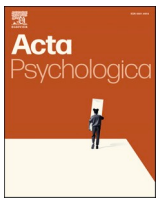
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# The associations between levels of inattention/hyperactivity and social media addiction among young adults: The mediating role of emotional regulation strategies in self-blame and blaming others

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ABSTRACT

Attention-deficit/hyperactivity disorder (ADHD) is a common neurobehavioral disorder beginning in childhood and often extending into adulthood. ADHD may negatively impact emotional regulation and cause addictive behaviors such as social media addiction. The present study investigated the association of ADHD symptoms (i.e., attention deficit [AD] and hyperactivity/impulsivity [HI]) with social media addiction among young adults. The mediating effect of internalizing and externalizing emotional regulation (i.e., self-blame [SB] and blaming others [BO]) were examined. Participants ($n = 96$; mean age = 19.9 years [SD = 2.07]) comprising 35 individuals with probable ADHD and 61 individuals who did not have ADHD completed measures assessing social media addiction, ADHD symptoms, and emotional regulation strategies. Results of Hayes' Process Micro showed that both ADHD symptoms were significantly positively associated with social media addiction (standardized coefficient [$\beta$] = 0.30 and 0.38 for AD and HI) and emotional regulation strategies ($\beta = 0.38$ and 0.27 for AD to SB and BO, $\beta = 0.23$ and 0.28 for HI to SB and BO). In addition, BO was a significant mediator in the association between AD and social media addiction ($\beta = 0.07$, 95 % confidence interval = 0.003, 0.11). The results suggest that externalizing emotional regulation may mediate the association between symptoms of AD and social media addiction. It is recommended that individuals with probable ADHD should focus on improving self-awareness (such as mindfulness), developing resilience skills, and/or incorporating positive coping strategies (such as physical activity) to reduce the negative impacts derived from symptoms of ADHD.

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## 1. Introduction

Attention-deficit/hyperactivity disorder (ADHD) is a common neurobehavioral condition in childhood which has an average prevalence of 5 % globally (Sayal et al., 2018). ADHD usually presents with the core symptoms of inattention (or 'attention deficit') and/or hyperactivity-impulsivity. Based on these symptoms, ADHD is classified into three subtypes: predominantly inattentive, predominantly hyperactive/impulsive, and combined types (Centers for Disease Control and Prevention, 2023). However, misdiagnosis or underdiagnosis of ADHD still exists (Furzer et al., 2022; Haverkampf, 2020) and cultural differences may be one of the reasons for this (Asherson et al., 2012). One study reported that professionals from different backgrounds (including national differences) may possess different perceptions toward hyperactivity symptoms, resulting in markedly different diagnostic rates among individuals with comparable hyperactive behaviors (Mann et al., 1992). Moreover, individuals with probable ADHD may experience varied difficulties in their daily living (Evren et al., 2018, 2017; Schmengler et al., 2023), especially when living in different and varied contexts. To comprehensively investigate the influence of ADHD symptoms, the present study adopted assessments from different dimensions to explore a wider population (i.e., probable ADHD). More specifically, probable ADHD and non-ADHD groups were included and compared in the present study.

Studies have reported a positive association between ADHD symptoms and social media use among both adolescents (Boer et al., 2020) and adults (Andreassen et al., 2016; Chen et al., 2024; Lee et al., 2023). According to the Interaction of Person-Affect-Cognition-Execution (I-PACE) model, an addictive behavior is the consequence of interaction between the personal characteristics and several moderating/mediating factors (Brand et al., 2019). With regards to ADHD, the symptoms of the condition may act as personal characteristics in the I-PACE model that foster the development of addictive behavior. Consequently, social media addiction (SMA) may be a maladaptive coping strategy (Andreassen et al., 2016; Wolfers & Utz, 2022) used by individuals to achieve gratification. Apart from the I-PACE model, the cognitive-behavioral model may also explain the relationship between ADHD symptoms and social media use. More specifically, cognitive thoughts regarding misbeliefs about social media use (e.g., "*I can only get others' praise from social media*") have the capacity to reinforce individuals' motivations for using social media, subsequently increasing the risk of developing SMA (Chou et al., 2018; Kakul & Javed, 2023; Tan, 2023; Yen et al., 2017).

