social functions. Emotional dysregulation in ADHD may be due to challenges in focusing on, identifying, and/or directing attention towards emotional stimuli which implicates the dysfunction within the brain's striato-amygdalo-medial prefrontal cortical network.[18]

This is also aligns with the impaired disengagement hypothesis. This hypothesis proposes that attentional control deficits and disengaging attention difficulties result in problems with emotion regulation, which is associated with inattention and psychological distress, especially among individuals with ADHD.[19,20] Consequently, the individuals will use maladaptive emotion regulation strategies such as catastrophizing, rumination, blaming-others, and self-blame. However, using these maladaptive strategies may not be helpful; instead, they may encourage more challenges. Therefore, it is unsurprising that individuals with ADHD can have other comorbidities. However, previous studies have rarely probed which of the primary symptoms of ADHD (i.e., hyperactivity and inattention) are associated with which subtypes of emotion regulation.[21]

The global situation of ADHD is not different among Chinese populations although the available prevalence evidence concerns adults (13% to 19.3%) with psychiatric conditions (e.g., chronic alcohol use, active substance use, and bipolar disorder)[22] and is highly related with functional impairment.[23] Moreover, 83.1% of individuals with ADHD diagnosed in childhood (6-12 years) still report the disorder after about 15 years, although only one-third receive treatment, with costs of treatment on the increase.[23,24] It also has been shown that adults with ADHD have maladaptive emotion regulation strategies (i.e., higher expressive suppression, lower cognitive reappraisal, and poorer emotional control) compared with healthy controls which highlights their challenges with emotion regulation.[25] All these studies indicate that ADHD condition, as a whole, is associated with changes in psychological distress (e.g., depression and anxiety) and emotion regulation. However, the key primary features of ADHD (i.e., hyperactivity and inattention) which are associated with a subtype of emotion regulation (i.e., self-blame and blaming-others) and consequently, psychological distress, have not been thoroughly examined. Blaming-others and self-blame were used in the present study because they represent two divergent attributional styles (i.e., internal and external respectively) which may help to show how

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these attributions contribute to psychological distress among individuals with ADHD.

The present study is of importance because existing research on ADHD largely focuses on its prevalence,[3,4] symptoms,[1,2] and general comorbidities,[9,10] but often overlooks the nuanced relationship between emotion regulation strategies and specific ADHD symptoms (i.e., hyperactivity and inattention). Previous studies have established that individuals with ADHD frequently experience emotion regulation dysfunction which negatively affects various aspects of their life.[1,9,18,25] However, they rarely examine which ADHD symptoms are associated with specific maladaptive strategies such as blaming others or self-blame.[21] Moreover, whereas there is evidence addressing the prevalence of comorbid mental health issues among individuals with ADHD (e.g., depression and anxiety),[22] the mechanisms linking these conditions remain underexplored. More specifically, no previous study has ever investigated the cognitive aspects of emotion regulation and its mechanisms in facilitating mental health conditions among individuals with ADHD. By addressing these gaps, we aimed to provide a more comprehensive understanding of how ADHD symptoms (i.e., inattention/hyperactivity), emotional regulation strategies (i.e., blaming-others and self-blame), and psychological distress (i.e., anxiety and depression) are associated, with the aim to contribute to better-targeted interventions for affected individuals.

Following the aforementioned literature review, our study examined the mediating roles of emotional regulation strategies in the associations of inattention/hyperactivity with different types of psychological distress (anxiety and depression) among young adults. The specific objectives of the study were to explore the (1) differences between participants with self-report symptoms of ADHD and non-ADHD on emotion regulation (i.e., blaming-others and self-blame) and psychological distress (i.e., anxiety and depression); (2) associations between ADHD features (i.e., hyperactivity and inattention), emotion regulation (i.e., blaming-others and self-blame) and psychological distress (i.e., anxiety and depression); and (3) mediating roles of emotional regulation strategies (i.e., blaming-others and self-blame) in the associations between inattention/hyperactivity and psychological distress (anxiety and depression). The hypotheses were (1) participants with self-reported ADHD symptoms (i.e., at-risk of ADHD group) would have higher levels of psychological distress than those who had no self-reported ADHD symptoms (i.e., non-ADHD group) (H_1); (2) features of ADHD, emotion regulation strategies, and psychological distress would be associated (H_2); and (3) emotional regulation strategies would be mediators in the associations between features of ADHD and psychological distress (H_3).

