Psychiatric Comorbidity Assessed in Korean Children and Adolescents Who Screen Positive for Internet Addiction

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Objectives: This study aimed to evaluate clinical comorbidity in children and adolescents with Internet addiction by using structured interview.

Method: The study was performed in 2 stages. We screened for the presence of Internet addiction among 455 children (mean ± SD age = 11.0 ± 0.9 years) and 836 adolescents (mean ± SD age = 15.8 ± 0.8 years) using Young's Internet Addiction Scale. These subjects also completed a measure of psychopathology for comparison between addicted and nonaddicted subjects. Sixty-three children (13.8%) and 170 adolescents (20.3%) screened positive for Internet addiction. Of these, 12 children (male, N = 9; female, N = 3) and 12 adolescents (male, N = 11; female, N = 1) were randomly selected for evaluation of current psychiatric diagnoses. Structured interviews used were K-SADS-PL-K for children and SCID-IV for adolescents. Data were collected and interviews were conducted from August 2003 through October 2004.

Results: In the child group, 7 were diagnosed with attention-deficit/hyperactivity disorder (ADHD) not otherwise specified including those with subthreshold levels. Mean DuPaul's ADHD Rating Scale scores were more than 20% higher than the mean in Korean children for 6 subjects. In the adolescent group, 3 subjects had major depressive disorder, 1 had schizophrenia, and 1 had obsessive-compulsive disorder.

Conclusion: By structured interview, we found that Internet-addicted subjects had various comorbid psychiatric disorders. The most closely related comorbidities differ with age. Though we can not conclude that Internet addiction is a cause or consequence of these disorders, clinicians must consider the possibility of age-specific comorbid psychiatric disorders in cases of Internet addiction.

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Internet is no longer a fancy new medium, at least for South Korean children and adolescents. A recent survey revealed that more than 95% of people under the age of 20 had been using the Internet for over 2 years. This is in contrast to 71.6% of the total population and nearly 50% of the middle age group in South Korea.[1]

Through the rapid spread of Internet use within the last 10 years, a new psychological problem termed *Internet addiction* has emerged. To date, there are no clear definitions of Internet addiction. It has been defined as the inability of individuals to control their Internet use, resulting in marked distress and/or functional impairment in daily life.[2,3] Conflicts with family and friends; impairment in social activities including job and academic fields; psychiatric symptoms, such as depression, anxiety, and obsessions; and physiologic problems such as insomnia, tension headache, and dry eyes have been reported by those with Internet addiction.[3–6]

These problems are more prominent in children and adolescents. Internet addiction can affect their academic achievement and family relationships.[4] Internet- and computer game–related problems are common. Some studies report that 14% to 18% of adolescents in South Korea are suspected of having Internet addiction.[7,8]

Several studies[4,5,9–11] have focused on the relationship between Internet addiction and various psychiatric symptoms and psychological problems. However, only a few studies have identified the clear psychiatric diagnoses of Internet-addicted subjects.[3,12] Furthermore, the subjects in previous studies[3,12] were adults.

Ongoing debates state that the nature of Internet addiction could be a genuine diagnosis, a new symptom mani-

festation of underlying disorders or psychosocial problems in adjusting to a new medium.[13,14] Although there are some proposed diagnostic criteria for Internet addiction,[15,16] we do not have clear data that distinguish between symptoms and disorders related to Internet addiction. Before further investigation into validating the issue and establishing diagnostic criteria, the comorbidity of Internet addiction must first be assessed with objective methods. The aim of this study is to identify psychiatric comorbidity in children and adolescents with Internet addiction through structured interview. The results will provide important information in defining the nature of Internet addiction and in establishing objective diagnostic criteria.

METHOD

The study was performed in 2 stages. First, we screened for Internet addiction within 2 nonclinical groups, different in ages, using a self-reported questionnaire that has been most commonly used and a measure of psychophathology for comparison between Internet-addicted and nonaddicted subjects. Among the Internet addiction group, we selected 12 subjects from each age group and applied a semistructured interview to assess for the presence of any DSM-IV Axis I disorder.

