Psychiatric Comorbidity of Internet Addiction in College Students: *An Interview Study*

By Chih-Hung Ko, MD, Ju-Yu Yen, MD, Cheng-Sheng Chen, MD, Cheng-Chung Chen, MD, PhD, and Cheng-Fang Yen, MD, PhD

ABSTRACT

Objective: This study was aimed to evaluate the association between Internet addiction and depressive disorder, social phobia and adult attention-deficit/hyperactivity disorder (ADHD) in a sample of Taiwanese college students; and examine gender differences in the psychiatric comorbidity of Internet addiction in this student population.

Methods: Two hundred sixteen college students (132 males, 84 females) were recruited. Internet addiction, major depressive disorder, dysthymic disorder, social phobia, and adult ADHD of all participants were diagnosed based on psychiatric diagnostic interview.

Results: This study revealed that adult ADHD and depressive disorders were associated with Internet addiction among college students. However, depressive disorders were associated with Internet addiction in the males but not the females.

Conclusion: With these results, it seems reasonable to suggest that effective evaluation of, and treatment for, adult ADHD and depressive disorders is required for college students with Internet addiction.

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Needs Assessment

To evaluate comorbid psychiatric disorder has significant implications with respect to the prevention and treatment of Internet addiction and also shed light on the underlying mechanism(s) of this dysfunction. This article reports the comorbid psychiatric disorders of Internet addiction based on a diagnostic interview.

Learning Objectives

At the end of this activity, the participant should be able to:
- Discuss the comorbidity of Internet addiction.
- Understand the gender difference in comorbid depression of Internet addiction.
- Understand what psychiatric disorders should be evaluated for Internet addiction among college students.

Target Audience: Neurologists and psychiatrists

CME Accreditation Statement

This activity has been planned and implemented in accordance with the Essentials and Standards of the Accreditation Council for Continuing Medical Education (ACCME) through the joint sponsorship of the Mount Sinai School of Medicine and MBL Communications, Inc. The Mount Sinai School of Medicine is accredited by the ACCME to provide continuing medical education for physicians.

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The Mount Sinai School of Medicine designates this educational activity for a maximum of 3 *AMA PRA Category 1 Credit(s)™*. Physicians should only claim credit commensurate with the extent of their participation in the activity.

This activity has been peer-reviewed and approved by Eric Hollander, MD, chair at the Mount Sinai School of Medicine. Review date: January 17, 2008. Dr. Hollander does not have an affiliation with or financial interest in any organization that might pose a conflict of interest.

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Dr. Ko is psychiatrist in the Department of Psychiatry at Kaohsiung Medical University Hospital in Kaohsiung, Taiwan; and doctoral student at Graduate Institute of Medicine at the Kaohsiung Medical University College of Medicine. Dr. J-Y Yen is psychiatrist in the Department of Psychiatry at Kaohsiung Medical University Hospital; doctoral student at Graduate Institute of Medicine at Kaohsiung Medical University College of Medicine and chief in the Department of Psychiatry of the Municipal Hsiao-Kang Hospital in Kaohsiung, Taiwan. Dr. C-S Chen is psychiatrist in the Department of Psychiatry at Kaohsiung Medical University Hospital; doctoral student at Graduate Institute of Medicine at Kaohsiung Medical University College of Medicine; and assistant professor in the Department of Psychiatry at in the Faculty of Medicine at Kaohsiung Medical University College of Medicine. Dr. C-C Chen is associate professor in the Department of Psychiatry at Kaohsiung Medical University Hospital; and chief at Kai-Suan Psychiatric Hospital in Kaohsiung. Dr. C-F Yen is psychiatrist in the Department of Psychiatry at Kaohsiung Medical University Hospital; and associate professor in the Department of Psychiatry in the Faculty of Medicine at Kaohsiung Medical University College of Medicine.

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Please direct all correspondence to: Cheng-Fang Yen, MD, PhD, Kaohsiung Medical University Hospital, Department of Psychiatry, 100 Tzyou First Road, Kaohsiung City, Taiwan 807; Tel: 886-7-3121101 ext. 6822, Fax: 886-7-3134761; E-mail: chfaye@cc.kmu.edu.tw.

