Are Adolescents with Internet Addiction Prone to Aggressive Behavior? The Mediating Effect of Clinical Comorbidities on the Predictability of Aggression in Adolescents with Internet Addiction

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Abstract

Previous studies have reported associations between aggression and Internet addiction disorder (IAD), which has also been linked with anxiety, depression, and impulsiveness. However, the causal relationship between aggression and IAD has thus far not been clearly demonstrated. This study was designed to (a) examine the association between aggression and IAD and (b) investigate the mediating effects of anxiety, depression, and impulsivity in cases in which IAD predicts aggression or aggression predicts IAD. A total of 714 middle school students in Seoul, South Korea, were asked to provide demographic information and complete the Young's Internet Addiction Test (Y-IAT), the Buss–Perry Aggression Questionnaire, the Barratt Impulsiveness Scale-11, the State–Trait Anger Expression Inventory-2, the Beck Anxiety Inventory, the Beck Depression Inventory, and the Conners–Wells Adolescent Self-Report Scale. Three groups were identified based on the Y-IAT: the usual user group ($n = 487$, 68.2%), the high-risk group ($n = 191$, 26.8%), and the Internet addiction group ($n = 13$, 1.8%). The data revealed a linear association between aggression and IAD such that one variable could be predicted by the other. According to the path analysis, the clinical scales (BAI, BDI, and CASS) had partial or full mediating effects on the ability of aggression to predict IAD, but the clinical scales had no mediating effect on the ability of IAD to predict aggression. The current findings suggest that adolescents with IAD seem to have more aggressive dispositions than do normal adolescents. If more aggressive individuals are clinically prone to Internet addiction, early psychiatric intervention may contribute to the prevention of IAD.

Introduction

RECENTLY, INTERNET ADDICTION DISORDER (IAD) has emerged as a serious social problem in many societies. Since the mid-1990s, Internet addiction has been recognized as a new type of addiction and a mental health problem that involves signs and symptoms similar to those of other established addictions.[1–4] In particular, Internet overuse in adolescents has been a major research topic in various countries.[5–8] Adolescence is a period of rapid psychological maturation and of susceptibility to Internet attraction,[9] and adolescents were found to be particularly vulnerable to the negative health impacts of Internet overuse.[10–12] Among the

negative health impacts, the relationship between Internet addiction and aggression has been addressed. Ko et al.[13] reported that although Internet use may reduce distress by providing immediate rewards and opportunities to engage in different activities, excessive use of the Internet is an important risk factor for aggression. Similarly, Yen et al.[8] found a high correlation between aggressive behaviors and Internet addiction. On the other hand, Lee et al.[14] reported that IAD could be conceptualized as an impulse control disorder and that trait impulsivity is a marker for vulnerability to IAD. However, a number of studies have reported that many factors, such as depressive symptoms, substance use, and exposure to violent media, are involved in aggression.[5,15–17]

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Aggressive behavior in childhood and adolescence is a risk factor for violence in adulthood.[18,19] Understanding the risk factors for the development of aggressive behavior is among the important precursors to the development of primary prevention strategies for adolescent violence.[12]

The associations between IAD and psychiatric comorbidities have also been reported. Carli et al.[20] systematically reviewed IAD and its associated psychopathology, and 75% of studies reported significant associations of IAD with depression, 57% with anxiety, 100% with symptoms of attention deficit/hyperactivity disorder (ADHD), 60% with obsessive-compulsive symptoms, and 66% with hostility/aggression.

Taken together, relevant research has demonstrated association between IAD and aggression, and correlation between IAD and psychiatric disorders such as anxiety, depression, and ADHD. However, to the best of the authors' knowledge, the causal directions of the relationships between IAD and the clinical conditions associated with this disorder remain to be clearly elucidated. Furthermore, research on the association between IAD and aggressive behaviors could not confirm the causal relationship up to now.[21] Thus, the primary aim of this study was to identify the causal relationships between IAD and aggression, and the secondary aim was to investigate the associations of IAD and aggression with comorbid clinical phenomena such as depression, anxiety, and ADHD.