Participants and Procedures

Child group. A total of 752 elementary school students in Jinju, a midsized city located in the southern region of South Korea (population: approximately 330,000; middle socioeconomic level), were recruited by one of the investigators (HJY) who previously worked in Jinju City as a child psychiatrist for a community school mental health program. Their grade levels ranged from 4th to 6th (age, from 9 to 13 years). The same investigator visited the school and gave a detailed explanation to teachers and students, acquired informed consents, then distributed and collected the questionnaires after 3 days. The authors also sent a letter to the parents indicating the objective of the study, the advantage in participation, a confirmation of confidentiality, a contact phone number and e-mail address of the investigator for any questions and concerns, and our intent to personally inform parents of the results after analyzing the data. The letter also included the announcement that all parents were free to refuse to respond if they did not agree with the objective of the study.

After excluding missing reports and inappropriate data, 455 subjects (229 male and 226 female) were included in the screening stage analysis. The response rate was 60.5% and mean ± SD age was 11.0 ± 0.9 years (male = 11.0 ± 0.9 years, female = 11.0 ± 1.0 years). Sixty-three subjects (13.8%) were assessed to have an Internet addiction according to Young's Internet Addiction Scale (IAS score > 50). Within this group, 12 subjects (19%), who were randomly selected, agreed to complete the semistructured interview with the child psychiatrist (male, N = 9; female, N = 3). There was no demographic difference between the screened group and interviewed subjects. A slightly higher ratio of boys to girls was selected to interview than that in the entire child Internet addiction group because the parents of boys were more willing to participate in the study. Children and 1 or 2 of their parents visited Gyeongsang National University Hospital, and an investigator (HJY) performed the Kiddie-Schedule for Affective Disorders and Schizophrenia-Present and Lifetime Version-Korean Version (K-SADS-PL-K) to confirm diagnoses of possible comorbidities in Internet-addicted subjects. After the interview, the investigator explained the results to the parents and recommended appropriate interventions for the children.

Adolescent group. A total of 1200 technical high school students in Pyongchon, a newly developed district in Anyang city in the Kyunggi province (population: approximately 200,000; midsized city district; middle socioeconomic level), were recruited. Their grade levels ranged from 1st to 3rd (age, from 15 to 17 years) and included almost all the students in the school. The study was held as a community mental health promotion program in Anyang city. One of the investigators (BC) visited the school and gave a detailed explanation to teachers and students, acquired informed consents, then distributed and collected the questionnaires. The teachers and investigator announced to the students that they were free to refuse to take part in the study. The test required approximately 45 minutes to complete.

After excluding nonparticipants, missing reports, and inappropriate data, 836 subjects (male, N = 777; female, N = 59) were included in the screening phase analysis. Male predominance in subjects was due to the fact that the high school where the survey was performed was a technical high school. The response rate was 69.7% and mean age was 15.8 ± 0.8 years (male = 15.8 ± 0.8 years, female = 15.7 ± 0.7 years). One hundred seventy subjects (20.3%) were assessed to have an Internet addiction (IAS score > 50). Within this group, 12 subjects (7.1%) were randomly selected and agreed to complete the interview (male, N = 11; female, N = 1). There was no difference in sex and age between the screened group and interviewed subjects. An investigator (JHH) visited the school and performed a structured interview with the subjects who agreed to have a further interview with a psychiatrist. After the interview, an investigator summarized the total results and sent a report for each student to the teachers as parent substitute, including an offer of appropriate psychiatric treatments.

Assessment

Questions related to Internet use. The questionnaire comprised items to determine the students' demographics,

including mean duration of Internet use per day, the main purpose of Internet use, self-awareness of discomfort by excessive Internet use, previous and current history of mental illness, and family history of psychiatric treatment.

Questionnaires used in screening stage.

Young's Internet Addiction Scale (IAS). The IAS,[17] a self-reported questionnaire, is composed of 20 questions with 5 Likert scales ranging from 1 (rarely) to 5 (always). It is one of the most widely used scales to evaluate Internet addiction[4,5,9,18] and was developed by modification of the DSM-IV criteria of pathological gambling.

In the IAS, Internet-related behavioral problems and psychological distress problems are covered. It consists of specific descriptions, such as "spend more time," "loss of control," "denial of problems," "decrease in real-life performance," and "mood elevating effect of online behavior."

An IAS score of 50 to 79 is regarded as a mild degree of Internet addiction, i.e., occasional problems through Internet use. A score of 80 or greater is regarded as a severe degree of Internet addiction, i.e., having significant problems in daily life. We defined the subjects with a score of 50 or greater as the addiction group (having problems with Internet use) and a score of 49 or below as the nonaddiction group. The IAS has been proven to be a reliable and valid tool.[10] The Korean translated and standardized version of the IAS questionnaire was used.[4,11] In this study, the internal consistency of IAS was over 0.90 (Cronbach $\alpha = 0.92$).