INTRODUCTION

The Internet has become an integral part of daily life for college students for both academic and recreational purposes. There is a dramatic proliferation of research exploring the effect of heavy Internet use on psychological wellbeing,[1] with 8% to 13% of undergraduates reportedly addicted to its use, impairing individual psychological well-being, peer and family interactions, and academic performance.[2-4] This phenomenon of excessive use has been labeled "Internet addiction"[1] and "problematic Internet use".[5,6] However, whether it is a primary addictive disorder or a secondary disorder of other psychiatric disorder has remained controversial.[7] Comorbidity of two disorders may indicate a causal relationship or common etiology.[8] It is important, therefore, to evaluate whether there are comorbid psychiatric disorders associated with the development and/or maintenance of Internet addiction. Further, comorbidity is often associated with poor prognosis[9] with an interventional approach to this concomitance usually suggested.[10] Thus, to evaluate comorbid psychiatric disorder has significant implications with respect to the prevention and treatment of Internet addiction, and also shed light on the underlying mechanism/s of this dysfunction.

Psychiatric disorders comorbid with Internet addiction are only mentioned in a few investigations. Association between depression and Internet addiction has been reported in adolescents and adults.[11-13] Attention-deficit/hyperactivity disorder (ADHD) has also been correlated with Internet addiction in children.[12,14] However, the aforementioned reports of Internet addiction, depression, and ADHD were assessed from self-report or parent and teacher evaluation rather than by diagnostic interview. Structured diagnostic interview with a psychiatrist provides greater diagnostic accuracy and contributes to more comprehensive evaluation. Ha and colleagues[12] used diagnostic interview to evaluate psychiatric comorbidity in 12 children and 12 adolescents classified as Internet addicts based on self-report questionnaires. Of this sample, six children were diagnosed with ADHD or subthreshold ADHD, and three adolescents with major depressive disorder (MDD). These results indicate that ADHD and depression are important psychiatric comorbidities of Internet addiction. However, the associations between Internet addiction and depression and ADHD have never been evaluated in college students. Although shyness is reportedly correlated with Internet addiction in a tertiary-student population,[15] the association between social phobia and Internet addiction has never been evaluated.

Gender differences in the prevalence and mechanism(s) of Internet addiction have been examined in adolescents.[16] Gender differences have also been reported for substance use disorder and psychiatric morbidity in teens.[17] For example, it was demonstrated that depression is a greater risk factor for development of alcohol abuse disorder in females.[10] Moreover, gender differentiation in terms of comorbidity usually leads to varying prognoses as well as gender-specific prevention and intervention.[10] However, no investigations of gender distribution in the psychiatric comorbidity of Internet addiction have been reported.

Accordingly, the study was aimed to evaluate the association between Internet addiction and depressive disorder, social phobia, and adult ADHD in a sample of Taiwanese college students; and examine gender differences in the psychiatric comorbidity of Internet addiction in this student population.

METHODS

Participants

From September 2005 to March 2006, a total of 216 college students (132 male, 84 female) responded to a posted advertisement inviting high or low frequency internet use. Mean age of the recruits was 21.45±2.05 years (range: 18–27 years of age), and mean education level was grade 14.55±1.42 (range: 13–18). Of these, 139 and 77 students reported high- and low-frequency Internet use, respectively.

Measurements

Diagnostic Criteria of Internet Addiction for College

Ko and colleagues[18] have developed the *Diagnostic Criteria of Internet Addiction* for college (*DC-IA-C*) based on empirical diagnostic interview study. Criterion A is met with six of nine characteristic symptoms of Internet addiction: preoccupation, uncontrolled impulse, use more than intended, tolerance, withdrawal, impairment of control, excessive time and effort devoted to the Internet, and impaired decision making. Criterion B describes functional impairment secondary to Internet use. Psychotic disorder and bipolar I disor-

der were listed in criterion C as exclusion criteria. Besides, the object of other behavior addiction, for example pathological gambling may exist online and represent with maladaptive Internet use. Thus, other behavior addiction classified in impulse-control disorder or paraphilia in *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition-Text Revisions* was added to criterion C to make further differential diagnosis. Good diagnostic accuracy (95.9%) and specificity (92.4%) have been demonstrated for the diagnostic criteria.[18]

The Chinese Version of the Mini-International Neuropsychiatric Interview

The diagnoses of current MDD, dysthymic disorder, and social phobia were assessed according to the Chinese version of the Mini-International Neuropsychiatric Interview[19] based on *DSM-IV* criteria. The college students who had MDD or dysthymic disorder were classified to have depressive disorders.