Materials and Methods

Participants

Data were collected from 714 (389 male) middle school students in Seoul, South Korea, who received an explanation about the research and completed self-administered questionnaires. Gift certificates were provided as rewards for their participation. This study was approved by the Institutional Review Board of Seoul St. Mary's Hospital, Seoul, Republic of Korea, and all subjects provided written informed consent prior to participation.

Measures

Young's Internet Addiction Test. The 20-item Young's Internet Addiction Test (Y-IAT) was developed by Young et al., and is a modification of Young's Diagnostic Questionnaire for Internet addiction, which is based on the DSM-IV-TR[22,23] criteria for pathological gambling.[24,25] The Y-IAT consists of three subscales: withdrawal and social problem (e.g., "How often do you feel depressed, moody, or nervous when you are offline, which goes away once you are back online?"); time management and performance (e.g., "How often do you neglect household chores to spend more time online?"); and reality substitute (e.g., "How often do you lose sleep due to late-night log-ins?").[23] Items on this instrument are rated on a 5-point Likert scale, where 1 = "very rarely" and 5 = "very frequently." Total scores were calculated according to Young's method, with possible scores for all 20 items ranging from 20 to 100.[26,27] Those who scored 20–39 were classified as "average users," those who scored 40–69 were classified as "experiencing frequent problems," and those who scored 70–100 were classified as suffering from "significant problems" because of Internet use.[27,28] The Cronbach's alpha coefficient in the current sample was 0.95.

Buss–Perry Aggression Questionnaire. The Buss–Perry Aggression Questionnaire (AQ) is a 29-item instrument on which participants rate statements along a 5-point continuum from 1 = "extremely uncharacteristic of me" to 5 = "extremely characteristic of me." The questionnaire yields scores for four dimensions of aggression: physical aggression (e.g., "If I have to resort to violence to protect my rights, I will"), verbal aggression (e.g., "I tell my friends openly when I disagree with them"), anger (e.g., "Some of my friends think I am a hothead"), and hostility (e.g., "When people are especially nice to me, I wonder what they want").[29] The Cronbach's alpha coefficient in the current sample was 0.94.

Barratt Impulsiveness Scale-11. The Barratt Impulsiveness Scale 11 (BIS-11)[30] assesses impulsivity, and uses a 4-point Likert scale (1 = "rarely/never" to 4 = "almost always/always"). This instrument includes three subscales: cognitive impulsiveness (e.g., "I get easily bored when solving cognitive problems"), motor impulsiveness (e.g., "I do things without thinking"), and nonplanning impulsiveness (e.g., "I am more interested in the present than in the future").[26] The BIS-11 has shown positive correlations with neuropsychological measures of impulsivity, and is sensitive to execute deficits in prefrontal and orbitofrontal systems in multiple clinical samples.[31] For example, problem gamblers tend to have higher scores on the BIS-11, and BIS-11 scores can significantly discriminate problem gamblers and nongamblers.[32,33] The Cronbach's alpha coefficient in the current sample was 0.86.

State–Trait Anger Expression Inventory-2. The State–Trait Anger Expression Inventory (STAXI-2)[34] assesses how a person feels at a given moment (state anger, e.g., "I am mad"), how frequently, and intensely the person feels angry (trait anger, e.g., "I get angry when slowed down"), and what the person does when feeling angry (anger expression in, e.g., "I tend to harbor grudges"; anger expression out, e.g., "I say nasty things"; anger control, e.g., "I control my temper").[35,36] Items are rated on a 4-point scale (1 = "not at all" to 4 = "almost always").[36] The Cronbach's alpha coefficient in the current sample was 0.90.

Beck Anxiety Inventory. The Beck Anxiety Inventory (BAI)[37] uses a 4-point scale (0 = "not at all" to 3 = "severely—it bothered me a lot") to measures an individual's anxiety. It is a 21-question multiple-choice self-report inventory that is used for measuring how the subject has been feeling in the last week, focusing primarily on somatic symptoms (e.g., "feeling hot"). Scores for the 21 items are summed to yield a single anxiety score.[26] A total score between 0 and 7 indicates minimal level of anxiety, a score between 8 and 15 indicates mild anxiety. a score between 16 and 25 indicates moderate anxiety, and a score between 26 and 63 indicates severe anxiety.[37] The internal consistency of the BAI in the current sample was 0.96.