Korean version of DuPaul's Attention-Deficit/Hyperactivity Disorder Rating Scale (ARS), parent and teacher version. The ARS was applied to the child group. Developed by DuPaul,[19] the ARS lists 18 symptoms of attention-deficit/hyperactivity disorder (ADHD), based on DSM-IV diagnostic criteria: 9 for attention-deficit and 9 for hyperactivity-impulsivity domains. The scale has been translated and standardized in Korean.[20] It consists of 4 Likert scales, which were checked by teacher and parent.

Beck Depression Inventory (BDI). The BDI, which was applied to the adolescent group, is a self-reported questionnaire used to assess the presence and severity of depressive symptoms. The BDI has good reliability and validity. It consists of 21 items with 4 Likert scales. The total range of scores is from 0 to 62. It has been translated and standardized in Korean.[21]

Interviews used in second stage.

Kiddie-Schedule for Affective Disorders and Schizophrenia-Present and Lifetime Version-Korean Version (K-SADS-PL-K). The K-SADS-PL-K is useful in the diagnosis of childhood psychiatric disorders, such as ADHD, disruptive behavior disorder, and tic disorders. It was originally designed to be completed by children and parents, which resulted in the final diagnosis by the interviewer referring to either parents' or children's responses. This semistructured interview was applied to the child group. It has been translated and standardized in Korean children (mean ± SD standardized age = 8.8 ± 2.1 years) and has been confirmed as having satisfactory reliability and validity.[22] K-SADS-PL-K was applied to children and 1 parent of each child.

Structured Clinical Interview for DSM-IV (SCID-IV). SCID-IV is a semistructured interview to diagnose Axis I disorders according to DSM-IV. A nonclinical patient version was applied to the adolescent group. It was translated and standardized in Korean.[23]

Statistical Analysis

Statistical analysis was applied to select the Internet addiction subjects, and we performed statistical analysis between selected Internet-addicted subjects and nonaddicted subjects for both the child and adolescent groups. The differences in demographic variables, Internet usage patterns, and psychopathology between the Internet addiction group and the nonaddiction group were analyzed by using unpaired t tests. Differences with a p value less than .05 were considered statistically significant. The statistical analysis was performed using the SPSS 12.0 (SPSS Inc., Chicago, Ill.).

RESULTS

In the child group, the mean ± SD score of IAS was 36.3 ± 12.8. Boys had a higher score than girls (38.9 ± 18.3 vs. 33.8 ± 11.8; $t = 4.38$, $df = 455$, $p < .001$). Sixty-three subjects (13.8%) were assessed to have Internet addiction (IAS score ≥ 50). There were more boys than girls in the Internet addiction group (17.7% vs. 10%; $\chi^2 = 5.58$, $df = 1$, $p < .05$), but no difference existed in socioeconomic status, history of mental illness, and other psychiatric treatment to children and parents between the Internet addiction and nonaddicted groups. However, the main purpose of Internet use was different: the Internet addiction group was for games, while the nonaddicted group was for e-mail. The Internet addiction group received more warnings about excessive use from parents than the nonaddicted group (87.3% vs. 53.5%; $\chi^2 = 25.00$, $df = 1$, $p < .0001$). In the Internet addiction group, mean ARS score was higher than in the nonaddicted group (11.7 ± 11.2 vs. 7.5 ± 9.2; $t = -2.75$, $df = 455$, $p < .01$).

The mean IAS score of selected child subjects was 59.4 ± 8.8 (lowest = 50, highest = 80). Six subjects had ARS scores more than 20% higher than the mean in Korean children.[20] None of the subjects had psychiatric treatment before or reported family history of psychiatric disorders. After K-SADS-PL-K, only 1 subject met the criteria for a current disorder, ADHD not otherwise specified (NOS). However, 5 subjects had ADHD at a subthreshold level, and 1 patient had dysthymic disorder, social phobia, and ADHD inattentive type, all at a sub-

Table 1. Characteristics and Comorbid Diagnoses of Children in the Internet Addiction Group