ADHD often extends from childhood to adolescence, and even adulthood (Sayal et al., 2018). Prior evidence has shown that during adolescence, poorer family function, less social support from school, and lower education are positively associated with ADHD symptoms (Schmengler et al., 2023). In adulthood, ADHD may be comorbid with emotional dysregulation (Bodalski et al., 2023) and/or substance use (Wilens & Kaminski, 2018). Such negative growing experiences may have an impact on individuals' social-emotional wellbeing (Attoe & Climie, 2023). In order to cope with these negative feelings, individuals with ADHD may adopt externalizing strategies (the negative behaviors that are acted outwardly) and internalizing strategies (the negative behaviors that are focused inwardly) to regulate their emotional disturbance (Riehm et al., 2019; Rosenthal et al., 2024).

For some individuals with ADHD, their disruptive behavior may prompt them to blame others as an externalizing strategy to release their anger (Harvey et al., 2016). In addition, their subsequent low self-esteem may increase the internalization of negative emotion, fostering them to adopt self-blame behavior in response to the negative emotion (Attoe & Climie, 2023). Therefore, blaming others may act as an externalizing emotional regulation and self-blame may act as an internalizing emotional regulation among adults with ADHD, and social media use may work as a way to show their resentment or as an emotional outlet. These two behavioral patterns may become the perception of external and internal triggers in the I-PACE or the cognitive-behavioral model, which further contribute to the development of SMA.

Similar to other behavioral addictions (e.g., gaming disorder) (Alimoradi et al., 2024; Phetphum et al., 2023; Ruckwongpatr et al., 2022), SMA may be associated with poor mental health, including those with ADHD (Chen et al., 2024; Lee et al., 2023). Negative impacts such as sleep disturbance, food addiction, lower self-esteem, and narcissism have been found to be associated with SMA (Andreassen et al., 2017; Huang et al., 2023; Thorell et al., 2022) Therefore, it is important for healthcare providers and researchers to know possible mechanisms regarding how is ADHD associated with SMA. More specifically, it would be important to know whether the two aforementioned types of emotional regulation (internalizing regulation of self-blame and externalizing regulation of blaming others) mediate ADHD and SMA. If such mechanisms are known, programs and interventions for reducing SMA could be developed based on the findings from such mechanisms.

Therefore, the present study investigated the mediating effect of emotional regulation in the association between ADHD symptoms and SMA among Taiwanese young adults (Fig. 1). More specifically, the mediating effects of self-blame (internalizing regulation) and blaming others (externalizing regulation) in the associations of attention deficit and hyperactivity/impulsivity to SMA were examined. It was hypothesized that (i) attention deficit and hyperactivity/impulsivity would be significantly associated with SMA ($H_1$), and (ii) self-blame and blaming others would be significant mediators in the association between ADHD symptoms and SMA.

## 2. Methods

### 2.1. Participants and procedure

The study protocol was approved by the institutional review board (IRB) of the Chang Gung Medical Foundation (IRB No. 202300096A3). After obtaining IRB approval, the first author disseminated the study purpose to counseling teachers and special education teachers across several university campuses. The counseling teachers and special education teachers invited and recruited adult students who were interested in participating the present study. The first author further explained the study purpose and participation rights. The first author then let those who were willing to participate sign a written consent and to complete the measures described below. The inclusion criteria of the eligible participants included were (i) being an adult aged 18 years or older; (ii) having sought mental health services such as counseling; and (iii) being an active university student at the time of the study. The participants completed the measures in a group without disturbance. The survey period was between April and June 2023.

### 2.2. Measures

#### 2.2.1. Dependent variable (social media addiction)

The level of SMA was assessed using the Bergen Social Media Addiction Scale (BSMAS) (Andreassen et al., 2017). The BSMAS assesses the level of SMA via six items (each rated using a five-point Likert scale ranging from 1 [*very rarely*] to 5 [*very often*]) based on the components model of addiction (Griffiths, 2000, 2005). A higher BSMAS scores indicates a greater risk of SMA. An example BSMAS item is *"I often think about social media when I am not using it"*. Prior studies have shown that the BSMAS, including its Chinese version for Taiwanese people, has acceptable psychometric properties (Andreassen et al., 2017; Yam et al., 2019). In the present study, the Cronbach's α of the BSMAS was 0.854.