Beck Depression Inventory. The Beck Depression Inventory (BDI)[38] is a 21-item self-report questionnaire in which each item consists of four statements indicating different levels of the severity of a particular symptom experienced during the past week.[26] This scale measures the existence and severity of symptoms of depression.[38] Scores for all 21 items are summed to yield a single depression score.[26] A total score of 0–13 is considered minimal

depression, 14–19 mild depression, 20–28 moderate depression, and 29–63 severe depression.[38] The Cronbach's alpha coefficient for the BDI in the current sample was 0.98.

Conners–Wells Adolescent Self-Report Scale. The Conners–Wells Adolescent Self-Report Scale-Short form (CASS-S) was derived from the Conners–Wells' Adolescent Self-Report Scale: Long Form (CASS-L). According to Conners, the conduct problems scale assesses difficulties with following rules, relating to people in authority, and becoming easily annoyed or angered; the cognitive problems scale measures problems with organizing work, finishing tasks or school work, and maintaining concentration on tasks that require sustained attention; and the hyperactivity scale evaluates problems with sitting still, working on a task for a long time, and being restless or impulsive. The instructions for the CASS-S ask an adolescent to describe how true each of the 27 symptoms is for himself or herself by using a 4-point rating scale ranging from 0 = "not true at all" to 3 = "very much true." Respective factors were conduct problems, cognitive problems, and hyperactivity scales.[39] The Cronbach's alpha coefficient in the current sample was 0.93.

Statistical analysis

SPSS v21.0 was used for group comparisons and correlations, and AMOS v21.0 software was used for path analysis. Three groups were compared with respect to demographic information (gender, age, Internet use time for weekday and weekend) and clinical scales, which were generally known to be related with aggression (AQ, BIS-11, STAXI-2), anxiety (BAI), depression (BDI), and ADHD (CASS), using the Kruskal–Wallis test. Pearson's correlation analysis was performed for variables including gender, age, Y-IAT, Y-IAT Group, AQ, BIS-11, STAXI-2, BAI, BDI, and CASS. Path analysis can examine one-way relationships between variables, similar to regression analysis. In addition, to identify relationships between variables included in the path trace, path analysis can also figure out certain variable's mediating effect. In this study, BAI, BDI, and CASS were set as mediator variables. Ko et al.[21] reported that IAD was associated with ADHD, major depressive disorder, and social anxiety disorder. It was, however, a descriptive review that lacked statistical analyses to support such associations.[40] Ho et al.[40] conducted a meta-analysis that examined the relationship between IAD and psychiatric comorbidity, and concluded that IAD is significantly associated with ADHD, depression, and anxiety. Despite meaningful conclusions, meta-analysis could not assess the cause and effect mechanisms underpinning IAD and psychiatric comorbidity. For these reasons, a path trace was designed to find out the relationship between aggression and IAD, as well as whether psychiatric comorbidities have a mediating effect on this relationship.

All path models were accepted as having a perfect fit, because they were saturated models (i.e., all variables were correlated with all others). Therefore, standard goodness of fit values were not considered.

Results

Demographic and clinical characteristics

In this study, participants were grouped based on Young's criteria,[28] and 13 participants (1.8%; 7 males) were classified

as suffering from IAD, as their score on the Y-IAT was at least 70 (M = 78, SD = 8.93, range = 70–100). A total of 191 participants (26.8%; 137 males) were classified as heavy Internet users, with Y-IAT scores of 40–69 (M = 48.74, SD = 7.21). The non-Internet-dependent group consisted of 487 individuals (68.2%; 232 males) with Y-IAT scores of ≤ 39 (M = 27.28, SD = 5.80, range = 20–39). The mean Y-IAT score of the total sample was 34.17 (SD = 12.95, range = 20–100). The AQ, BIS-11, and STAXI-2 were treated as measures of aggression, whereas the BAI, BDI, and CASS were treated as measures of clinical variables. The Kruskal–Wallis test revealed statistically significant differences in all categories except age (see Table 1). The Internet addiction group had the highest scores on all the aggression and clinical scales, followed by the high-risk group. The usual user group received the lowest scores on both the aggression and clinical scales. The average time using the Internet for purposes of gaming was highest in the Internet addiction group.

