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Substance abuse precedes internet addiction

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Abstract

The purpose of the current study was to evaluate possible overlapping substance abuse and internet addiction in a large, uniformly sampled population, ranging in age from 13 to 18 years. Participants (N=73,238) in the current study were drawn from the 6th Korea Youth Risk Behavior Web-based Survey (KYRBWS-V) for students from 400 middle schools and 400 high schools in 16 cities within South Korea. Of adolescent internet users, 85.2% were general users (GU), 11.9% were users with potential risk for internet addiction (PR), and 3.0% were users with high risk for internet addiction (HR). There was a difference in the number of students with alcohol drinking among the GU, PR, and HR groups (20.8% vs 23.1% vs 27.4%). There was a difference in the number of students who smoked among the GS, PR, and HR groups (11.7% vs 13.5% vs 20.4%). There was a difference in the number of students with drug use among the GU, PR, and HR groups (1.7% vs 2.0% vs 6.5%). After adjusting for sex, age, stress, depressed mood, and suicidal ideation, smoking may predict a high risk for internet addiction (OR=1.203, p=0.004). In addition, drug use may predict a high risk for internet addiction (OR=2.591, p<0.001). Because students with a high risk for internet addiction have vulnerability for addictive behaviors, co-morbid substance abuse should be evaluated and, if found, treated in adolescents with internet addiction.

Keywords

Internet use; Adolescence; Alcohol; Smoking; Drug; Co-morbidity

1. Introduction

Several studies have reported that the risk of internet addiction is associated with an increased prevalence of substance dependence (Bakken, Wenzel, Gotestam, Johansson, & Oren, 2009; Padilla-Walker, Nelson, Carroll, & Jensen, 2010). However, the subjects in most published studies have been adults and the number of subjects surveyed not been typically large enough to demonstrate significant co-morbidity of substance and internet

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Contributors

Doug Hyun Han and Perry Renshaw designed the study and wrote the protocol. Young Sik Lee and Sun Mi Kim conducted literature searches and provided summaries of previous research studies. Doug Hyun Han conducted the statistical analysis. Doug Hyun Han and Perry Renshaw wrote the first draft of the manuscript and all authors contributed to and have approved the final manuscript.

Conflict of interest

All authors declare that they have no conflicts of interest.

addiction. Adolescence is a critical period which is characterized by risk-taking behavior, increased levels of novelty seeking and exploration, and intimate social interaction (Spear, 2000). In addition, 12% of 8th graders (13–14 years old) and 22% of 10th graders in USA students had episodes of heavy alcohol drinking within past two years (Johnston, O'Malley, Bachman, & Schulenberg, 2004).

The overlap between internet addiction and substance abuse and dependence may be due to similar characteristics predisposing toward, and brain regions responding to, internet use or substances. Individuals with internet addiction and substance addiction share similar temperaments. In a study of 686 high school students, Cho, Kim, Kim, Lee, and Kim (2008) reported that adolescents with problematic internet use showed higher self-directedness and cooperativeness and lower scores in novelty seeking and self-transcendence on a junior temperament and character inventory. In a study of 166 high school students, Lee et al. (2008) reported that adolescents with excessive internet use showed higher harm avoidance, relative to healthy comparison adolescents. In 88 patients with alcohol dependence, harm avoidance was negatively associated with the duration of abstinence (Ando et al., 2012) In addition, low novelty seeking and high self-directedness were also reported in adults with alcohol dependence (Angheliescu et al., 2010). Individuals with internet addiction and substance addiction may also share similar vulnerable brain regions including dorsolateral and orbitofrontal cortices (Crockford, Goodyear, Edwards, Quickfall, & el-Guebaly, 2005; Han, Hwang, & Renshaw, 2010; Ko et al., 2009).

Based on studies consistently reporting overlap and shared characteristics in individuals with internet and substance addiction, the purpose of the current study was to evaluate possible overlapping substance addiction and internet addiction in a large uniformly sampled population, ranging in age from 13 to 18 years.

2. Methods

2.1. Participants and data collecting

Seventy three thousand two hundred thirty eight participants in the current study were drawn from the 6th Korea Youth Risk Behavior Web-based Survey (KYRBWS-V) for students from 400 middle schools and 400 high schools in 16 cities within South Korea (KCDCP, 2011). The response rate for students was 97.7% (N=73,238). The IRB of Chung Ang University Hospital approved data analysis without informed consent considering that the KYRBWS-V cohort is a nationally representative group and the survey results did not contain protected health information.