#### 2.2.2. Independent variables (attention deficit and hyperactivity)

Both levels of attention deficit and hyperactivity/impulsivity were assessed using the Adult ADHD Self-Report Scale (ASRS) (Kessler et al., 2005). The ASRS assesses the level of ADHD symptoms via 18 items

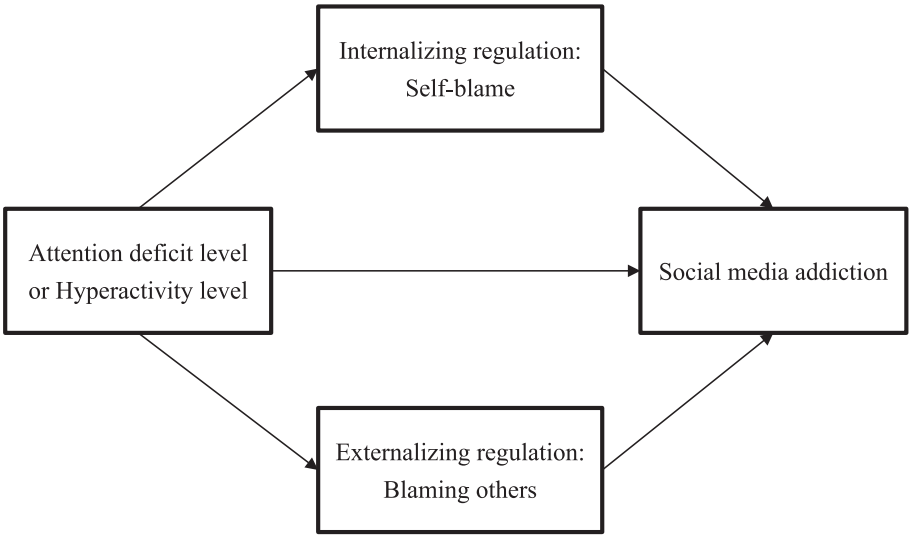



**Fig. 1.** Conceptual model for testing internalizing/externalizing regulation in the association between attention deficit/hyperactivity level and social media addiction.

(each rated using a five-point Likert scale ranging from 0 [*never*] to 4 [*very often*]) based on the DSM-IV criteria (Kessler et al., 2005). The ASRS used in the present study was separated into two domains (each containing nine items): attention deficit and hyperactivity/impulsivity (Gray et al., 2014). A higher ASRS score indicates a higher level of attention deficit or hyperactivity/impulsivity. Example ASRS items include "*How often do you have difficulty getting things in order when you have to do a task that requires organization?*" (attention deficit) and "*How often do you feel restless or fidgety?*" (hyperactivity/impulsivity). Prior studies have shown that the ASRS, including its Chinese version for Taiwanese people, has acceptable psychometric properties (Kessler et al., 2007; Yeh et al., 2008). Moreover, individuals who score 17 or above in either domain (i.e., attention deficit or hyperactivity) indicates probable ADHD (Yeh et al., 2008). In the present study, the Cronbach's α of the ASRS was 0.877 (attention deficit) and 0.853 (hyperactivity/impulsivity).

#### 2.2.3. Mediating variables (self-blame and blaming others)

Both levels of self-blame and blaming others were assessed using the Cognitive Emotion Regulation Questionnaire (CERQ) (Garnefski et al., 2001). The CERQ assesses the use of emotional regulation strategies when an individual encounters difficulty. In the present study, only two strategies (self-blame and blaming others) from the CERQ were assessed via eight items (each rated using a five-point Likert scale ranging from 1 [*almost never*] to 5 [*almost always*]) (Garnefski et al., 2001). A higher CERQ score indicates using more of that specific strategy for emotional regulation. Example CERQ items include "*I feel that I am the one to blame for it*" (self-blame) and "*I feel that others are to blame for it*" (blaming others). Prior studies have shown that the CERQ, including its Chinese version for Taiwanese people, has acceptable psychometric properties (Garnefski & Kraaij, 2007; Hsu, 2013). In the present study, the Cronbach's α of the CERQ was 0.782 (self-blame) and 0.655 (blaming others).

#### 2.2.4. Demographic variables

The participants completed a background information sheet assessing the following variables: age (in years), sex (male or female), time spent on social media during weekdays (hours per weekday), and time spent on social media during the weekend (hours per weekend day).