Interview Diagnosis for Attention-Deficit/ Hyperactivity Disorder

We developed the semi-structured Diagnostic Tool for Adult ADHD based on the *DSM-IV* criteria for ADHD. The questions for 18 current ADHD symptoms were worded and scored according to the Adult ADHD Self-Reported Scale.[20] The existence of current attention deficit or hyperactivity is defined where six or more symptoms are reported to occur "often" or "very often". As the diagnosis of ADHD assumes childhood dysfunction, the relevant section of the Kiddie version of the Schedule for Affective Disorders and Schizophrenia-Present and Life Version was used to assess early occurrence of ADHD.[21] Functional impairment associated with ADHD symptoms was also determined by assessing academic achievement, social interaction, and job performance. Adult ADHD was diagnosed from current and childhood ADHD as well as from functional impairment caused by the characteristic symptoms.

Procedure and Statistical Analysis

All participants provided written informed consents prior to commencement of the study. All subjects completed the research questionnaires for collection of the salient demographic data. A psychiatrist blind to the students' frequency of internet use subsequently conducted diagnostic interviews, which was based on the structured interview schedule of *DC-IA-C*, the section of the Mini-International Neuropsychiatric Interview related to depressive disorders and social phobia, and the Semi-structured Diagnostic Tool for Adult ADHD and Kiddie version of the Schedule for Affective Disorders and Schizophrenia-Present and Life Version to diagnose Internet addiction, MDD, dysthymic disorder, social phobia, and adult ADHD, respectively. The χ^2 test was applied to determine the associations between Internet addiction, and, gender, MDD, dysthymic disorder, depressive disorders, social phobia, and adult ADHD. Internet addiction was regressed on depressive disorders, social phobia, and adult ADHD using stepwise logistic regression, controlling for gender and age. Furthermore, the same ways to evaluate the association between Internet addiction and psychiatric disorders were conduct for male and female college students, respectively. All statistical analyses were performed using the SPSS 10.0 computer program. Statistical significance was considered where $P<.05$ for all tests.

RESULTS

Based on the results of diagnostic interview, a total of 87 participants (65 male, 22 female) were classified as Internet addicts while the other 129 participants were deemed unaffected (67 male, 62 female). Seventeen (7.9%), 15 (6.9%), 24 (11.1%), 20 (9.3%), and 39 (18.1%) participants were diagnosed with MDD, dysthymic disorder, depressive disorder, social phobia, and adult ADHD, respectively. The associations between Internet addiction, and, gender and psychiatric comorbidity are shown in Table 1. The Internet addicts were more likely to be male and to have MDD, dysthymic disorder, depressive disorder, social phobia, or adult ADHD compared to their non-addict analogs. The associations between Internet addiction and psychiatric comorbidity examined using logistic regression (Table 2) revealed that adult ADHD was the first predictor entered in the regression model, followed by depressive disorders. However, social phobia was no longer associated with Internet addiction in the logistic regression model.

Examination of Table 3 reveals that the male college students with Internet addiction were more likely to have MDD, depressive disorders, and adult ADHD than those without this dysfunction. The logistic regression demonstrated that Adult ADHD and depressive disorder were associated Internet addiction in male college students (Table 4). For female college students, those with Internet addiction were more likely to have adult ADHD than unaffected analogs (Table 3). Further, adult

ADHD was also associated with Internet addiction in the logistic regression model (Table 4).

DISCUSSION

The results of this study demonstrate that our sample of college students with Internet addiction were more likely to have MDD, dysthymic disorder, social phobia and adult ADHD than their unaffected counterparts. Adult ADHD is the most significant predictor for Internet addiction, followed by depressive disorders. Social phobia, however, was not correlated with Internet addiction in our sample after controlling for depressive disorders and adult ADHD. Further, depressive disorders and Internet addiction were associated in the male college students, but not the females.

TABLE 1.
The Association Between Internet Addiction and Gender, Characteristics of Internet Activities, and Psychiatric Comorbidity

	Internet Addiction			
	Yes, n (%)	*No, n (%)*	χ^2	P
Gender				
Male	65 (74.7)	67 (51.9)	11.34	.001
Female	22 (25.3)	62 (48.1)		
Major Depressive Disorder				
Yes	11 (12.6)	6 (4.7)	4.58	.03
No	76 (87.4)	123 (95.3)	–	–
Dysthymic Disorder				
Yes	10 (11.5)	5 (3.9)	4.67	.03
No	77 (88.5)	124 (96.1)	–	–
*Depressive Disorders**				
Yes	16 (18.4)	8 (6.2)	7.82	.005
No	71 (81.6)	121 (93.8)	–	–
Social Phobia				
Yes	13 (14.9)	7 (5.4)	5.60	.02
No	74 (85.1)	122 (94.6)	–	–
Adult ADHD				
Yes	28 (32.2)	11 (8.5)	19.65	<.001
No	59 (67.8)	118 (91.5)	–	–

* Depressive disorders: major depressive or dysthymic disorder.