METHODS

Participants and Recruitment

One of the coauthors contacted the following parties to disseminate the recruitment information: faculties, counseling teachers, and special education teachers in university campuses. Eligible participants should: (1) be aged 18 years or older; (2) have sought any services related to mental health (e.g., counselling); and (3) be studying at a university at the time of data collection. The participants who were interested in the present study were gathered in groups but with enough privacy to complete the measures described later in this paper. Moreover, before anyone began completing the measures, they were asked to provide written informed consent to indicate their willingness to participate. None of the participants (N=83; mean [SD] age = 19.98 [2.11] years) had any formal diagnosis of ADHD at the time of data collection and were classified into at-risk of ADHD group (N=31; 37.3%) or a non-ADHD group (N=52; 72.7%) based on their scores using the Adult ADHD Self-report Scale. Compared to the non-ADHD group, the at-risk of ADHD group was comprised of significantly more males (48.39% vs 26.92%; p = .047) who were significantly younger (19.35 years vs 20.35 years; p = .037).

Measures

Psychological Distress (anxiety and depression): Depression and anxiety were assessed using the Beck Depression Inventory (BDI)[26] and Beck Anxiety Inventory (BAI),[27] respectively. Both the BAI and BDI are self-report scales comprising 21 items rated on a 4-point Likert scale (0 = *not at all*; 3 = *severely*). The items are summed and a higher score indicates a greater level of anxiety (using the BAI) or depression (using the BDI). A sample BAI item is "*feeling of choking,*" and a sample BDI item is "*I feel sad.*" Prior psychometric findings on both BAI and BDI, including their Chinese versions, have been reported to be acceptable.[28,29] In the present study, both the BAI (α = 0.92) and BDI (α = 0.95) had excellent internal consistency.

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ADHD Symptoms (hyperactivity and attention deficit): Hyperactivity and attention deficit were assessed using the Adult ADHD Self-report Scale (ASRS).[30] The ASRS is a self-report scale comprising 18 items rated on a 5-point Likert scale (0 = *never*; 4 = *very often*). The items are summed and a higher score indicates a greater level of attention deficit (9 items) or hyperactivity (9 items). A sample attention deficit item is "*How often do you have difficulty getting things in order when you have to do a task that requires organization?*" and a sample hyperactivity item is "*How often do you feel restless or fidgety?*"[31] Prior psychometric findings on the ASRS, including its Chinese versions, have been reported to be acceptable.[30-33] In the present study, both the attention deficit domain (α = 0.88) and hyperactivity domain (α = 0.85) had good internal consistency. Additionally, the ASRS domain scores can be used to identify individuals at-risk of ADHD: a score of 17 or higher in either domain is considered at-risk of ADHD.[33]

Emotional Regulation Strategy (blaming-others and self-blame): The strategies of blaming-others and self-blame were assessed using the Cognitive Emotion Regulation Questionnaire (CERQ).[15] The CERQ is a self-report scale, and each of the 2 strategies (i.e., blaming-others and self-blame) are assessed with 4 items rated on a 5-point Likert scale (1 = *almost never*; 5 = *almost always*). The items are summed and a higher score indicates a greater level of blaming-others strategy or self-blame strategy. A sample self-blame item is "*I feel that I am the one to blame for it,*" and a sample blaming-others item is "*I feel that others are to blame for it.*" Prior psychometric findings on the CERQ, including its Chinese versions, have been reported to be acceptable.[15,34,35] In the present study, both the self-blame domain (α = 0.69) and blaming-others domain (α = 0.78) had acceptable internal consistency.

Data Analysis

The participants were grouped into two groups (i.e., at-risk of ADHD and non-ADHD) according to their ASRS scores. In addition, their demographics and characteristics were analyzed using descriptive statistics (e.g., means and percentages) and compared using independent t-tests or χ^2 tests between the two groups. Analyses of covariance (ANCOVAs) controlling for age and sex were used to compare hyperactivity, attention deficit, blaming-others, self-blame, anxiety, and depression between the two groups. Then, all participants' data on hyperactivity, attention deficit, blaming-others, self-blame, anxiety, and depression were examined using Pearson correlation coefficients to explore their mutual relationships. Lastly, four parallel mediation models were constructed to examine the mediated effects of self-blame and blaming-others after controlling age and sex. The first two mediation models used the same independent variable of attention deficit on different dependent variables of anxiety and depression. The next two mediation models used the same independent variable of hyperactivity on different dependent variables of anxiety and depression. All the mediation models were analyzed using Hayes' Process Macro Model 4,[36] with 5000 bootstrapping resamples. The statistically significant mediated effects were determined using the 95% bootstrapping confidence interval: the range between upper limit confidence interval (ULCI) and lower limit confidence interval (LLCI) did not cover 0. We used SPSS 20.0 (IBM Corp, Armonk, NY) for all the statistical analyses.