2.1.1. Questionnaire of survey—The survey consisted of 128 questions in 14 fields including demographics, smoking, alcohol, drugs, obesity, eating behaviors, physical activity, prevention of trauma, sexual behaviors, psychiatric illness, oral hygiene, individual hygiene, atrophy/asthma, and internet use. Among these 14 fields, we extracted information from 6 fields including demographics, smoking, alcohol, drugs, psychiatric illness, and internet use for the purpose of our study. In a 2 week interval test-retest reliability assessment of the KYRBWS-V questionnaire, all of the self-reported health risk behavior indices had kappas ≥ 0.41 (Bae et al., 2010).

The students were asked to check the Korean self-reporting internet addiction scale short form (KS-scale) developed by Kim, Jeng, Lee, Kim, and Joe (2008). The KS-scale consists of 20 items scored with a four-point Likert scale (1: “not at all” and 4: “always”). According to the scores of KS-scale total and subscales, students were classified into high risk for internet addiction, potential risk for internet addiction, and general user groups. As a result of reliability analysis of the KS-scale, the Cronbach’s alpha for middle school student scores was 0.909 (Kim et al., 2008). Alcohol use, smoking, and drug use were assessed by the questionnaires which were described in supplementary.

2.2. Statistical analysis

All the data from students in the current survey is presented as an average and standard deviation. The comparison of substance use characteristics between groups was analyzed with chi-square analysis and one way ANOVA. For confirmation that the results were not due to large sample size and for multiple comparisons instead of a substantive relationship between variables, Cramer’s V coefficient of less than 0.3 in chi-square testing and Bonferroni collection $p < 0.05/5$ (internet use, alcohol, smoking, drug, and multi-substances) in one way ANOVA were applied. The correlations of the risk between internet addiction and substance addiction were conducted by binary logistic regression analyses after adjusting for age, sex, mental stress, depression, and suicidal ideation.

3. Results

3.1. Demographic characteristics

Eighty-two percent of Korean teenager students reported use of the internet in the current survey. Of internet users, 85.2% were general users, 11.9% were users with potential risk for internet addiction, and 3.0% were users with high risk for internet addiction. Twenty one point two percent of students reported drinking alcohol. The rate of alcohol drinking in male students (23.5%) was higher than the rate (18.7%) in female students ($\chi^2=256.9$, $p < 0.01$). Twelve point two percent of students were smokers. One point nine percent of students reported drug use (Table 1).

3.2. Internet use pattern

The high risk group used the internet 202 ± 149 min/day on weekdays and 318 ± 172 min/day on weekends. The Potential group used internet 150 ± 110 min/day on weekdays and 244 ± 141 min/day on weekends. General users used the internet 110 ± 87 min/day on weekdays and 166 ± 110 min/day on weekends. Controlling for age, sex, depressed mood, and suicidal ideation, reported stress was positively correlated with the risk for internet addiction ($B=0.216$, $S.E.=0.007$, $\beta=0.103$, $t=30.7$, $p < 0.01$). Controlling for age, sex, stress, and suicidal ideation, the number of depressed students was higher in high risk group than in the potential group or among general users ($B=0.685$, $S.E.=0.011$, $OR=1.944$, $p < 0.001$). Controlling for age, sex, stress, and depressed mood, the number of students with suicidal ideation was higher in the high risk group, compared to the potential group and general users ($B=0.729$, $S.E.=0.013$, $OR=2.072$, $p < 0.001$).

3.3. Internet addiction risk vs alcohol use pattern

There was a difference in the number of students with alcohol drinking among the general user group, the potential risk group, and the high risk group (20.8% vs 23.1% vs 27.4%, $\chi^2=73.5$, $p<0.01$). However, alcohol use did not predict an increased risk for internet addiction after adjusting for sex, age, stress, depressed mood, and suicidal ideation (beta=0.06, S.E.=0.05, OR=1.235, $p=0.266$) (Table 2). Adjusting for sex, age, depressed mood, sadness, and suicidal ideation, the age of first drinking alcohol was earlier in the high risk group, compared to general user and the potential risk groups (beta=0.353, S.E.=0.07, $t=5.101$, $p<0.01$). Adjusting for sex, age, depressed mood, sadness, and suicidal ideation, heavy alcohol drinking predicted a high risk for internet addiction (beta=0.037, S.E.=0.09, OR=1.038, $p<0.01$).

