JKMS

Brief Communication
Psychiatry & Psychology

Check for updates

Address for Correspondence:
Soo-Young Bhang, MD, PhD, MPH
Department of Psychiatry, Eulji University Eulji
Hospital, Eulji University School of Medicine,
68 Hangeulbiseok-ro, Nowon-gu, Seoul 01830,
Korea.
E-mail: dresme@dreamwiz.com

Dongyun Lee, MD, PhD
Department of Psychiatry, Gyeongsang
National University Changwon Hospital, 11
Samjeongja-ro, Seongsan-gu, Changwon
51472, Republic of Korea.
E-mail: yuny0829@gnu.ac.kr

ORCID iDs
Jiyeong Seo
https://orcid.org/0000-0002-7329-8296
Cheol-soon Lee
https://orcid.org/0000-0003-1479-6962
Young-Ji Lee
https://orcid.org/0000-0003-0201-2518
Mi-Sun Lee
https://orcid.org/0000-0003-2918-0546
Soo-Young Bhang
https://orcid.org/0000-0001-5254-0314
Dongyun Lee
https://orcid.org/0000-0002-3977-3663

The Mediating Effect of Depressive Symptoms on the Relationship between Adverse Childhood Experiences and Problematic Internet Use in Children and Adolescents

Jiyeong Seo [iD],[1] Cheol-soon Lee [iD],[1,2] Young-Ji Lee [iD],[1] Mi-Sun Lee [iD],[3]
Soo-Young Bhang [iD],[4] and Dongyun Lee [iD] [1,2]

[1]Department of Psychiatry, Gyeongsang National University Changwon Hospital, Changwon, Korea
[2]Department of Psychiatry, Gyeongsang National University College of Medicine, Jinju, Korea
[3]Department of Meditation Psychology, Nungin University, Hwaseong, Korea
[4]Department of Psychiatry, Eulji University Hospital, Eulji University School of Medicine, Seoul, Korea

ABSTRACT

The purpose of this study was to evaluate the mediating effect of depressive symptoms on the relationship between adverse childhood experiences (ACEs) and problematic internet use. The study participants were 180 students between the ages of 9 and 18 years. Path analysis was performed to measure the relationships among ACEs, depressive symptoms and problematic internet use. ACEs significantly affected depressive symptoms (standardized regression weight, 0.36; $P < 0.01$), and depressive symptoms also affected problematic internet use (standardized regression weight, 0.40; $P < 0.01$). We found that depressive symptoms had a significant mediating effect on the relationship between problematic internet use and ACEs. The management of depressive symptoms would be important to prevent problematic internet use in children and adolescents with ACEs.

Keywords: Depression; Childhood Adversity; Problematic Internet Use

Adverse childhood experiences (ACEs) have generally included adversities such as childhood abuse, neglect, and an upbringing in a dysfunctional household.[1] ACEs are associated with high-risk health behaviors and may increase the risk of mental illness, including depression and substance addiction, in young adulthood.[2-4] Traumatic experiences during childhood can also be associated with psychopathology, including problematic internet use, which has been related to an individual's inability to control his or her use of the internet. Adolescents with ACEs who had experienced inadequate parenting and were raised in insecure home environments are at high risk of emotional dysregulation and may exhibit addictive behaviors such as excessive use of the Internet as self-medication for negative emotional problems.[5,6] Problematic internet use has been noted as an important psychosocial concern because it has been reported to affect not only psychopathology, such as hyperactivity and depression, but also physical health and poor academic performance.[7] In children and adolescents, ACEs, depression, and problematic internet use may appear in sequence or at the same time, but few studies have identified the relationships among these factors. In the systematic review of

Author Contributions

Conceptualization: Lee CS; Formal analysis: Lee D, Lee CS; Data curation: Lee MS; Validation: Lee CS; Investigation: Lee YJ; Methodology: Bhang SY; Software: Lee CS; Writing - original draft: Seo J; Writing - review & editing: Bhang SY, Lee D.