RESULTS

The participants (N=83; mean [SD] age = 19.98 [2.11] years) were classified into an at-risk of ADHD group (N=31; 37.3%) or a non-ADHD group (N=52; 72.7%) for the comparisons. The chi-square results showed that the at-risk of ADHD group consisted of significantly more males (48.39% vs 26.92%; p = .047) than the non-ADHD group. The independent t-tests showed that the at-risk of ADHD group, compared to the non-ADHD group, were younger in age (19.35 years vs 20.35 years; p = .037), had a greater level of depression (14.94 vs 6.83; p = .009), and frequently used self-blame strategies for emotional regulation (13.61 vs 11.87; p = .022). However, no statistically significant differences were found between the two groups in anxiety level (4.23 vs 2.40; p = .166) and using blaming-others strategies for emotional regulation (10.42 vs 9.42; p = .170) (Table 1). Additionally, comparisons in anxiety, depression, use of self-blame or blaming-others strategies for emotional regulation, and ADHD symptoms between the two groups with age and sex being controlled for in the analysis are reported in Supplementary Table 1. More specifically, the ANCOVA results showed that the at-risk of ADHD group had higher levels of anxiety, depression, self-blame, attention deficit, and hyperactivity than the non-ADHD group.

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Table 1
Demographics and Participants Characteristics for the 2 Groups

	Mean (SD)			t or χ^2 (p)
	Total Sample (N=83)	At-risk of ADHD (N=31)	Non-ADHD (N=52)	
Age (in years)	19.98 (2.11)	19.35 (2.42)	20.35 (1.82)	2.12 (0.037)
Sex (male)[a]	29 (34.94)	15 (48.39)	14 (26.92)	3.94 (0.047)
Anxiety	3.07 (4.96)	4.23 (6.52)	2.40 (3.70)	-1.41 (0.166)
Depression	9.86 (11.42)	14.94 (15.53)	6.83 (6.54)	-2.76 (0.009)
Blaming-others	9.80 (3.19)	10.42 (2.77)	9.42 (3.39)	-1.38 (0.170)
Self-blame	12.52 (3.39)	13.61 (3.39)	11.87 (3.25)	-2.33 (0.022)
Attention deficit	13.63 (6.89)	20.45 (3.20)	9.56 (5.01)	-12.08 (<0.001)
Hyperactivity	9.65 (7.11)	16.03 (6.13)	5.85 (4.43)	-8.08 (<0.001)

Note.
[a] Reported using n (%).

Regarding findings from Pearson correlations, most of the studied variables (hyperactivity, attention deficit, blaming-others, self-blame, anxiety, and depression) were significantly related with each other in the entire sample, except for the relationships between hyperactivity and self-blame (r = 0.19; p = .091), and anxiety (r = 0.16; p = .138) (Table 2).

Table 2
Pearson Correlations between Study Variables

	r (p-value)					
	1	2	3	4	5	6
1. Attention deficit	-					
2. Hyperactivity	0.70 (< .001)**	-				
3. Self-blame	0.36 (< .001)**	0.19 (.091)	-			
4. Blaming-others	0.24 (.027)*	0.22 (.045)*	0.50 (< .001)**	-		
5. Anxiety	0.38 (< .001)**	0.16 (.138)	0.30 (.006)**	0.23 (.034)*	-	
6. Depression	0.44 (< .001)**	0.30 (.005)**	0.46 (< .001)**	0.45 (< .001)**	0.48 (< .001)**	-

*p < .05; **p < .01.

