



# The association of Internet addiction symptoms with anxiety, depression and self-esteem among adolescents with attention-deficit/hyperactivity disorder

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## Abstract

**Background:** The aims of this study were to examine the associations of the severity of Internet addiction symptoms with various dimensions of anxiety (physical anxiety symptoms, harm avoidance, social anxiety, and separation/panic) and depression symptoms (depressed affect, somatic symptoms, interpersonal problems, and positive affect) and self-esteem among adolescents diagnosed with attention-deficit/hyperactivity disorder (ADHD) in Taiwan.

**Method:** A total of 287 adolescents aged between 11 and 18 years who had been diagnosed with ADHD participated in this study. Their severity of Internet addiction symptoms was assessed using the Chen Internet Addiction Scale. Anxiety and depression symptoms and self-esteem were assessed using the Taiwanese version of the Multidimensional Anxiety Scale for Children (MASC-T), the Center for Epidemiological Studies Depression Scale (CES-D), and the Rosenberg Self-Esteem Scale (RSES), respectively. The association between the severity of Internet addiction symptoms and anxiety and depression symptoms and self-esteem were examined using multiple regression analyses.

**Results:** The results indicated that higher physical symptoms and lower harm avoidance scores on the MASC-T, higher somatic discomfort/retarded activity scores on the CES-D, and lower self-esteem scores on the RSES were significantly associated with more severe Internet addiction symptoms.

**Conclusions:** Prevention and intervention programs for Internet addiction in adolescents with ADHD should take anxiety, depression, and self-esteem into consideration.

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## 1. Introduction

Internet addiction can result in substantial adverse effects on the lives of adolescents, such as declines in physical and mental health, interpersonal relationships, and academic performance [1,2]. Attention-deficit/hyperactivity disorder (ADHD) is the most common psychiatric disorder among adolescents with Internet addiction who have been referred for psychiatric treatment [3]. A prospective community study

also found that ADHD can predict the occurrence of Internet addiction 2 years later in adolescents [4]. Several biopsychosocial mechanisms might explain the coexistence of Internet addiction and ADHD. Firstly, Internet behavior is characterized by rapid response and immediate reward, which may provide immediate stimulation and reward for people with the core ADHD symptoms of “being easily bored” and “having an aversion for delayed reward” [5]. Meanwhile, people with ADHD tend to seek enhanced stimulation of the reward pathway [6]. Most Internet games, the major Internet activity for many adolescents, are designed to provide an incentive to “get to the next level,” which instantaneously creates a salient reward for users with ADHD [7]. Adolescents with ADHD have abnormal brain activities associated with impaired inhibition [8], which may

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result in difficulty in controlling Internet use and hence increased vulnerability to Internet addiction. ADHD symptoms can also negatively influence interpersonal relationships in the real lives of adolescents, and thus, adolescents with ADHD may seek interpersonal relationships online instead of in the real world [5]. The association between ADHD and Internet addiction suggests that adolescents with ADHD should be an important target group of preventive scheduling for Internet addiction.

Other than ADHD, anxiety and depression are the two psychological symptoms that are prevalent in people with Internet addiction [5]. Some issues regarding the relationships of Internet addiction with anxiety and depression in adolescents with ADHD have not been examined in depth. First, both anxiety and depression are multi-dimensional and not single-dimensional psychological symptoms. Studies on children and adolescents found multiple dimensions of anxiety symptoms as measured by the Multidimensional Anxiety Scale for Children (MASC), including physical symptoms, harm avoidance, social anxiety, and separation/panic [9,10]. However, previous studies only examined the association between Internet addiction and social anxiety in adolescents. For example, research has found that social anxiety and shyness are significantly associated with Internet addiction [4,11] and Instant Messaging addiction among adolescents [12], respectively. Moreover, research on adolescents found multiple dimensions of depression symptoms as measured by the Center for Epidemiological Studies Depression Scale (CES-D), including affect (depressed and positive), somatic symptoms, and interpersonal problems [13]. However, previous studies have considered depression as a single-dimensional symptom and did not differentiate the various relationships of Internet addiction with different dimensions of depressive symptoms [4,11]. The relationships of Internet addiction with multiple dimensions of anxiety and depression need further study. Second, research has found that over one-third of adolescents with ADHD have comorbid anxiety disorders [14], and that generalized anxiety disorder but not social phobia is the most prevalent diagnosis co-occurring with ADHD in children and adolescents [15]. Meanwhile, between 5 and 40% of children and teens with ADHD meet the criteria for major depression [16]. Based on our research, however, no study has examined the relationships of Internet addiction with multiple dimensions of anxiety and depression in adolescents clinically diagnosed with ADHD.

Research has found that adolescents with lower self-esteem are more easily addicted to the Internet [17]. It has been hypothesized that the Internet provides adolescent players with activities in which they can feel confident, and they have positive self-esteem in the virtual world [17,18]. Furthermore, children diagnosed with ADHD report lower self-esteem in adolescence as compared with controls [19]. Multiple failures in school and family contests may drive adolescents with ADHD to experience a low perception of their competency as compared with their peers. It is reasonable to hypothesize that Internet addiction is significantly associated with low self-

esteem in adolescents with ADHD. However, no study has examined this hypothesis.

The aims of this study were to examine the associations of the severity of Internet addiction symptoms with various dimensions of anxiety (physical anxiety symptoms, harm avoidance, social anxiety, and separation/panic) and depression symptoms (depressed affect, somatic symptoms, interpersonal problems, and positive affect) and self-esteem and the moderating effects of sex and age on the associations among adolescents with the clinical diagnosis of ADHD in Taiwan. Based on the results of previous studies [17,18], we hypothesized that the severity of Internet addiction symptoms is negatively associated with the level of self-esteem. Owing to a lack of previous studies, we temporally hypothesize that the severity of Internet addiction symptoms is positively associated with the severities of anxiety and depression symptoms and that the associations are various in term of different dimensions of anxiety and depression symptoms among adolescents with ADHD.

## 2. Methods

### 2.1. Participants

The participants were recruited from the child and adolescent psychiatric outpatient clinics of two medical centers in Kaohsiung, Taiwan. Adolescents aged between 11 and 18 years diagnosed with ADHD were consecutively invited to participate in this study between November 2012 and November 2013. Five child psychiatrists conducted a diagnostic interview with the adolescents and the parents to confirm the diagnosis of ADHD and subtypes according to the diagnostic criteria in the *Diagnostic and Statistical Manual of Mental Disorders-IV Text Revision (DSM-IV-TR)* [20]. If the adolescents visited the clinics not for the first time, their previous medical records and the results of the short version of the Swanson, Nolan, and Pelham Version IV Scale-Chinese version (SNAP-IV) [21,22] reported by the parents and teachers previously were also used as the references to support the diagnosis of ADHD and subtypes.

To make sure that the participants can understand the study purpose and complete the research questionnaires, adolescents who had the diagnosis of intellectual disability, whose current or previously recorded full intelligence quotient on any version of the Wechsler Intelligence Scale for Children or Wechsler Preschool and Primary Scale of Intelligence was 70 or below, or whose poor adaptive functioning indicated the possibility of intellectual disability were excluded from this study. Adolescents who had or might have the diagnosis of schizophrenia, bipolar disorder, or organic mental disorder based on the results of medical records, parents' reports, or clinicians' observation in interview room were also excluded. Although according to *DSM-IV-TR* autistic disorder should not be diagnosed with ADHD concurrently [20], this study only exclude those whose autistic disorder resulted in difficulty in communicating. Anyone who had cognitive, reading, or

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