Correlations among variables

Pearson's correlation analysis showed that Y-IAT scores were positively correlated with all the aggression and clinical scales. See Table 2 for additional details.

The mediating roles of the BDI, BAI, and CASS in the relationships between aggression and Internet addiction

Path analysis was performed to examine the mediating effect of the clinical scales in cases where scores on the aggression scales predicted IAD. As shown in Figure 1, when AQ scores predicted IAD, the direct effect was 0.19 (i.e., the standardized path coefficient from the AQ to IAD), the critical ratio (CR; regarded as the T value in AMOS statistics) was 4.479, and the p-value was 0.000. The indirect effect was $0.50 \times 0.23 = 0.115$ (i.e., the standardized path coefficients from the AQ to the BAI and from the BAI to IAD were multiplied), and each indirect path was statistically significant ($p < 0.001$). The Sobel test, which was used to test the significance of the mediating effect, yielded a significant result (Sobel test $Z = 32.17$, $p < 0.001$, two-tailed). Thus, when AQ scores predicted IAD, the BAI partially mediated the significance of both the direct and indirect effects. However, the BDI showed no mediating effect when the AQ predicted IAD because the path from the BDI to IAD was not significant (CR = 1.166, n.s.). The CASS served as a partial mediator when the AQ predicted IAD. In such cases, the direct effect was 0.16, and the direct path was significant (CR = 3.727, $p < 0.001$); the indirect effect was 0.14, and each indirect path was also significant ($p < 0.001$). The Sobel test statistic was significant (Sobel test $Z = 27.27$, $p < 0.001$, two-tailed).

The BAI served as a partial mediator when BIS-11 scores predicted IAD. In such cases, the direct effect was 0.20 (CR = 5.335, $p < 0.001$), the indirect effect was 0.081 ($p < 0.001$), and the Sobel test Z was 8.46 ($p < 0.001$, two-tailed). The BDI also partially mediated the relationship between BIS-11 scores and IAD. In such cases, the direct effect was 0.25 (CR = 6.315, $p < 0.001$), the indirect effect was 0.034. Both indirect paths were significant ($p < 0.001$ and $p < 0.01$, respectively). The Sobel test Z was 8.63 ($p < 0.001$, two-tailed). Similarly, the CASS served as a partial mediator when BIS-11 scores predicted IAD. In such cases, the direct effect

TABLE 1. DEMOGRAPHIC AND CLINICAL RESULTS FOR INTERNET ADDICTION AND NONADDICTION GROUPS

	Usual user group (N=487)		High-risk group (N=191)		Internet addiction group (N=13)		
	n (%)	SD	n (%)	SD	n (%)	SD	χ^2
Gender							32.050***
Male	232 (47.6)	0.500	137 (71.7)	0.452	7 (53.8)	0.519	
Female	255 (52.4)		54 (28.3)		6 (46.2)		
Age							1.564
14	58 (11.9)		21 (11.0)		0		
15	420 (86.2)	0.338	163 (85.3)	0.319	13 (100)	0.000	
16	3 (0.6)		0		0		
Internet game use (weekday)							52.158***
0–4 hours	477 (97.9)		177 (92.7)		11 (84.6)		
5–9 hours	3 (0.6)	1.153	8 (4)	1.915	2 (15.4)	1.713	
>10 hours	0		2 (1)		0		
Average number of hours	0.75		1.54		2.46		
Internet game use (weekend)							64.673***
0–4 hours	450 (92)		147 (77)		8 (61.5)		
5–9 hours	29 (6)	1.725	36 (19)	2.603	4 (30.8)	4.054	
>10 hours	2 (0.4)		4 (2)		1 (7.7)		
Average number of hours	1.34		2.78		4.46		
	M	SD	M	SD	M	SD	χ^2
Y-IAT	27.28	5.805	48.74	7.218	78.00	8.935	434.819***
AQ	59.62	18.655	69.69	18.545	96.62	32.139	53.930***
BIS-11	50.97	8.648	55.61	6.278	59.83	9.466	57.256***
STAXI-2	52.01	11.787	55.54	9.859	60.92	11.079	24.661***
BAI	4.85	6.818	8.36	8.482	26.46	17.448	52.294***
BDI	6.60	7.557	8.39	7.375	18.91	12.724	23.547***
CASS	15.51	11.648	22.30	11.183	43.42	21.462	70.778***