ADHD=attention-deficit/hyperactivity disorder.

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This study is the first to demonstrate an association between adult ADHD and Internet addiction based on psychiatric diagnostic interview. Four models had been reported to explain the relationship between a psychiatric disorder and its comorbidity.[8] Since ADHD is a preexisted disorder since childhood, the hypothesis of secondary adult ADHD or bi-directional model could not well explain the association. The two other proposed models are Internet addiction secondary to adult ADHD and common factors shared in Internet addiction and adult ADHD. Several characteristics of adult ADHD may contribute to the vulnerability to Internet addiction. Firstly, a shortened reward-delay gradient is reportedly one of the four endophenotypes of ADHD.[22] It is demonstrated in delay aversion, which is the preference for immediate small reward rather than large delayed reward. The feeling of control, synchronous interactivity of chatting, and immediate reward provided by online gaming may satisfy college students with this endophenotype more than other activities. Secondly, Koepp and colleagues[23] have demonstrated striatal dopamine release during video gaming. Biological changes during gaming may enhance concentration and produce superior gaming performance,[24] with this greater competence compensating for frustrations associated with poor performance in the real world. Thirdly, the abnormal brain activity associated with the impaired inhibitory performance demonstrated in ADHD may make it more difficult to control/stop Internet use after engaging in online activities.[25] As a result, under the designing characteristics of endlessness

TABLE 2.
The Associations Between Internet Addiction and Psychiatric Comorbidity Examined by the Stepwise Logistic Regression Model Under Control of Gender and Age

	WALD χ^2	P	*OR*	*95% CI*
Age	0.39	.53	0.95	0.82~1.11
Gender	10.16	.001	2.81	1.49~5.31
Adult ADHD	13.82	<.001	4.53	1.49~5.31
Depressive disorders*	5.55	.018	3.29	1.22~8.84

* Depressive disorders: major depressive or dysthymic disorder.

OR=odds ratio; ADHD=attention-deficit/hyperactivity disorder.

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in online gaming, it would consume heavy time, deprive them of creative activities, and make college students with ADHD progress to addiction. Thus, college students with ADHD are at higher risk of Internet addiction than unaffected analogs. On the other hand, adult ADHD and Internet addiction share a common personality characteristic, high novelty seeking,[26,27] which may also contribute to the association between the two disorders.

Associations between Internet addiction and depression have been reported in adolescents and adults.[11-13] However, this is the first report to

TABLE 3.
The Association Between Internet Addiction and Main Internet Activity and Psychiatric Comorbidity by Gender

	Male (n=132) Internet Addiction				Female (n=84) Internet Addiction			
Variables	***Yes, n (%)***	***No, n (%)***	χ^2	**P**	***Yes, n (%)***	***No, n (%)***	χ^2	**P**
Major Depressive Disorder								
Yes	10 (15.4)	3 (4.5)	4.42	.04	1 (4.5)	3 (4.8)	0.003	.96
No	55 (84.6)	64 (95.5)	–	–	21 (95.5)	59 (95.2)	–	–
Dysthymic Disorder								
Yes	6 (9.2)	2 (3.0)	2.26	.13	4 (18.2)	3 (4.8)	3.79	.05
No	59 (90.8)	65 (97.0)	–	–	18 (81.8)	59 (95.2)	–	–
*Depressive Disorders**								
Yes	12 (18.5)	3 (4.5)	6.41	.01	4 (18.2)	5 (8.1)	1.74	.19
No	53 (81.5)	64 (95.5)	–	–	18 (81.8)	57 (91.9)	–	–
Social Phobia								
Yes	9 (13.8)	3 (4.5)	3.50	.06	4 (18.2)	4 (6.5)	2.59	.11
No	56 (86.2)	64 (95.5)	–	–	18 (81.8)	58 (93.5)	–	–
Adult ADHD								
Yes	21 (32.3)	6 (41.9)	11.06	.001	7(31.8)	5 (8.1)	7.48	.006
No	44 (67.7)	61 (58.1)	–	–	15 (68.2)	57 (91.9)	–	–

* Depressive disorders: major depressive or dysthymic disorder.