### 2.3. Data analysis

Apart from the descriptive statistics, independent *t*-tests and $\chi^2$ tests were used to examine the differences (including demographics and participants' characteristics) between participants with probable ADHD and those without ADHD. Pearson correlations were then used to examine the relationships between the following variables: attention deficit, hyperactivity, self-blame, blaming others, and SMA. Lastly, two parallel mediation models were constructed using the Hayes' Process Macro Model 4 (Hayes, 2017). The two parallel mediation models shared the same mediators (the two emotional regulation strategies of self-blame and blaming others), dependent variables (SMA), and controlled variables (age and sex). However, the first parallel mediation model used the level of attention deficit as the independent variable, while the second model used the level of hyperactivity as the independent variable. Both mediation models used 5000 bootstrapping resamples and the indirect effect is considered significant when the 95 % upper limit confidence interval (ULCI) and lower limit confidence interval (LLCI) in the bootstrapping resamples do not cover zero. All the statistical analyses were performed using the IBM SPSS 20.0 (IBM Corp., Armonk, NY).

## 3. Results

Among the 96 participants, 35 were probable ADHD (36.4 %) according to the cutoff score in the ASRS (i.e., either attention deficit or hyperactivity domain score larger than 17). The two groups were not significantly different in age ($p = 0.053$), time spent on social media ($p = 0.91$ for weekdays and 0.76 for weekends), and emotional regulation strategy of blaming others ($p = 0.13$). The probable ADHD group contained significantly more males (51.4 % vs. 29.5 %; $p = 0.03$), used significantly more emotional regulation strategy of self-blame (13.43 vs. 11.87; $p = 0.02$), and had significantly higher SMA scores (14.73 vs. 12.30; $p = 0.02$) (see Table 1).

Relationships between levels of attention deficit, hyperactivity, self-blame, blaming others, and SMA were significant ($r = 0.27$ to $0.71$; $p < 0.05$), except for the following two relationships: the levels of hyperactivity and self-blame ($r = 0.17$; $p = 0.09$), and the levels of self-blame and SMA ($r = 0.09$; $p = 0.37$) (see Table 2).

The parallel mediation models additionally showed that blaming others was a significant mediator in the association between levels of attention deficit and SMA (unstandardized coefficient [B] = 0.05; LLCI = 0.003, ULCI = 0.11), while it was not a significant mediator in the association between levels of hyperactivity and SMA (B = 0.04; LLCI = −0.004, ULCI = 0.09). Self-blame was not a significant mediator in the association between levels of attention deficit and SMA (B = −0.03;

**Table 1**
Demographics and participants' characteristics between the two study groups.

| | Mean (SD) | | | $t$ or $\chi^2$ ($p$) |
|---|---|---|---|---|
| | Entire sample (N = 96) | Probable ADHD ($n$ = 35) | Non-ADHD ($n$ = 61) | |
| Age (year) | 19.85 (2.07) | 19.31 (2.35) | 20.16 (1.85) | 1.962 (0.053) |
| Sex (male)[a] | 36 (37.5 %) | 18 (51.4 %) | 18 (29.5 %) | **4.56 (0.03)** |
| Time on social media (hours per week day) | 6.01 (4.52) | 5.94 (5.77) | 6.05 (4.29) | 0.11 (0.91) |
| Time on social media (hours per weekend day) | 7.04 (3.65) | 7.20 (4.43) | 6.95 (2.15) | 0.31 (0.76) |
| Blaming others | 9.82 (3.12) | 10.46 (2.87) | 9.46 (3.22) | 1.52 (0.13) |
| Self-blame | 12.44 (3.27) | 13.43 (3.37) | 11.87 (3.10) | **2.30 (0.02)** |
| Social media addiction | 13.15 (4.42) | 14.73 (5.15) | 12.30 (3.75) | **2.39 (0.02)** |

ADHD = attention-deficit/hyperactivity disorder.
[a] Reported using n (%). Significant differences are shown in **bold**.