***$p < 0.001$.

SD, standard deviation; Y-IAT, Young's Internet Addiction Test; AQ, Aggression Questionnaire; BIS-11, Barratt Impulsiveness Scale-11; STAXI-2, State–Trait Anger Expression Inventory-2; BAI, Beck Anxiety Inventory; BDI, Beck Depression Inventory; CASS, Conners–Wells Adolescent Self-Report Scale.

Groups were divided into based on Young's criteria.

was 0.16 (CR=3.983, $p < 0.001$), the indirect effect was 0.118 ($p < 0.001$), and the Sobel test Z was 8.52 ($p < 0.001$, two-tailed).

When the STAXI-2 predicted IAD, the BAI served as a partial mediator. In such cases, the direct effect was 0.08 (CR=2.023, $p < 0.05$), the indirect effect was 0.087 ($p < 0.001$), and the Sobel test Z was also significant (Z=8.46, $p < 0.001$, two-tailed). The BDI also served as a partial mediator of this relationship. The direct effect was 0.12 (CR=2.966, $p < 0.01$), the indirect effect was 0.043 ($p < 0.001$), and the Sobel test Z was 11.67 ($p < 0.001$, two-tailed). Finally, the CASS fully mediated the relationship between the STAXI-2 and IAD; that is, the direct effect of the STAXI-2 was rendered insignificant when the CASS scores were included in the