Table 3
Mediated Roles of Self-blame and Blaming Others in the Association between Attention Deficit Levels and Anxiety (Hayes' Model 4)

Path	Coeff. (SE)	Stand. Coeff.	LLCI, ULCI	p-value
Direct Association				
AD→SB	0.19 (0.05)	0.38	0.09, 0.29	< .001
AD→BO	0.12 (0.05)	0.25	0.02, 0.22	.024
SB→ANX	0.20 (0.21)	0.12	-0.21, 0.62	.335
BO→ANX	0.15 (0.21)	0.09	-0.27, 0.57	.474
AD→ANX	0.26 (0.09)	0.32	0.08, 0.44	.005
Indirect Association				
AD→SB→ANX	0.04 (0.03)[a]	0.05[a]	-0.02, 0.10[a]	--
AD→BO→ANX	0.02 (0.02)[a]	0.02[a]	-0.03, 0.07[a]	--

Note.
Age and sex were controlled in the mediation model. R^2 = 0.18 for SB; 0.07 for BO; and 0.19 for ANX.
AD = attention deficit level; SB = self-blame; BO = blaming others; ANX = anxiety; Coeff. = unstandardized coefficient; SE = standard error; Stand. Coeff. = standardized coefficient; LLCI = lower limit confidence interval at 95%; ULCI = upper limit confidence interval at 95%.
[a] Calculated using 5000 bootstrapping resamples.

The parallel mediation models from Hayes' Process Macro were used to understand if self-blame or blaming-others strategies for emotional regulation were parallel mediators in explaining the associations of attention deficit with depression and anxiety levels. The results showed that strategies of using blaming-others or self-blame for emotional regulation were not statistically significant mediators in the association of

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attention deficit with anxiety level (unstandardized coefficient [LLCI, ULCI] = 0.04 [-0.02, 0.10] and 0.02 [-0.03, 0.07]) (Table 4). However, both strategies were significant mediators in the association of attention deficit with depression level (unstandardized coefficient [LLCI, ULCI] = 0.14 [0.01, 0.31] for self-blame and 0.11 [0.003, 0.27] for blaming-others) (Table 4). Moreover, attention deficit was a statistically significant factor explaining self-blame (unstandardized coefficient [LLCI, ULCI] = 0.19 [0.09, 0.29]), blaming-others (unstandardized coefficient [LLCI, ULCI] = 0.12 [0.02, 0.22]), anxiety level (unstandardized coefficient [LLCI, ULCI] = 0.26 [0.08, 0.44]), and depression level (unstandardized coefficient [LLCI, ULCI] = 0.51 [0.19, 0.83]). Additionally, blaming-others was a significant factor explaining depression level (unstandardized coefficient [LLCI, ULCI] = 0.96 [0.22, 1.70]) (Tables 3 and 4).

Table 4

Mediated Roles of Self-blame and Blaming Others in the Association between Attention Deficit Levels and Depression (Hayes' Model 4)

Path	Coeff. (SE)	Stand. Coeff.	LLCI, ULCI	p-value
Direct Association				
AD→SB	0.19 (0.05)	0.38	0.09, 0.29	< .001
AD→BO	0.12 (0.05)	0.25	0.02, 0.22	.024
SB→DEP	0.73 (0.37)	0.22	-0.02, 1.47	.056
BO→DEP	0.96 (0.37)	0.27	0.22, 1.70	.012
AD→DEP	0.51 (0.16)	0.31	0.19, 0.83	.002
Indirect Association				
AD→SB→DEP	0.14 (0.08) [a]	0.08 [a]	0.01, 0.31 [a]	--
AD→BO→DEP	0.11 (0.07) [a]	0.07 [a]	0.003, 0.27 [a]	--

Note.
Age and sex were controlled in the mediation model. R^2 = 0.18 for SB; 0.07 for BO; and 0.38 for DEP.
AD = attention deficit level; SB = self-blame; BO = blaming others; DEP = depression; Coeff. = unstandardized coefficient; SE = standard error; Stand. Coeff. = standardized coefficient; LLCI = lower limit confidence interval at 95%; ULCI = upper limit confidence interval at 95%.
[a] Calculated using 5000 bootstrapping resamples.

Table 5

Mediated Roles of Self-blame and Blaming Others in the Association between Hyperactivity Levels and Anxiety (Hayes' Model 4)

Path	Coeff. (SE)	Stand. Coeff.	LLCI, ULCI	p-value
Direct Association				
HA→SB	0.12 (0.05)	0.25	0.01, 0.22	.028
HA→BO	0.11 (0.05)	0.25	0.01, 0.21	.027
SB→ANX	0.36 (0.21)	0.22	-0.06, 0.78	.092
BO→ANX	0.16 (0.22)	0.09	-0.28, 0.60	.466
HA→ANX	0.09 (0.09)	0.12	-0.09, 0.27	.312
Indirect Association				
HA→SB→ANX	0.04 (0.03) [a]	0.05 [a]	0.0001, 0.11 [a]	--
HA→BO→ANX	0.02 (0.02) [a]	0.02 [a]	-0.03, 0.07 [a]	--