**Table 2**
Pearson correlations between study variables ($N$ = 96).

| | R ($p$-value) | | | | |
|---|---|---|---|---|---|
| | AD | HI | SB | BO | SMA |
| AD | – | | | | |
| HI | **0.71 (<0.001)** | – | | | |
| SB | **0.36 (<0.001)** | 0.17 (0.09) | – | | |
| BO | **0.28 (0.006)** | **0.27 (0.008)** | **0.50 (<0.001)** | – | |
| SMA | **0.31 (0.002)** | **0.42 (<0.001)** | 0.09 (0.37) | **0.29 (0.005)** | – |

AD = attention deficit; HI = hyperactivity/impulsivity; SB = self-blame; BO = blaming other; SMA = social media addiction. Significant associations are shown in **bold**.

LLCI = −0.010, ULCI = 0.03) or in the association between levels of hyperactivity and SMA (B = −0.01; LLCI = −0.07, ULCI = 0.02) (see Tables 3 and 4). Moreover, blaming others, attention deficit, and hyperactivity had significant direct effects on SMA, while self-blame did not (see Tables 3 and 4).

**Table 3**
Mediated roles of self-blame and blaming others in the association between attention deficit levels and social media addiction (Hayes' Model 4).

| Path | Coeff. (SE) | Stand. coeff. | LLCI, ULCI | $p$-value |
|---|---|---|---|---|
| Direct effect | | | | |
| AD→SB | 0.18 (0.05) | 0.38 | 0.09, 0.27 | <0.001 |
| AD→BO | 0.12 (0.05) | 0.27 | 0.03, 0.21 | 0.01 |
| SB→SMA | −0.18 (0.16) | −0.13 | −0.50, 0.14 | 0.28 |
| BO→SMA | 0.39 (0.16) | 0.27 | 0.07, 0.71 | 0.02 |
| AD→SMA | 0.20 (0.07) | 0.30 | 0.06, 0.33 | 0.006 |
| Indirect effect[a] | | | | |
| AD→SB→SMA | −0.03 (0.03) | −0.05 | −0.10, 0.03 | – |
| AD→BO→SMA | 0.05 (0.03) | 0.07 | 0.003, 0.11 | – |

Note. Age and sex were controlled in the mediation model. $R^2$ = 0.19 for SB; 0.08 for BO; and 0.18 for SMA. AD = attention deficit level; SB = self-blame; BO = blaming others; SMA = social media addiction; 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 4**
Mediated roles of self-blame and blaming others in the association between hyperactivity levels and social media addiction (Hayes' Model 4).

| Path | Coeff. (SE) | Stand. coeff. | LLCI, ULCI | $p$-value |
|---|---|---|---|---|
| Direct effect | | | | |
| HI→SB | 0.11 (0.05) | 0.23 | 0.01, 0.20 | 0.03 |
| HI→BO | 0.12 (0.05) | 0.28 | 0.03, 0.21 | 0.008 |
| SB→SMA | −0.10 (0.15) | −0.08 | −0.40, 0.19 | 0.49 |
| BO→SMA | 0.32 (0.16) | 0.22 | 0.01, 0.63 | 0.04 |
| HA→SMA | 0.24 (0.06) | 0.38 | 0.11, 0.36 | <0.001 |
| Indirect effect[a] | | | | |
| HI→SB→SMA | −0.01 (0.02) | −0.02 | −0.07, 0.02 | – |
| HI→BO→SMA | 0.04 (0.03) | 0.06 | −0.004, 0.09 | – |

Note. Age and sex were controlled in the mediation model. $R^2$ = 0.10 for SB; 0.08 for BO; and 0.23 for SMA. HI = hyperactivity/impulsivity level; SB = self-blame; BO = blaming others; SMA = social media addiction; 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.

## 4. Discussion

The present study investigated the mediating effects of self-blame and blaming others in the associations between ADHD symptoms (i.e., attention deficit and hyperactivity/impulsivity) and SMA among Taiwanese young adults. The results showed the significant associations between both ADHD symptoms and SMA, which supported $H_1$. Additionally, blaming others was a significant mediator in the association between attention deficit and SMA, which partially supported $H_2$.

Both ADHD symptoms (i.e., attention deficit and hyperactivity/impulsivity) were found to be significantly associated with different emotional regulation strategies (i.e., self-blame and blaming others), which concurs with a previous study investigating the ADHD symptoms and three forms of impulsivity (Rosenthal et al., 2024). Rosenthal et al. (2024) found that impulsive action with strong emotion was particularly associated with hyperactivity/impulsivity, while poor constraint over negative thoughts and low motivation was particularly associated with attention deficit, suggesting that both ADHD symptoms and the context of emotional disturbance may interfere with the emotional regulation strategies among adults with ADHD symptoms.