TABLE 2. CORRELATIONS AMONG GENDER, AGE, Y-IAT SCORES, AND CLINICAL SCALES

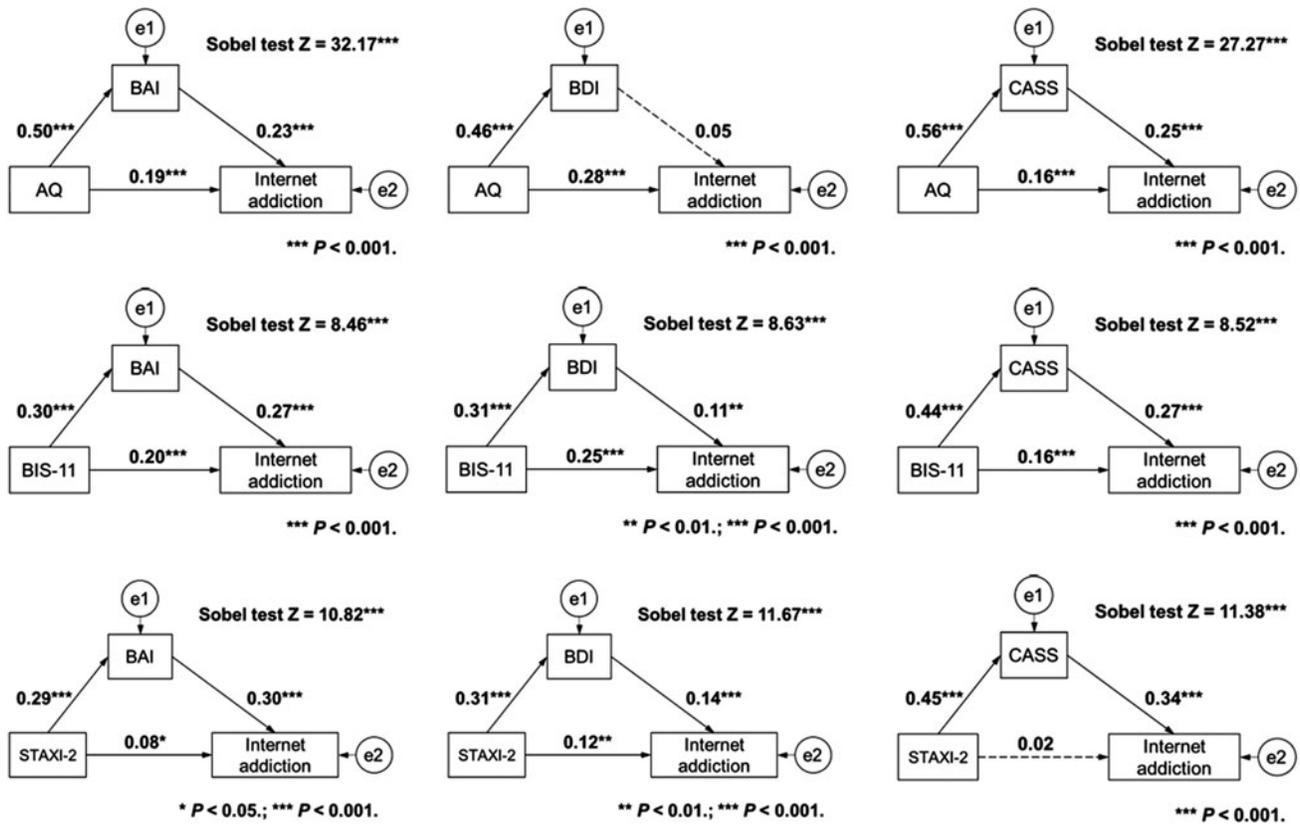|	Gender	Age	Y-IAT	Y-IAT group	AQ	BIS-11	STAXI-2	BAI	BDI	CASS
Gender	1									
Age	−0.039	1								
Y-IAT	−0.218**	0.007	1							
Y-IAT group	−0.190**	0.023	0.872**	1						
AQ	0.068	−0.002	0.376**	0.309**	1					
BIS-11	−0.022	0.038	0.323**	0.276**	0.305**	1				
STAXI-2	0.137**	−0.008	0.225**	0.166**	0.527**	0.148**	1			
BAI	0.079*	−0.006	0.378**	0.327**	0.501**	0.294**	0.296**	1		
BDI	0.222**	0.042	0.198**	0.180**	0.461**	0.308**	0.312**	0.653**	1	
CASS	−0.059	0.042	0.394**	0.340**	0.562**	0.444**	0.439**	0.532**	0.515**	1

*$p < 0.05$; **$p < 0.01$.

FIG. 1. The mediating role of clinical factors when aggression predicts Internet addiction. The arrows show assumed causal relationships and indicate the direction of causality. A solid line indicates a significant path; a dotted line indicates a nonsignificant path. AQ, Aggression Questionnaire; BIS-11, Barratt Impulsiveness Scale-11; STAXI-2, State–Trait Anger Expression Inventory-2; BAI, Beck Anxiety Inventory; BDI, Beck Depression Inventory; CASS, Conners–Wells Adolescent Self-Report Scale.

analysis. In such cases, the direct effect was 0.01 (CR = 0.362, n.s.), the indirect effect was 0.153 ($p < 0.001$), and the Sobel test Z was 11.38 ($p < 0.001$, two-tailed).

The mediating roles of the BDI, BAI, and CASS in the relationships between aggression and Internet addiction with regard to gender

Gender differences in motivation for substance abuse have been frequently reported.[41] Meanwhile, gender differences on Internet addiction remain controversial.[42] For this reason, a path analysis was performed for males and females separately. Path traces were the same as shown in Figure 1. The overall outcomes were similar to gender as a whole, but parts of the models were somewhat different. In the case of males, the BDI served as a partial mediator when the AQ predicted IAD. The direct effect was 0.26, and the direct path was significant (CR = 4.778, $p < 0.001$). The indirect effect was 0.07, and each indirect path was significant ($p < 0.001$ and $p < 0.01$, respectively), and the Sobel test Z was significant ($Z = 22.48$, $p < 0.001$, two-tailed). For females, the BDI showed no mediating effect. The BAI fully mediated the relationship between STAXI-2 scores and IAD. In such cases, the direct effect was 0.07 (CR = 1.148, n.s.), the indirect effect was 0.132, and both indirect paths were significant ($p < 0.001$). The Sobel test Z was 8.56 ($p < 0.001$, two-tailed). The rest of the path models for males and females had an identical pattern to gender as a whole.

