

## Risk of Internet Addiction in Adolescent with Attention Deficit Hyperactivity Disorder: An Evidence Based Case Report

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### Abstract

Attention Deficit Hyperactivity Disorder (ADHD) constitutes a prominent neurodevelopmental disorder frequently observed in childhood, characterized by three core symptoms encompassing inattention, hyperactivity, and impulsivity. Notably, the persistence of ADHD can extend from childhood into adolescence and even adulthood. Importantly, it has been noted that in nearly half of cases where ADHD endures beyond childhood and into the later stages of life, there is a substantial elevation in the risk of various addictive behaviors, encompassing alcohol, nicotine, other substances, and behavioral addictions like internet addiction, in comparison to individuals without a history of ADHD. Against this backdrop, the present literature exploration is specifically focused on discerning the influence of childhood ADHD on the propensity for internet addiction in adolescence and young adulthood. To comprehensively address this query, a meticulously structured search was conducted across several renowned databases including Pubmed, EBSCOhost, Scopus, and ProQuest. The search parameters were thoughtfully adapted and refined to align seamlessly with the clinical question, ensuring the retrieval of pertinent and valuable information. Among the amassed results, one article was identified as particularly pertinent, serving as a concise compilation of the most recent insights into the intricate interplay between ADHD and internet addiction. The outcomes derived from this thorough meta-analytical review not only establish a substantial association between childhood and adolescent ADHD and an augmented susceptibility to internet addiction in later years but also provide quantification through a notable Crude Odds Ratio (COR) of 3.76 (95% CI: 2.75, 5.15) and an Adjusted Odds Ratio (AOR) of 2.51 (95% CI: 2.09, 3.02) following meticulous confounder adjustments. Furthermore, a striking observation emerges wherein adolescents grappling with internet addiction manifest intensified ADHD symptoms, corroborated by evident elevation in Abbreviated Conners Rating Scale scores relative to their non-addicted counterparts. Collectively, these findings underscore the imperative of recognizing and addressing the heightened risk of internet addiction among adolescents with a history of ADHD and spotlight the pressing need for nuanced interventions and comprehensive support strategies.

**Keywords:** Adolescence, attention deficit hyperactivity disorder, internet addiction.

## Risiko Terjadinya Adiksi Internet pada Remaja dengan Gangguan Pemusatan Perhatian dan Hiperaktivitas : Sebuah Laporan Kasus Berbasis Bukti

### Abstrak

Gangguan Pemusatan Perhatian dan Hiperaktivitas (GPPH) merupakan salah satu gangguan neurodevelopmental yang umum terjadi pada masa kanak. Dikenal dengan tiga gejala inti, yakni inatensi, hiperaktivitas, dan impulsivitas, GPPH mampu bertahan hingga masa remaja dan bahkan dewasa. Signifikansi penting terletak pada fakta bahwa hampir 50% kasus GPPH yang berlanjut ke fase remaja dan dewasa mengalami risiko lebih tinggi terhadap beragam bentuk adiksi, seperti alkohol, nikotin, zat aditif lainnya, dan adiksi perilaku seperti adiksi internet. Perbandingannya menunjukkan angka yang lebih tinggi dibandingkan dengan individu tanpa riwayat GPPH. Penelusuran literatur ini diarahkan untuk menggali dampak GPPH pada masa kanak terhadap potensi terjadinya adiksi internet pada fase remaja hingga dewasa muda. Langkah pencarian secara terstruktur dilakukan melalui berbagai basis data terkemuka seperti Pubmed, EBSCOhost, Scopus, dan ProQuest. Kata kunci dikalibrasi untuk sejalan dengan pertanyaan klinis, dengan penyusuaian guna memastikan hasil yang relevan dan berarti diperoleh. Dari rangkaian hasil ini, satu artikel teridentifikasi sebagai relevan dengan kerangka pemahaman yang diusung, menghadirkan gambaran komprehensif mengenai hubungan antara GPPH dan adiksi internet. Ulasan hasil meta-analisis yang mendalam menegaskan bahwa remaja dengan GPPH memiliki risiko lebih tinggi mengalami adiksi internet pada masa remaja hingga dewasa muda. Fakta ini terlihat dalam nilai Crude Odds Ratio (COR) sebesar 3.76 (95% CI: 2.75, 5.15) dan Adjusted Odds Ratio (AOR) sebesar 2.51 (95% CI: 2.09, 3.02) setelah mempertimbangkan faktor perancu. Peneliti menemukan bahwa pasien dengan adiksi internet menunjukkan gejala GPPH yang lebih parah, sebagaimana diindikasikan oleh peningkatan skor Abbreviated Conners Rating Scale dibandingkan dengan kelompok kontrol. Secara keseluruhan, temuan ini menegaskan perlunya mengakui risiko yang lebih tinggi terhadap adiksi internet pada remaja dengan riwayat GPPH, serta menegaskan urgensi intervensi tepat dan dukungan komprehensif dalam mengatasi permasalahan ini.