Notably, emotional regulation strategies may differ between cultural contexts. Tangney et al. (1992) reported among American children, shame-proneness positively predicted anger-proneness via the mediation of externalization of blame (i.e., blaming others). However, shame-proneness did not predict anger-proneness, but positively predicted externalization of blame among Japanese children. Bear et al. (2009) also reported that compared to American children, Japanese children were less likely to externalize their blame. This can be explained through individuals' perception toward shame (where the feelings of shame may cause self-blaming), as well as societal differences with regards to individualism and collectivism (Sheikh, 2014). More specifically, collectivist cultures consider 'shame' as a valuable behavior as it represents a sense of self-discipline (Smith, 2017), while in individualistic cultures, people tend to deny their shame and place the blame on others, resulting in the cultural differences in emotional regulation strategies.

In addition, the significant associations between ADHD symptoms and SMA found in the present study corroborate previous findings (Andreassen et al., 2016; Boer et al., 2020; Settanni et al., 2018; Thorell et al., 2022). Notably, Boer et al. (2020) found that increased ADHD symptoms do not necessarily result in worsened SMA, but the presence of SMA may exacerbate the ADHD symptoms. However, a review that summarized 28 longitudinal studies which investigated the association between ADHD and SMA (Thorell et al., 2022) reported mixed findings. In 10 bi-directional design studies, three supported the bi-directional

relationships between social media use and ADHD symptoms, four supported the relationship between social media use and late ADHD symptoms, two supported the reverse relationship, and one reported a non-significant result. The cultural differences in social media use may also be attributed to these findings. More specifically, the prevalence of SMA was two-fold higher in collectivistic countries than in individualist countries (Cheng et al., 2021). Family and friends may reduce the risk of developing SMA in collectivist societies, whereas the importance of self and a wide but shallow circle of friends may increase the risk of developing SMA in individualist societies (Jackson & Wang, 2013). In addition, a recent study further reported that regional differences may influence the habits of internet use even among individuals with a similar cultural background, resulting in different patterns of social media use (Huang et al., 2024). Despite these findings, Thorell et al. (2022) suggested that the effect of 'time lag' should be carefully considered. That is, the effect of ADHD symptoms (on late SMA) may take different time to manifest than the effect of social media (on late ADHD symptoms) (Thorell et al., 2022). In sum, the reciprocal associations between ADHD symptoms and SMA warrants more longitudinal studies to examine this relationship.

The present study also found a direct effect between external emotional regulation strategy (i.e., blaming others) and SMA. Two previous studies have investigated the associations between internalizing/externalizing behaviors and SMA among adolescents (Gul et al., 2018; Riehm et al., 2019) and the results showed that higher ADHD symptoms were the risk factor for social media overuse and addiction (Gul et al., 2018). However, despite more externalizing behaviors being found among social media overuse users (Gul et al., 2018), more time spent on social media was found to increase the risk of internalizing behaviors (Riehm et al., 2019). One study has suggested that genetic and environmental factors that emerge at different lifespan phases may interact with the association between ADHD symptoms and emotional regulation strategies (Kuja-Halkola et al., 2015). Moreover, another study reported that individuals with ADHD tend to fixate on these maladaptive strategies (e.g., blame themselves or others, catastrophize or ruminate) in their adulthood (Soler-Gutierrez et al., 2023). Therefore, the present study's findings corroborate prior evidence showing associations between ADHD symptoms and external emotional regulation strategies. More specifically, one symptom of ADHD (i.e., attention deficit) among young adults was associated with SMA via emotional regulations of externalizing behavior.