The mediating roles of the BDI, BAI, and CASS in the relationships between Internet addiction and aggression

Path analysis was performed to examine the mediating effects of the clinical scales when IAD predicted scores on the aggression scales. Figure 2 shows the mediating effect of the clinical scales when IAD predicted aggression. With the exception of the path from IAD to the STAXI-2, the effects of both direct and indirect paths were significant in every model. However, the results of the Sobel test were not significant in any of these models. These results indicate that clinical scales such as the BAI, BDI, and CASS seem to have no mediating effects when IAD predicts aggression.

Discussion

The present study examined (a) the causal relationships between aggression and IAD and (b) the mediating effects of other clinical factors in the direction of causality between aggression and IAD. The results were as follows. When only two variables (aggression and IAD) were considered, bidirectional relationships were possible. That is, aggression scores could be predicted by IAD and vice versa. However, statistical analyses that included potential mediating variables (the BAI, BDI, and CASS) showed that clinical factors played mediating roles only when aggression predicted IAD and not vice versa.
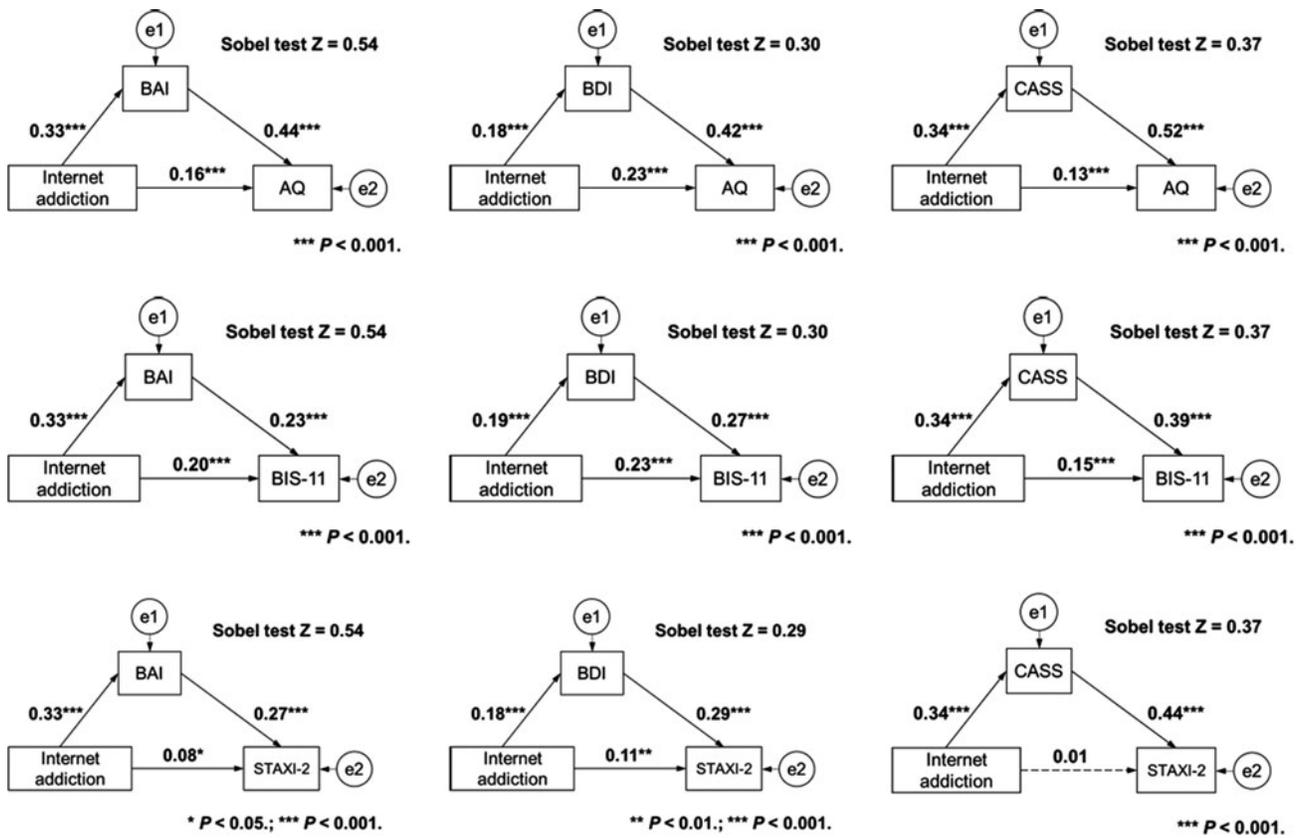
FIG. 2. The mediating role of clinical variables when Internet addiction predicts aggression. The arrows show assumed causal relationships and indicate the direction of causality. A solid line indicates a significant path; a dotted line indicates a nonsignificant path.