Note.
Age and sex were controlled in the mediation model. R^2 = 0.10 for SB; 0.07 for BO; and 0.11 for ANX.
HA = hyperactivity level; SB = self-blame; BO = blaming others; ANX = anxiety; Coeff. = unstandardized coefficient; SE = standard error; Stand. Coeff. = standardized coefficient; LLCI = lower limit confidence interval at 95%; ULCI = upper limit confidence interval at 95%.
[a] Calculated using 5000 bootstrapping resamples.

The parallel mediation models from Hayes' Process Macro were again used to examine if self-blame or blaming-others strategies for emotional regulation were parallel mediators in the associations of hyperactivity with depression and anxiety levels. The results showed that the use of self-blame strategy for emotional regulation was a statistically significant mediator in the associations of hyperactivity with anxiety level (unstandardized coefficient [LLCI, ULCI] = 0.04 [0.0001, 0.11]) and depression level (unstandardized coefficient [LLCI, ULCI] = 0.12 [0.003, 0.29]). However, blaming-others

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for emotional regulation was not a statistically significant mediator in the association of hyperactivity with anxiety level (unstandardized coefficient [LLCI, ULCI] = 0.02 [-0.03, 0.07]) or depression level (unstandardized coefficient [LLCI, ULCI] = 0.11 [-0.01, 0.25]) (Tables 5 and 6). Moreover, hyperactivity was a statistically significant factor explaining self-blame (unstandardized coefficient [LLCI, ULCI] = 0.12 [0.01, 0.22]), blaming-others (unstandardized coefficient [LLCI, ULCI] = 0.11 [0.01, 0.21]), and depression level (unstandardized coefficient [LLCI, ULCI] = 0.33 [0.01, 0.65]). Additionally, both emotional regulation strategies were statistically significant factors explaining depression level (unstandardized coefficient [LLCI, ULCI] = 0.98 [0.24, 1.72] for self-blame and 0.93 [0.15, 1.70] for blaming-others) (Table 6).

Table 6
Mediated Roles of Self-blame and Blaming Others in the Association between Hyperactivity Levels and Depression (Hayes' Model 4)

Path	Coeff. (SE)	Stand. Coeff.	LLCI, ULCI	p-value
Direct Association				
HA→SB	0.12 (0.05)	0.25	0.01, 0.22	.028
HA→BO	0.11 (0.05)	0.25	0.01, 0.21	.027
SB→DEP	0.98 (0.37)	0.29	0.24, 1.72	.010
BO→DEP	0.93 (0.39)	0.26	0.15, 1.70	.020
HA→DEP	0.33 (0.16)	0.21	0.01, 0.65	.042
Indirect Association				
HA→SB→DEP	0.12 (0.07) [a]	0.07 [a]	0.003, 0.29 [a]	--
HA→BO→DEP	0.11 (0.07) [a]	0.07 [a]	-0.01, 0.25 [a]	--

Note.
Age and sex were controlled in the mediation model. $R^2 = 0.10$ for SB; 0.07 for BO; and 0.34 for DEP.
HA = hyperactivity level; SB = self-blame; BO = blaming others; DEP = depression; Coeff. = unstandardized coefficient; SE = standard error; Stand. Coeff. = standardized coefficient; LLCI = lower limit confidence interval at 95%; ULCI = upper limit confidence interval at 95%.
[a] Calculated using 5000 bootstrapping resamples.

DISCUSSION

In the present study, we verified that associations between features of ADHD, psychological distress, and emotion regulation strategies were mostly statistically significant (partially supporting H_2). Also, we found significant mediating roles of emotional regulation strategies in the associations of inattention/hyperactivity with depression but not anxiety among young adults (partially supporting H_3). Between-group differences in anxiety, depression, blaming-others, and self-blame were also investigated. The independent t-test showed that the ADHD group compared to the non-ADHD group had significantly greater levels of depression (but not anxiety) and more frequently used self-blame strategies (but not blaming-others) for emotional regulation (partially supporting H_1).