Subject No.	Sex	Age, y	Usage, h/d	IAS Score	ARS Score			K-SADS-PL-K Diagnosis[a]
					Parent	Teacher	Total	
1	M	10	5.0	80	13	14	27	ADHD NOS
2	F	12	1.5	68	9	2	11	None
3	M	9	1.5	67	22	47	69	ADHD inattentive type, OCD
4	F	12	1.5	62	0	1	1	None
5	M	12	1.5	60	32	31	63	ADHD combined type
6	M	11	5.0	60	9	13	22	ADHD NOS
7	M	10	1.5	55	5	6	11	ADHD inattentive type
8	M	10	1.5	54	13	7	20	None
9	M	11	1.0	52	7	4	11	ADHD NOS
10	F	12	1.0	50	29	4	33	Dysthymia, social phobia, ADHD inattentive type
11	M	10	1.0	54	35	40	75	None
12	M	12	1.5	51	18	31	49	None

[a]All diagnoses are at the subthreshold level except for subject no. 9.
Abbreviations: ADHD = attention-deficit/hyperactivity disorder, ARS = ADHD Rating Scale, IAS = Internet Addiction Scale, K-SADS-PL-K = Kiddie-Schedule for Affective Disorders and Schizophrenia-Present and Lifetime Version-Korean Version, NOS = not otherwise specified, OCD = obsessive-compulsive disorder.

Table 2. Characteristics and Comorbid Axis I Diagnoses of Adolescents in the Internet Addiction Group

Subject No.	Sex	Age, y	Usage, h/d	IAS Score	BDI Score	SCID-IV Current Diagnosis
1	M	16	1	100	6	None
2	M	15	6	96	8	None
3	M	15	5	87	21	MDD
4	M	16	5	83	22	OCD
5	M	16	3	78	15	None
6	M	16	4	73	23	MDD
7	M	15	2	70	10	None
8	M	16	5	69	9	None
9	M	16	2	68	12	Schizophrenia
10	F	15	4	65	24	MDD
11	M	16	4	65	5	None
12	M	16	3	63	13	None

Abbreviations: BDI = Beck Depression Inventory, MDD = major depressive disorder, IAS = Internet Addiction Scale, OCD = obsessive-compulsive disorder, SCID-IV = Structured Clinical Interview for DSM-IV.

threshold level. A total of 7 subjects had ADHD including those at a subthreshold level (Table 1).

In the adolescent group, the mean score of IAS was 38.8 ± 13.9. Boys had a higher score than girls (39.1 ± 14.0 vs. 34.5 ± 13.5; $t = 2.43$, $df = 834$, $p < .05$). One hundred seventy subjects (20.3%) were assessed as having Internet addiction, and there was no gender difference between the Internet addiction group and the nonaddicted group. In the Internet addiction group, the mean BDI score was higher (10.9 ± 6.4 vs. 7.5 ± 5.3; $t = –7.16$, $df = 834$, $p < .001$), and the subjects spent more time (3.64 ± 2.19 vs. 2.44 ± 1.55 h/day; $t = –8.18$, $p < .001$) than in the nonaddicted group. The main purpose of Internet use in the Internet addiction group was for games.

The mean IAS score was 76.0 ± 12.5 in selected adolescent subjects (lowest = 63, highest = 100). Ten of the 12 subjects selected the main purpose of Internet use as games. None of the subjects had previous psychiatric treatment or family history of psychiatric disorders. Four subjects showed significant depressive symptoms as assessed by the BDI (score > 21). By SCID-IV, almost half of the subjects met the criteria for a current diagnosis according to DSM-IV. Three subjects met the criteria for current major depressive disorder, moderate degree; 1 subject, for schizophrenia; and 1 subject, for obsessive-compulsive disorder (OCD) (Table 2). Two subjects had social phobia, 1 had psychotic disorder NOS, and 1 had panic disorder, all at subthreshold levels. Except for current diagnoses, there were no subjects with lifetime psychiatric diagnoses.

DISCUSSION

In our study, nearly half of the subjects in the Internet addiction group had various kinds of psychiatric disorders, requiring clinical interventions. Although only 1 subject was diagnosed as having ADHD by structured interview, 7 of 12 interviewed children were diagnosed as having ADHD including subthreshold levels. The mean

ARS score in the Internet addiction group was 20% higher than the mean level in Korean children of the same age. The prevalence of ADHD was higher than results (1.99%) from an epidemiologic study in South Korea.[24] It is common in clinical experience to see that children with attention problems tend to indulge in playing video games and watching television. Internet and computer games can be understandable in the same context. Children with ADHD have deficits in behavioral inhibition and strategic flexibility due to frontal lobe immaturity.[25,26] Deficits can cause a failure of self-control of Internet use. For this reason, children with ADHD or a subclinical level of attention problems could easily indulge in Internet and computer games. Hence, ADHD tendency should be carefully evaluated with Internet addiction in children. In a previous study,[4] we found that the ADHD group assessed by ARS had higher Internet addiction scores compared with the nonADHD group. We tried to confirm the previous findings by face-to-face structured interview and found that a significant number of Internet-addicted children might have ADHD.