Several studies regarding the relationship between Internet addiction and comorbid psychiatric disorders have been conducted,[21,43,44] enabling the current study to incorporate particular clinical variables (as measured by the BAI, BDI, and CASS) as potential mediators in this relationship. With respect to the influence of Internet addiction on aggression, it was found that Internet addiction predicted aggression in adolescents, irrespective of whether clinical factors were considered. A previous study found that adolescents with Internet addiction were more likely to demonstrate aggressive behavior and that various factors, including computer-mediated social interaction, exposure to media violence, and entering a deindividuated state during Internet activities, may be involved in the association between Internet addiction and aggressive behavior.[18] However, when aggression predicted Internet addiction, comorbid clinical entities mediated the effect of aggression on the development of Internet addiction. These results suggest that aggressive individuals with depression, anxiety, or ADHD may be especially vulnerable to Internet addiction.

In terms of demographic data, it was confirmed that adolescents in the Internet addiction group had higher scores on the BDI, BAI, and CASS than did those in the other two groups. At this point, it is likely that fewer adolescents suffer from pure IAD than suffer from IAD in addition to a comorbid condition. Yang et al. noted that excessive Internet use according to the Y-IAT was associated with higher levels of psychiatric symptoms on the Symptom Checklist-90-

Revision in Korea.[21,45] Additionally, Yen et al. also reported that adolescents with Internet addiction had more ADHD symptoms and more severe depression.[46] Although the concept of and criteria for Internet addiction remain controversial, four components are considered essential: (a) excessive use, often with a loss of sense of time or neglect of basic drives; (b) withdrawal, including feelings of anger, tension, and/or depression and anxiety when the Internet is inaccessible; (c) obsession, including a constant need for better computer equipment, more software, or more hours of use; and (d) negative consequences, including arguments, lying, poor achievement, social isolation, and fatigue.[47,48] Thus, psychiatric interventions that consider both aggression and comorbid conditions will assist in the treatment and understanding of IAD.

This study has several limitations. First, only 13 students met the criteria for the Internet addiction group. Thus, a larger sample is needed to establish the validity of the results. Further research will therefore be conducted to compensate for the small sample size of the IAD group. Second, the sample was confined to middle school students. Generalization of this study's results would require samples including students in the higher grades of elementary school, high school students, and university freshmen.

However, despite these limitations, this study adds to the literature. First, it addressed both directions of the potential causal relationships involving aggression and IAD. To the authors' knowledge, previous studies were unable to

elucidate these relationships clearly. Nonetheless, research with a prospective design is still needed. Second, several potential mediators of this relationship (depression, anxiety, and ADHD) were tested simultaneously.

Conclusion

The current findings indicate that adolescents with IAD appear to be more disposed to aggression than are non-addicted ones. If more aggressive individuals are prone to Internet addiction, early psychiatric interventions that target both level of aggression and clinical status should assist in the prevention and treatment of IAD.

Acknowledgments

Author Disclosure Statement

No competing financial interests exist.

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