**Kata kunci:** Adiksi internet, gangguan pemusatan perhatian dan hiperaktivitas, remaja

## Introduction

The contribution and influence of the internet cannot be separated from daily human life, especially in teenagers and young adults. Teenagers in the United States are said to spend more than 3 hours online on a regular day for something unrelated to their schoolwork, such as online games or social media. The internet is a double-edged sword in that it can help spread information, but on the other hand, it has various negative consequences from excessive use, including sleep problems, mood disorders, and interpersonal relationship problems. Several terminologies have been given for problems related to internet use, including Internet gaming disorder (IGD), excessive internet use, compulsive internet use, problematic internet usage, and pathological internet usage.<sup>1</sup>

The term internet addiction was first introduced by Young. Young defined internet addiction as the presence of 5 or more of 8 symptoms that arise from internet use: preoccupation, tolerance, withdrawal, inability to control, using more than desired, functional decline, lying about the amount and duration of use, and using to reduce uncomfortable moods. Young developed the Young Diagnostic Questionnaire and the Internet Addiction Test as instruments to diagnose and assess maladaptive internet use. Both instruments have been widely validated and become commonly used instruments to assess the presence of internet addiction in someone.<sup>1,2</sup>

The prevalence of internet addiction varies depending on differences in methodology, the lack of a standardized diagnostic consensus for internet addiction, and the socio-cultural influences of each country. Surveys in the United States and some European countries show a prevalence range of 4.4% and higher in males. It is said that males use the internet more for online gaming, while females use it more for social media interaction.<sup>2,11</sup> The prevalence of internet addiction is higher in Asian countries (especially China, Taiwan, and South Korea), but there is no definite reason for this. Chi et al. identified the prevalence of internet addiction in high school students at 17.9% and 12.2% in college students in China.<sup>3</sup> Wu et al. found a prevalence of 10.8% in Taiwan,<sup>4</sup> Park et al. found a prevalence of

10.7% in Korea,<sup>5</sup> and Fu et al. found a prevalence of 6.7% in Hong Kong.<sup>6</sup>

All studies consistently show that males are at higher risk of internet addiction than females. Psychiatric disorders are also said to be the biggest risk factor for internet addiction in someone. The most commonly mentioned psychiatric disorders are depression, anxiety, behavioral disorders, and attention deficit hyperactivity disorder (ADHD).<sup>1,7,8</sup>

ADHD is a neurodevelopmental disorder characterized by difficulty maintaining attention and concentration, increased activity, and difficulty controlling behavior that is inappropriate for the individual's age. Approximately 36.3% of cases of childhood ADHD persist into adolescence and even adulthood, and this can be a risk factor for substance addiction or behavioral addiction later in life. In a study, it was said that ADHD was a predictor of addiction within less than 10 years since diagnosis.<sup>9</sup>