Externalizing emotional regulation (i.e., blaming others) was found to mediate the association between symptom of attention deficit and SMA. Social media use is a particularly prevalent coping strategy among those with ADHD (Andreassen et al., 2016; Wolfers & Utz, 2022) and the way to regulate emotion is closely linked to an individual's attachment style (Ferraro & Taylor, 2021). Al-Yagon et al. (2020) investigated the mediating role of attachment patterns in the associations between ADHD symptoms and coping strategies. Attachment patterns were divided into attachment anxiety, which demonstrated a tendency toward self-blame, and attachment avoidance, which demonstrated a tendency toward blaming others (Gormley, 2005). Coping strategies were divided into task-oriented, emotional-oriented, and avoidance-oriented coping. The results showed that attachment anxiety mediated three types of coping strategies, but attachment avoidance only mediated the avoidance-oriented coping, suggesting a unique interaction between coping strategies and mediators. Although SMA may be considered as one type of avoidance-oriented coping (Kocabıyık & Bacıoğlu, 2022), the association between the present study's findings and attachment styles warrants further investigation. In addition, more studies are needed to understand the mediating factors for different coping strategies adopted by those with probable ADHD.

The present study found differences in emotional regulation strategy of self-blame and social media use between probable ADHD and non-ADHD participants. Emotional regulation, as a broad concept of self-control, refers to the preliminary control of individuals' emotions that substantially overlaps with inhibitory control, which is an important component of executive function (Diamond, 2013). Previous studies found structural and functional difference in brain levels between those with ADHD and those without (Gehricke et al., 2017; Yap et al., 2021), which may cause difficulties in regulating emotions, making decisions, and controlling impulses, subsequently leading to emotional dysregulation and impaired executive function (Christiansen et al., 2019; Landis et al., 2021). Additionally, the difficulties those with ADHD experience during their growth may lower their self-esteem and increase the emotional struggles, further resulting in self-blame behavior (Attoe & Climie, 2023). Therefore, the difference in neuropsychological function (Herrmann et al., 2010) and the impact on social-emotional well-being (Attoe & Climie, 2023) may foster the those with ADHD to adopt different strategies to regulate their emotion and cope with stress.

The present study has several limitations. First, the cross-sectional study design cannot determine any causality between study variables. Second, the use of self-reported assessments may cause methodological bias such as social desirability bias or recall bias. Third, a relatively small sample size may jeopardize the credibility. Fourth, the use of convenience sampling and only inclusion of students who were recruited by counseling and special education teachers lack of representativeness and validity and may cause the sampling bias. Nevertheless, instead of recruiting participants with confirmed ADHD, the present study included general young adults and used the symptoms of ADHD to investigate the underlying associations, which may increase the generalizability by expanding the present finding to general population with ADHD-like symptoms. In applying the present findings, the cultural contexts with regards to ADHD diagnosis, emotional regulation strategies, as well as the development of SMA, should be considered in order to provide the specific approaches for different populations.

## 5. Conclusion

The present study investigated the associations between ADHD symptoms (i.e., attention deficit and hyperactivity/impulsivity) and SMA among young adults. The mediation effects of internalizing and externalizing emotional regulation (i.e., self-blame and blaming others) were also examined. The results showed that both ADHD symptoms were significantly associated with two emotional regulation strategies and SMA. In addition, externalizing regulation of blaming others was significantly associated with SMA and was the mediator in the association between attention deficit and SMA. Therefore, externalizing emotional strategies may mediate the association between attention deficit and SMA. It is recommended that individuals with probable ADHD should focus on improving self-awareness (such as mindfulness), developing resilience skills, and/or incorporating positive coping strategies (such as physical activity) to reduce the negative impacts derived from symptoms of ADHD.

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## Ethics approval and patient consent 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.

## CRediT authorship contribution statement

**Tzu-Yu Liu:** Writing – review & editing, Software, Resources, Project

administration, Methodology, Investigation, Funding acquisition, Data curation, Conceptualization. **Wei-Ting Ko:** Writing – review & editing, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Data curation, Conceptualization. **Mark D. Griffiths:** Writing – review & editing, Validation, Methodology. **Amir H. Pakpour:** Writing – review & editing, Validation, Methodology. **Servet Üztemur:** Writing – review & editing, Validation, Methodology. **Daniel Kwasi Ahorsu:** Writing – review & editing, Validation, Methodology. **Po-Ching Huang:** Writing – review & editing, Writing – original draft, Validation, Methodology, Investigation, Conceptualization. **Chung-Ying Lin:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Methodology, Investigation, Formal analysis, Conceptualization.

## Declaration of competing interest

The authors declare no conflict of interest.

## Data availability

Data will be made available upon reasonable request.

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