Therefore, our findings indicate that individuals with ADHD are likely to have depression probably by using maladaptive emotion regulation (i.e., self-blame) strategies compared to non-ADHD group. This suggests that young adults with ADHD have a higher chance of having depression in addition to ADHD and so there is a need for clinicians to teach individuals with ADHD effective coping strategies so as to limit if not nullify the possibility of having depression. This supports previous studies that reported that youths with ADHD are more prone to use emotion regulation strategies in a maladaptive way (i.e., self-blame, catastrophizing, and rumination) compared to healthy controls.[1,37,38] Moreover, strong associations have been reported between ADHD, depression, and maladaptive emotion regulation strategies.[1,38-40] Therefore, continuous psycho-education and training that incorporate effective coping strategies are needed to help enhance their functioning and well-being.

A positive and statistically significant direct association was found between inattention and self-blame, blaming-others, anxiety, and depression. This suggests that individuals with attention deficit are likely to have anxiety and depression probably due to the use of more maladaptive emotion regulation strategies such as self-blame and blaming-others. These suggest that effective emotion regulation strategies are needed to help individuals with inattention deal with their emotional situations. Apart from the direct positive association between

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inattention and both anxiety and depression, we also found that self-blame and blaming-others served as mediators to depression but not anxiety. This suggests that there are three pathways through which attention deficit associates with an individual's depression level (direct and indirect associations – self-blame and blaming-others) whereas there is only one pathway for anxiety level (direct association). This suggests that individuals with attention deficit are more likely to suffer from depression compared to anxiety.

The literature shows that those with ADHD usually have depression and/or anxiety.[38] Moreover, inattention has been found to be related to emotional dysregulation such as catastrophizing, other-blame, self-blame, and rumination.[6,41,42] Therefore, their inability to manage emotions effectively may contribute to their stress and frustration levels, further limiting their ability to think and manage emotions. This may eventually trigger other psychopathologies (e.g., depression, oppositional defiant disorder), important functional impairments (e.g., social and academic), and poor well-being. These findings are important for clinicians. They could psycho-educate and train individuals with inattention and their parents so they are aware of how to handle their emotions and the most effective strategies to regulate their emotions (e.g., person-oriented emotion regulation, goal-oriented, and need-oriented,).[43,44] Moreover, future studies could examine the most effective emotion regulation strategies for individuals with inattention taking into consideration their age, functional need, specific impairment, and culture.

Additionally, we found a positive and statistically significant direct association between hyperactivity and self-blame, blaming-others, and depression (but not anxiety). These findings suggest that individuals with hyperactivity are more likely to have depression probably due to the use of self-blame and/or blaming-others as emotion regulation strategies. We found no statistically significant direct association between hyperactivity and anxiety, which suggests that hyperactivity may not, in itself, be significantly associated with the level of anxiety among individuals with ADHD. Moreover, we found self-blame to mediate the association between hyperactivity and anxiety, and depression. These findings suggest that there are two pathways through which hyperactivity is associated with an individual's depression level (direct and indirect associations – self-blame) whereas there is only one pathway for anxiety level (indirect association – self-blame). The use of self-blame as an emotion regulation strategy among individuals with hyperactivity may be associated with their levels of depression and/or anxiety. This is consistent with a previous study that reported an association between hyperactivity and self-blame, and blaming-others.[21] Another study reported an association between ADHD and maladaptive emotion regulation as well as psychopathology (e.g., depression, oppositional defiant disorder).[6] However, a distinction was not made as to which aspect of ADHD was associated with emotion dysregulation and psychopathology which makes the present study unique. Therefore, individuals with hyperactivity must be trained in effective ways to deal with their emotional challenges so as to limit the development of further mental health problems. Moreover, an individual's culture can play a significant role in ADHD symptom manifestation, emotion regulation, and its strategies.[45,46] Our participants (i.e., Chinese) live in a collectivistic culture with high academic expectations which may influence how they view (1) ADHD (and mental health more generally), (2) parenting styles and socialization, and (3) emotion regulation strategies. Similar data from a collectivistic culture may result in similar findings but there may be different findings if the study was replicated among those from an individualistic culture. Therefore, there is a need for replication in an individualistic culture.

Limitations and Strengths

There are a few limitations to our study. First, we used a cross-sectional survey design which limits the delineating of the causality between study variables. Therefore, caution is required in overly inferring causality among the findings. Consequently, it also may have inherent limitations in evaluating mediation models. However, a cross-sectional design can provide preliminary insights into mediation effects, especially with the use of advanced statistical methods (Hayes' Process Macro Model 4 with controlled covariates).[47,48] Therefore, longitudinal studies are needed to ascertain the veracity of the current results. Second, there is a possibility of social desirability response bias and/or recall bias because self-reports were used for data collection. To limit these biases, participants were given enough privacy and the anonymity and confidentiality of their responses were ensured.