Ko et al. explained the mechanism linking internet addiction and ADHD as follows: first, individuals with ADHD tend to get bored easily and cannot wait for rewards that are not immediately obtained. The internet provides a quick response and immediate reward, so when using the internet, the individual's boredom will decrease. Second, there is a release of dopamine in the striatum when individuals play on the internet, which makes internet users more focused and even perform well when playing online games.<sup>10</sup>

Third, individuals with ADHD have abnormal brain activity associated with decreased inhibition, making them vulnerable to internet addiction. Individuals with ADHD and IGD also show increased N-acetyl-aspartate in the frontal lobes on Proton Magnetic Resonance Spectroscopy.<sup>11</sup>

Many studies have been conducted and show a relationship between internet addiction and ADHD, indicating that adolescents with ADHD have an increased risk of internet addiction and require immediate intervention.<sup>12</sup> Therefore Early detection Interventions in Primary Care are necessary to address the increased risk of internet addiction in adolescents with ADHD.

### Case Illustration

M, a 14-year-old boy, was brought by his mother to the Primary Care Clinic for routine check-up, and referral to the Child and Adolescent Clinic at the Provincial Mental Hospital. The patient first visited the clinic 4 years ago when he started second grade in elementary school because he had difficulty concentrating in class. The patient appeared to have walked in and out of the classroom, disturbing his friends, and often forgetting what the teacher had taught in school. The patient was referred to his current child and adolescent psychiatrist where was diagnosed with ADHD and received methylphenidate therapy.

The patient's mother complained that since the end of last year, the patient played online games excessively, and could spend more than 10 hours almost every day. The patient missed working on homework, eat, bathe, rest, and even forgets to take his ADHD medications. If the internet connection at home was turned off, the patient would get angry and yell at his parents. The patient's parents several times found the patient secretly playing online games until late at night, causing the patient to wake up late and appear sleepy at school. The patient also often lied to his parents about the amount of time spent online.

Inside a WhatsApp Group for ADHD Caregiver the patient's mother chatted with the parents of another patient, a 15-year-old teenager who had ADHD since childhood and recently also could not be separated from his mobile phone to watch videos on the internet and play online games, causing his grades at school to decrease. The patient's mother asked whether adolescent with ADHD is at risk of internet addiction compared to adolescent who do not have ADHD.

### Methods

The clinical inquiry aims to determine whether adolescents with ADHD are more susceptible to developing internet addiction during adolescence or young adulthood, compared to their counterparts without ADHD. The formulated PICO question is as follows: In