In the adolescent group, 3 had major depressive disorder. In BDI score, 4 subjects had 21 or over, which represented current depressive disorder. It meant that almost one third of subjects could have a significant level of depressive symptoms that required psychiatric intervention. It is a higher level of prevalence compared with the data (3.6%) from an epidemiologic study in South Korea.[27,28] Depressive disorders seemed to have a close relationship with Internet addiction in adolescence. Previous studies reporting a relationship between Internet addiction and depression[3,29,30] did not show the direct association with major depressive disorder, but only the correlation of higher depressive symptom level with the severity of Internet addiction. It is significant that a noticeable number of Internet-addicted subjects may have major depressive disorder that has never been detected by teachers and parents.

The possible comorbidity of major depressive disorder among Internet-addicted adolescents can be explained by the internalizing tendency of adolescents. This tendency can be a specific characteristic of adolescent depression and can predict the development of depression.[31,32] Some people use the technology to avoid difficulties in their lives.[33] Internalized depressive adolescents can give themselves up to cyberspace to avoid discomfort in reality and take emotional comfort through interpersonal supports in cyberspace. Hence, behaviors related to Internet addiction may be a symptom of depressive disorders in adolescents.

Two previous studies have applied the same structured interview to Internet-addicted subjects. Shapira et al.[3] reported that all subjects also had impulse control disorder NOS, and 70% of subjects had bipolar disorder. Black et al.[12] reported comorbidity of mood disorder (33%), anxiety disorder (19%), and any personality disorders (52%). The high prevalence of bipolar disorder and a history of psychiatric treatment (85%) reflected a possible selection bias in the study. Both studies revealed that Internet addiction might be closely related to any of the mood disorders, which is the same as our results from adolescents.

Substance-related problems have been suspected to have a close relationship with Internet addiction in the concept of "behavioral addiction" and presupposed to have a common key factor with psychological dependence.[34] In this study, we could not find the relationship or overlapping of Internet addiction with substance-related problems. However, we are cautious in making a conclusion. First, children participating in this study were too young to have substance use problems. Second, while adolescents completed the survey and interviews in their school, it should be noted that substance use, including alcohol and smoking, are very strictly prohibited during adolescence in South Korea. Hence, it might have been difficult for the teens to report their problems frankly.

Obsessive-compulsive disorder, schizophrenia, and social phobia were diagnosed in Internet-addicted adolescents. Characteristic symptom manifestations of each disorder have been suspected to be closely related to Internet addiction: repetitive behaviors and failure of control in unnecessary behaviors in OCD[35]; avoidance of symptoms, such as referential delusions, by escaping into cyberspace and easily identifying with cyber characters due to poor reality testing in schizophrenia; feeling more comfortable in cyberspace than reality because of pathologic interpersonal sensitivity in social phobia. These results indicate that psychiatric comorbidities may differ by their underlying causes, and Internet addiction may not be a single-entity disorder, but rather a syndrome with various etiologies.

The limitations of this study are as follows. First, K-SADS-PL-K can be applied to adolescents as well as children; however, it was validated only in elementary school–aged children in Korea, and therefore we applied SCID-IV to the adolescent group. Second, only a few female subjects participated in the adolescent group. There was a male predominance in the total student cohort since the school was a technical high school. Third, we selected only 24 subjects to interview among 1291 enrolled subjects. The number of subjects in our sample is relatively small to represent the general population. There were practical limitations of resources, availabilities, and cooperation to participate by more subjects. However, the percentage of interviews is increased by considering samples after the screening test. The child group represents 19% of subjects who screened positive for Internet addiction (N = 63), and the adolescent group represents 7% of subjects who screened positive for Internet addiction (N = 170).

Despite the limitations, this study was the first study applying a semistructured interview to children and ado-

lescents with Internet addiction after screening from a nonclinical cohort. The results of our study indicate it is quite likely that Internet addiction may be related to psychiatric disorders that are different by age and underlying conditions. It is important to evaluate the existence of current psychiatric disorders when the clinician meets the subject with suspected Internet addiction. The most common possible underlying disorders related to Internet addiction may be major depressive disorder, dysthymia, ADHD, OCD, social phobia, and schizophrenia.

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