Third, we had a small sample size which may bias our findings. Therefore, future large-scale studies

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will be needed to replicate the veracity of the present findings. Lastly, none of the participants had a formal ADHD diagnosis. Their ADHD symptoms were assessed using the Adult ADHD Self-report Scale. Therefore, our findings need to be replicated in future research by using a sample of participants who have a formal ADHD diagnosis. Notwithstanding these limitations, the participants (i.e., young adults) were recruited from the general population to respond to the ADHD scale (i.e., the Adult ADHD Self-report Scale) which increases the chances of generalizing the findings to other young adults. Our findings are novel with respect to distinguishing the associations of inattention and hyperactivity with depression and anxiety, and the possible mediating roles of self-blame and blaming-others. This will help researchers and clinicians understand the need to distinguish the exact type of ADHD for appropriate intervention and/or further investigation.

Academic and Clinical Implications

From an academic perspective, our study contributes to the existing body of knowledge on ADHD by clarifying the distinct pathways through which ADHD symptoms (i.e., inattention and hyperactivity) are associated with psychological distress (i.e., depression and anxiety). More specifically, it identified three pathways through which inattention affects an individual's depression level (direct association, indirect association–self-blame, and indirect association–blaming-others) whereas only one pathway was identified for anxiety level (direct association). We identified two pathways through which hyperactivity affects an individual's depression level (direct and indirect associations–self-blame) whereas only one pathway was identified for anxiety level (indirect association–self-blame). Therefore, by ascertaining the mediating roles of emotion regulation strategies (i.e., self-blame and blaming-others), we addressed a crucial gap in understanding the cognitive and emotional mechanisms underlying these associations (i.e., ADHD symptoms and psychological distress). Consequently, this nuanced perspective can inform future research directions and encourage more comprehensive examinations into ADHD's impact on emotional health.

From a clinical perspective, our findings highlight the necessity for targeted interventions for young adults with ADHD. By establishing that maladaptive emotion regulation strategies significantly contribute to the heightened levels of depression and anxiety, the study emphasizes the importance of psychoeducation and training in effective coping strategies. Moreover, inattention and hyperactivity symptoms appear to use different pathways to trigger other mental health problems such as depression and anxiety when maladaptive emotion regulation strategies are used. Therefore, clinicians can leverage these insights to develop bespoke interventions that address both ADHD symptoms and associated emotional challenges. More specifically, our study suggests that providing individuals with information regarding adaptive emotion regulation techniques could mitigate the risk of developing comorbid mental health conditions, thereby improving their overall well-being and functioning in daily life.

CONCLUSION

In this cross-sectional study, we explored how emotion regulation strategies mediated in the associations of inattention/hyperactivity with anxiety and depression among young adults. We found (1) a statistically significant direct positive association between inattention and self-blame, blaming-others, anxiety, and depression; (2) a statistically significant direct positive association between hyperactivity and self-blame, blaming-others, and depression (but not anxiety), and (3) self-blame and blaming-others served as mediators to inattention and depression (whereas only self-blame mediated the association between hyperactivity and anxiety, and depression). These findings suggest that (1) there are three pathways through which inattention affects an individual's depression level (direct association, indirect association–self-blame, and indirect association–blaming-others) whereas there is only one pathway for anxiety level (direct association); and (2) there are two pathways through which hyperactivity affects an individual's depression level (direct and indirect associations–self-blame) whereas there is only one pathway for anxiety level (indirect association-self-blame). In sum, inattention and hyperactivity appear to use different ways to trigger other mental health problems (e.g., anxiety and depression) when maladaptive emotion regulation strategies are used. We recommend that clinicians and other health experts psycho-educate and train young adults regularly on different adaptive coping strategies (including emotion regulations) so as to deal effectively with their emotional issues.

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Human Participants Approval Statement

All procedures in the present study were conducted in accordance with the Declaration of Helsinki. Additionally, this present study protocol was reviewed and approved by the institutional review board of the Chang Gung Medical Foundation (IRB No. 202300096A3) prior to data collection. All participants were informed about the study, and all provided informed consent.

Conflict of Interest Disclosure Statement

The authors declare no conflict of interest.

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