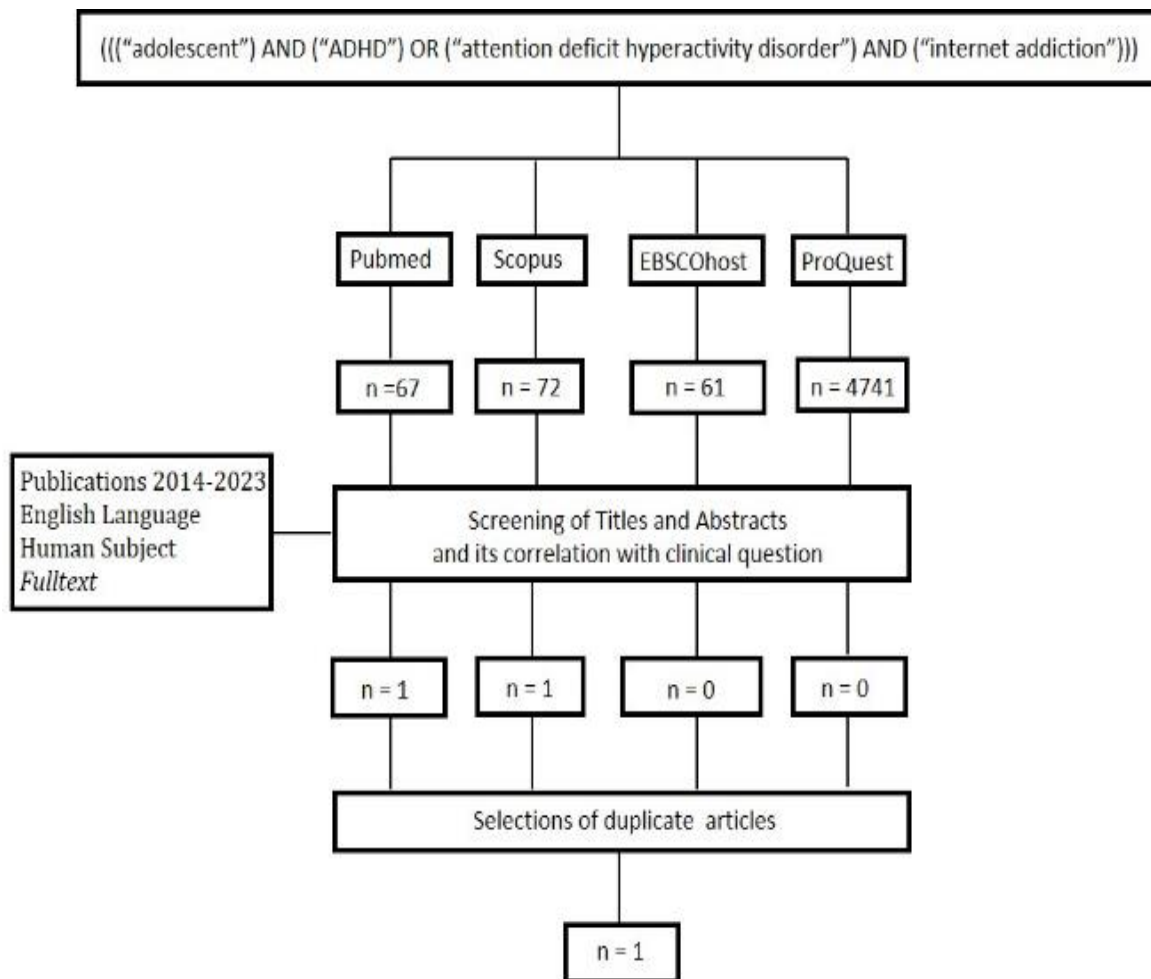
adolescents (P), does the presence of attention deficit hyperactivity disorder (ADHD) (I) elevate the risk of encountering internet addiction in adolescence or young adulthood, in contrast to adolescents without ADHD (C)? The primary outcome of interest is internet addiction. Relevant keywords encompass adolescents, attention deficit hyperactivity disorder, and internet addiction.

The search was conducted using keywords created based on Boolean operators. The search engines used were Pubmed, Scopus, EBSCOhost, and ProQuest. In this search, selection was made using keywords to obtain relevant results, as shown in table 1.

**Table 1.** Results of journal article search

Search Engine	Key Words	Results
Pubmed	((adolescent) AND adhd) AND attention deficit hyperactivity disorder) AND internet addiction)))	67
Scopus	((adolescent) AND adhd) AND attention deficit hyperactivity disorder) AND internet addiction)))	72
EBSCOhost	((adolescent) AND adhd) AND attention deficit hyperactivity disorder) AND internet addiction)))	61
ProQuest	((adolescent) AND adhd) AND attention deficit hyperactivity disorder) AND internet addiction)))	4741

The search results were selected using limitations such as the type of article published within the last 10 years, written in English, and available in full text. The selected articles were those involving studies on humans, then filtered based on the title and abstract that matched the clinical question. Screening was also done to avoid duplicate articles. After the selection process, one meta-analysis article was obtained that matched the clinical question. Figure 1. Shows the flow of the article selection process.



**Figure 1.** The flow of article selection process

**Results**

The single article, by Wang et al<sup>13</sup>, was critically reviewed by assessing validity, importance, and applicability to the case using an assessment sheet provided by the Centre for Evidence-Based Medicine.