ADHD=attention-deficit/hyperactivity disorder.

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TABLE 4.
The Association Between Internet Addiction and Psychiatric Comorbidity by Gender in Logistic Regression Analysis

	Male				Female			
	WALD χ^2	**P**	***OR***	***95% CI***	***WALD*** χ^2	**P**	***OR***	***95% CI***
Age	0.19	.66	1.04	0.86-1.26	1.10	.29	0.88	0.69-1.12
Adult ADHD	9.08	.003	4.70	1.72-12.86	6.18*	.01	5.16	1.42-18.82
Depressive disorders*	4.50	.03	4.34	1.12-16.85	–	–	–	–

* Depressive disorders: major depressive or dysthymic disorder.

OR=odds ratio; ADHD=attention-deficit/hyperactivity disorder.

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demonstrate such associations for Internet addiction and MDD and dysthymic disorder based on diagnostic interview. The four models outlined above may account for this relationship. Firstly, Internet addiction may result in depression. Kraut and colleagues[28] reported that Internet use negatively affects psychological wellbeing. In their follow-up study, however, this negative impact had decreased after 3 years.[29] Secondly, online activity may be used to escape from difficulty in reality.[30] Therefore, it seems reasonable to suggest, that college students with depressive disorders are more likely to use the Internet to alleviate depression and are more prone to this form of addiction than their unaffected peers. Thirdly, Kraut and colleagues[29] proposed a "rich get richer" model where the Internet provides more benefits to those who are already well-adjusted. By contrast, poorly adjusted college students may suffer more deleterious effects with heavy Internet use, creating a vicious circle. This bi-directional interaction between Internet addiction and depressive disorders may produce mutual exacerbation, explaining the association. However, which model was best to explain the association between Internet addiction and depressive disorders should be clarified by further prospective investigation.

Previous reports had argued that Internet was utilized to copy for social anxiety.[31] On the other hand, social anxiety increased as the amount of time spent on playing online games increase among college students.[32] Thus, the effect of Internet use on social anxiety may account for part of the association between social phobia and Internet addiction in this study. However, social phobia did not predict Internet addiction controlling for depressive disorders and adult ADHD in this study. This may indicate that depressive disorders and adult ADHD are more proximal correlates of Internet addiction than social anxiety.

Gender comparison of the relationship between Internet addiction and psychiatric disorders revealed an association with MDD for male, but not female, students. The evaluation of the gender difference in coping with depression revealed that while women tend to seek professional help to resolve their negative emotions, men tend towards self-medication or resort to self-defeating behavior to deal with depression.[33] Further, it has been demonstrated that Chinese men are more likely to believe that they can get rid of negative emotion without help from, and less likely to disclose to, others.[34] Thus, the inherent anonymity of most Internet activity may provide depressed male college students to relieve their depression, get emotional support, or escape to gaming from the dysphoric mood without disclosing and/or seeking help from others in the real world. This gender difference in coping with depression may explain our finding that only depressed males, but not females, were associated with Internet addiction. Accordingly, more attention and active screening for depression should be provided to male college students with Internet addiction.

Until now, no comprehensive intervention has been developed for Internet addiction. However, the therapeutic treatments for adult ADHD, and depression are well-established.[35,36] In order to interrupt the possible bi-direction deteriorated effect, these comorbid psychiatric disorders should be carefully evaluated and treated for college students with Internet addiction. Further study is required, however, to establish whether intervention and prevention strategies for psychiatric comorbidity will be helpful for Internet addiction.

This study has a number of limitations. Firstly, as random sampling was not used for the recruitment, the rate of Internet addiction is not representative of the prevalence in all college students. Secondly, the cross-sectional design of our investigation did not elaborate temporal relationships for the associative factors. Thus, the causal relationship/s between Internet addiction and adult ADHD, depressive disorders and social phobia could not be determined in this study.

CONCLUSION

This diagnostic interview study revealed that adult ADHD and depressive disorders were associated with Internet addiction among college students. However, depressive disorders were associated with Internet addiction in the males but not the females. Although the mechanism of the association was beyond the scope of this study, it appears reasonable to suggest that effective evaluation of, and treatment for, adult ADHD and depressive disorders is required for college students with Internet addiction. ***CNS***

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