the relationship between problematic smartphone use and psychopathology, the relationship between problematic smartphone use and depression was bidirectional.[8] People with depression were likely to engage in problematic smartphone use because they excessively use their smartphones to cope with negative emotions.[9] The individual relationships between ACEs, depressive mood, and problematic internet use have been reported in previous studies, however, there are few studies examining the role of depressive mood in the relationship between ACEs and problematic internet use. We hypothesize that depressive symptoms mediate the relationship between ACEs and problematic internet use. The purpose of this study was to investigate whether depressive symptoms mediate the relationship between problematic internet use and ACEs in children and adolescents.

From March to October 2017, we surveyed 3,937 students attending schools in Seoul, Korea, who were smartphone users. We used the data from a survey administered as part of a regional mental health project to screen for Internet and smartphone addiction. This study was conducted with adolescents in elementary (from grade 4), middle or high school in Seoul. Researchers provided self-reported questionnaires to the supervisor of the school, and the students whose parents permitted their participating in the survey completed the questionnaires in school. Among these students, one hundred eighty students were considered to be at high risk for problematic internet use and were enrolled with the permission of their parents. Individuals were categorized into the high-risk group if they satisfied any of the following criteria: 1) scores on the Internet Gaming Use-Elicited Symptom Screen (IGUESS)[10] ≥ 10; 2) smartphone addiction proneness scale scores[11] ≥ 23; 3) daily internet use ≥ 3 hr/wk (elementary school) or ≥ 4 hr/wk (middle school and high school); and 4) internet gambling experience or online payments ≥ 80 dollars/year.

The questionnaire used to assess ACEs consisted of 10 questions associated with physical, sexual, or verbal abuse, familial conflicts and psychiatric history.[12] The Children's Depression Inventory (CDI) has a total of 27 items and was used to assess depressive symptoms in children 8–13 years of age.[13] In the Korean validity study, there were no significant differences according to sex, age, or grade, and this version was found to be a useful tool in screening for depression (Cronbach's α = 0.88).[14] IGUESS was used as a tool to assess problematic internet use.[10] This tool was developed in Korea based on the Diagnostic and Statistical Manual of Mental Disorders, 5th Edition content to identify obstacles related to Internet game use at community and primary health care centers. The IGUESS included the following 9 items: preoccupation with internet games, withdrawal symptoms, tolerance, unsuccessful attempts to control, loss of interest, continued excessive use, lies regarding the amount of internet gaming, use of internet games to escape negative feeling, and lost opportunities in relationships, work, and education. The responses are divided into four categories: one point is scored for not at all, two for occasionally, three for frequently and four for always. The reliability and validity of this tool have been confirmed (Cronbach's α = 0.94).[10] The smartphone addiction proneness scale was developed by the National Information Society agency in Korea. This is a self-reported scale for evaluating smartphone addiction in adolescents. Cronbach's α was 0.880.[11] The self-reported questionnaires were used to survey daily internet use duration and internet gambling experience. All self-reported questionnaires were directly completed by the participants.

The data were statistically analyzed to define the sociodemographic characteristics of the subjects, and Pearson correlation analysis and A path analysis was performed to measure the relationships among ACEs, depressive symptoms and problematic internet use. A P

value of 0.05 was set to indicate statistical significance. The model fit of the path analysis was evaluated by calculating the χ2 value (CMIN), root mean square error of approximation (RMSEA), and comparative fit index (CFI). The smaller the value of the CMIN is, the better the fit of the model. The RMSEA is acceptable if it is 0.08 or lower, and the CFI is judged to be acceptable if it is 0.09 or higher. The statistical analysis was performed using SPSS for Windows, version 21.0 (SPSS Inc., Chicago, IL, USA) and AMOS 19.0 (SPSS Inc.).