3.4. Internet addiction risk vs smoking pattern

There was a difference in the number of students who smoked among the general user group, the potential risk group, and the high risk group (11.7% vs 13.5% vs 20.4%, $\chi^2=73.5$, $p<0.01$). Moreover, smoking may predict a high risk for internet addiction after adjusting for sex, age, stress, depressed mood, and suicidal ideation (beta=0.185, S.E.=0.06, OR=1.203, $p=0.004$). Adjusting for sex, age, depressed mood, and suicidal ideation, the age of first smoking was earlier in the high risk group, compared to the general user group and the potential risk group (beta=748.9, S.E.=93.8, $t=7.983$, $p<0.01$). Adjusting for sex, age, depressed mood, sadness, and suicidal ideation, heavy smoking predicted a high risk for internet addiction (beta=0.410, S.E.=0.114, OR=1.507, $p<0.01$).

3.5. Internet addiction risk vs substance use pattern

There was a difference in the number of students with drug use among the general user group, the potential risk group, and the high risk group (1.7% vs 2.0% vs 6.5%, $\chi^2=73.5$, $p<0.01$). Moreover, drug use may predict high risk for internet addiction after adjusting for sex, age, stress, depressed mood, and suicidal ideation (beta=0.952, S.E.=0.104, OR=2.591, $p<0.001$) (Table 2). In addition, all substance use can strongly predict high risk for internet addiction after adjusting for sex, age, stress, depressed mood, and suicidal ideation (beta=2.225, S.E.=0.256, OR=9.256, $p<0.001$) (Table 2).

4. Discussion

The current study suggests that the risk for internet addiction is associated with smoking and drug use in teenage students. Moreover, the severity of internet use was positively correlated with the severity of alcohol use, smoking, and drug use. In addition, adolescents with earlier ages of onset of substance use and multiple substance use were more likely to be at increased risk of internet addiction. The present study is valuable for its uniform sampling of a large population with 73,000 students, the correlation of patterns between chemical addiction and behavioral addiction, and the inclusion of younger subjects.

Several studies have reported a correlation between internet addiction and substance addiction. The current survey showed that the percentage of students who drank alcohol (23.1%) or who smoked (13.5) in the potential risk group was greater than the percentage

observed among general users (alcohol: 20.8%, smoke 11.7%). The high risk group drank alcohol (27.4%) more and smoked more (20.4%) than the potential risk group. In addition, earlier alcohol use and smoking were correlated with a high risk for internet addiction. Smoking, but not alcohol use, can predict a high risk for internet addiction. Similar to these observation, a survey of 2336 Korean high school students by Choi et al. (2009) noted that the prevalence of alcohol use was not linearly correlated with the severity of internet addiction (Choi et al., 2009). The students with internet addiction drank alcohol more (32.1%), compared to the non-addiction group (20.4%). However, the rate of alcohol use in the possible addiction cohort (17.9%) was lower than in the non-addicted group. The different correlation of internet addiction risk with alcohol and smoking may be due to the different pharmacological effects of alcohol, a sedative, and nicotine, a stimulant. In addition, internet use and alcohol use may substitute for each other. As alcohol use generally takes place in groups, adolescents also play Massive multi-user on-line role playing game (MMORPG). MMORPG is known to be associated with high risk for internet addiction (Achab et al., 2011).

The prevalence rate of alcohol use (23.5%) in all students was almost twice than that of smoking (12.2%) in the current survey. In addition, a strong correlation between drug use and the risk for internet addiction was observed. The prevalence of drug use in all students is 1.9%. The drug use odds ratio for predicting a high risk for internet addiction is 2.59 compared to OR of 1.51 in smokers and an OR of 1.04 in drinkers. Moreover, multi-substance use strongly predicts a high risk for internet addiction (OR=9.26). Those results suggest that chemical and behavioral addictions may share similar biological characteristics. Recent genetic studies and reviews have suggested that the strong association among onset age of smoking, alcohol, and drug use provide evidence for biological vulnerability including heritability (Bierut et al., 1998; Kapoor et al., 2012).

The current study has several limitations. First, because the present study is a secondary analysis, we cannot interpret further the correlation between variables. Second, because the information was obtained by self-report, adolescents' perceptions could have been inaccurate. Finally, the administration of a long questionnaire may have increased a tendency to provide inaccurate answers in some students.

5. Conclusions

As far as we know, this is the first large scale study of the correlation between substance abuse and internet addiction in teenagers. Because students with a high risk for internet addiction have vulnerability for addictive behaviors, co-morbid substance abuse should be evaluated and, if found, treated in adolescents with internet addiction.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <http://dx.doi.org/10.1016/j.addbeh.2012.12.024>.

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HIGHLIGHTS

- ▶ Of internet users, 3.0 percent were users with high risk for internet addiction.
- ▶ The severity of internet use was correlated with the severity of substance use.
- ▶ Earlier onset of substance use was associated with internet addiction.