The purpose of this meta-analysis study was clearly stated in the article. This study aimed to determine the relationship between internet addiction and ADHD, the influence of the severity of ADHD symptoms on the occurrence of internet addiction, and the relationship between demographic characteristics and internet addiction. The inclusion criteria in this study were clearly stated. The methodological quality of each article was assessed by each researcher using The Newcastle-Ottawa Scale, and then compared, and if there were differences in the assessment results, the two researchers would discuss and add assessment from a third researcher if the results obtained were still

inconclusive. The article search included articles published through 4 databases, namely CENTRAL, EMBASE, PubMed, and PsychINFO without language restrictions. References from each article obtained were searched manually. The study report stated the heterogeneity value estimation in the form of I<sup>2</sup> at 8%, which means that the assessment is heterogeneous but does not affect the analysis results obtained.

The study concluded that there is a moderate relationship between internet addiction and ADHD in adolescents and young adults, and patients with internet addiction show more severe ADHD symptoms than the control group. With overall Crude Odds Ratio (COR) is 3.76, 95%CI 2.75, 5.15, with significant heterogeneity (P = 0.004, I<sup>2</sup> = 68%). After adjusting for confounding factors, the Adjusted Odds Ratio (AOR) was 2.51, 95%CI 2.09, 3.02 with low heterogeneity (P = 0.36, I<sup>2</sup> = 8%).

The results of this study can be applied in primary and secondary mental health services in Indonesia, especially in child and adolescent

mental health. ADHD is the most commonly encountered neurodevelopmental disorder in daily clinical practice, so knowledge about the course of the disease, management, and biological basis linking ADHD and internet addiction can be used to identify individuals at high risk so that patients can receive more comprehensive management.

### Discussion

The results of the meta-analysis study by Wang et al. showed a positive relationship between internet addiction and ADHD even after controlling for confounding factors. ADHD symptoms in the group with internet addiction were more severe than in the group without internet addiction as shown by a marked increase in score of the Abbreviated Conners Rating Scale. Adolescent males and young adults were more likely to be diagnosed with internet addiction, but age patterns were not related to internet addiction in this study. Evidence indicating a causal relationship between internet addiction and ADHD is still lacking.

Several factors predict the occurrence of internet addiction, including male gender, low family support, protective parenting style, poor school performance, and poor interpersonal skills. These predictor factors are especially useful in determining internet addiction prevention programs in the child and adolescent population. Internet addiction therapy generally has the same goals as substance addiction management, which is to modify neurobiological or environmental factors combined with limiting exposure or access to related substances/behaviors.

Some suggestions that can be given to parents to prevent internet addiction include encouraging other interests and activities that do not involve the internet, such as group sports and extracurricular activities that can facilitate peer interaction. Setting clear limits on online time (less than 2 hours per night), placing computers in public areas for monitoring online activities, utilizing various applications to restrict internet usage on mobile phones, and demonstrating positive internet use behavior to children. Additionally, it's important for parents to engage in open communication with their

children and adolescents about the stressors they face in their lives.

A family-based approach can be used when there are family risk factors associated with internet addiction. Specifically, Ko et al. stated that reducing interparental conflict and improving family function and internet regulation can be used to prevent internet addiction. Reducing family conflict and improving communication are the main targets of management.<sup>10</sup>

### Conclusion

In conclusion, Wang et al.'s meticulously reviewed study establishes a clear link between internet addiction and ADHD in adolescents and young adults. The findings indicate that internet-addicted individuals experience more severe ADHD symptoms, with significant effect sizes evident in both Crude Odds Ratio (COR) and Adjusted Odds Ratio (AOR) analyses. These results have practical implications for enhancing mental health services, particularly for youths. The discussion underscores the value of predictive factors in crafting preventive strategies and highlights the parallels between internet and substance addiction management.

Proposed parental recommendations emphasize diversifying offline activities, setting time limits, and promoting healthy online behavior. A family-based approach holds promise in mitigating addiction risk factors. This evidence-based case report substantiates the ADHD-internet addiction connection, emphasizing the need for proactive intervention and monitoring.

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