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Table 1

Demographic data.

	Boys (N=38,391, 52.4%)	Girls (N=34,847, 47.6%)	Total (N=73,238, 100%)	t/ χ^2 , p, Cramer's V
Age (years)	15.1±1.7	15.1±1.8	15.1±1.7	t=1.5, p=0.14
School grade ^a				$\chi^2=23.7$, p<0.01, V=0.02
1st middle school	6519 (17.0)	5949 (17.1)	12,468 (17.0)	
2nd middle school	6620 (17.2)	5879 (16.9)	12,499 (17.1)	
3rd middle school	6817 (17.8)	5786 (16.6)	12,603 (17.2)	
1st high school	6229 (16.2)	5792 (16.6)	12,021 (16.4)	
2nd high school	6273 (16.3)	5851 (16.8)	12,124 (16.6)	
3rd high school	5933 (15.5)	5590 (16.0)	11,523 (15.7)	
Economic state ^a				$\chi^2=383.9$, p<0.01, V=0.07
Rich	12,238 (31.9)	8834 (28.8)	21,072 (28.8)	
Average	17,061 (44.4)	17,192 (49.3)	34,253 (46.8)	
Poor	9092 (23.7)	8821 (25.3)	17,913 (24.5)	
Stress ^a	3.3±1.0	3.5±0.9	3.4±1.0	t=40.5, p<0.01
Depressed mood ^a				
Yes/No	12,366 (32.2)/26,025 (67.8)	15,007 (43.1)/19,840 (56.9)	27,373 (37.4)/45,865 (62.6)	$\chi^2=919.5$, p<0.01, V=0.11
Suicidal ideation ^a				
Yes/No	5855 (15.3)/32,536 (84.7)	8156 (23.4)/26,691 (76.6)	14,001 (19.3)/59,227 (80.7)	$\chi^2=785.1$, p<0.01, V=0.10
Internet use				
WKD (use/non-use) ^a	25,612 (66.7)/12,779 (33.3)	25,706 (73.8)/9141 (26.2)	51,318 (70.1)/21,920 (29.9)	$\chi^2=433.5$, p<0.01, V=0.08
WKD (use time/min) ^a	123±103	113±87	118±96	
WED (use/non-use) ^a	28,882 (75.2)/9509 (24.8)	27,574 (79.1)/7273 (20.9)	56,456 (77.1)/16,782 (22.9)	$\chi^2=157.1$, p<0.01, V=0.05
WED (use time/min) ^a	197±131	163±109	181±122	
General users	31,574 (82.2)	30,746 (88.2)	62,320 (85.1)	$\chi^2=559.7$, p<0.01, V=0.09
Potential risk ^a	5305 (13.8)	3417 (9.8)	8722 (11.9)	
High risk ^a	1512 (3.9)	2194 (2.0)	2196 (3.0)	
Alcohol (use/non-use) ^a	9040 (23.5)/29,351 (76.5)	6515 (18.7)/28,332 (81.3)	15,555 (21.2)/57,683 (78.8)	$\chi^2=256.9$, p<0.01, V=0.06
Smoking (use/non-use) ^a	6482 (16.9)/31,909 (83.1)	2455 (7.0)/32,392 (93.0)	8937 (12.2)/64,301 (87.8)	$\chi^2=256.9$, p<0.01, V=0.15
Drugs (use/non-use) ^a	814 (2.1)/37,577 (97.9)	586 (1.7)/34,261 (98.3)	1400 (1.9)/71,838 (98.1)	$\chi^2=18.7$, p<0.01, V=0.02

^aStatistically significant (p<0.01, V<0.3), WKD: week day, WED: weekend, post hoc Cramer's V coefficient.

The binary logistic regression analyses of substance use for high risk group for internet addiction comparing general and potential risk group.

Table 2

Category	Beta	S.E.	OR	95% CI	p-values
Alcohol	0.06	0.05	1.235	0.957–1.173	0.266
Smoking	0.185	0.064	1.203	1.060–1.365	0.004
Drugs	0.952	0.104	2.591	2.111–3.180	<0.001
Multi-substances					
One substance	0.122	0.057	1.129	1.011–1.262	0.032
Two substances	0.101	0.073	1.106	0.958–1.277	0.168
Three substances	2.225	0.256	9.256	5.600–15.297	<0.001
Non user	Ref				

S.E.: standard error; OR: odd ratio; CI: confidential interval; adjusting for the covariate variables: sex, age, stress, sadness, and suicidal ideation; one/two/three substances: students using one/two/all of three substances (alcohol, tobacco, and drugs).