A total of 180 students (95 boys, 85 girls) aged 9–18 years (mean, 12.72 ± 1.76) participated, including 134 elementary school students (74.4%), 35 middle school students (19.4%) and 11 high school students (6.1%). In the results of Pearson correlation analyses (**Table 1**), there were significant correlations among ACEs, the CDI score and the IGUESS score and between ACEs and the CDI score ($r = 0.34$, $P < 0.01$), ACEs and the IGUESS score ($r = 0.27$, $P < 0.01$), and the CDI and IGUESS scores (0.44, $P < 0.01$). In the linear regression analysis between ACEs and IGUESS, in the absence of the CDI, ACEs significantly affected IGUESS scores (standardized regression weight, 0.27; $P < 0.01$). After the CDI score was added to this model as a mediator, the direct effect of ACEs on the IGUESS score was not significant. Accordingly, a significant mediating effect was found for depressive symptoms on the relationship between problematic internet use and ACEs (**Fig. 1**). Regarding the indirect effect, ACEs significantly affected the CDI score (standardized regression weight, 0.36; $P < 0.01$), and the CDI score also affected the IGUESS score (standardized regression weight, 0.40; $P < 0.01$). The model fit was appropriate, and the indexes of model validation were as follows: CMIN, 0.01; RMSEA, 0.01; and CFI > 0.9.

The purpose of this study was to evaluate the mediating effect of depressive symptoms on ACEs and problematic internet use. The main results of this study were as follows: there was a significant association between only two variables, ACEs and IGUESS scores; however, in the path analysis results that included CDI scores as a mediator between ACEs and IGUESS scores, the indirect effect of the CDI scores was statistically significant, and the association between ACEs and IGUESS was not significant. This analysis indicated that depressive symptoms had a significant mediating effect on the relationship between ACEs and problematic internet

Table 1. Pearson's correlation analysis of depressive symptoms, problematic internet use and ACEs

Variables	CDI	ACEs	IGUESS
CDI	1.00		
ACEs	0.34[*]	1.00	
IGUESS	0.44[*]	0.27[*]	1.00

The above values represent correlation coefficients.
CDI = Children's Depression Inventory, ACE = adverse childhood experience, IGUESS = Internet Gaming Use-Elicited Symptom Screen.
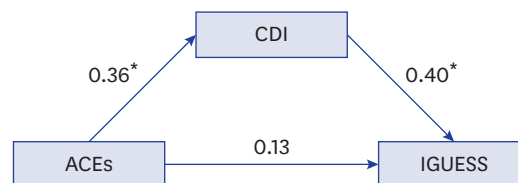[*]$P < 0.01$.

Fig. 1. Model of the mediating effect of depressive symptoms on the relationship between problematic internet use and ACEs using path analysis. The values shown are standardized regression coefficients. Model fit: CMIN = 0.01, RMSEA = 0.01, and CFI > 0.9.
CMIN = χ2 value, RMSEA = root mean square error of approximation, CFI = comparative fit index, CDI = Children's Depression Inventory, ACEs = adverse childhood experiences, IGUESS = Internet Gaming Use-Elicited Symptom Screen.
[*]$P < 0.01$.

use. Although few studies have found relationships among depression, problematic internet use and ACEs, previous studies have described associations between internet addiction and several mental health problems, of which depression is the most frequently reported to be associated with internet addiction among adolescents.[15,16] These previous results suggested that the relationship between Internet addiction and depression may not necessarily be linear but may rather adopt a bidirectional pattern, resulting in a vicious cycle. Another study found that the effect of Internet addiction on adolescent depression is mediated by negative life events.[17] In regard to the relationship between traumatic experiences and internet addiction, traumatic memories may increase the risk of problematic internet use via the mediating effect of alexithymia.[18] Previous findings support the existence of the associations among depression, problematic internet use and ACEs that were found in this study. ACEs have been reported to be risk factors for diverse psychiatric diseases, such as depression and anxiety disorders.[8] Excessive usage of the internet is a strategy for coping with negative emotions in adolescents experiencing stress. Adolescents alleviate negative emotions by communicating via the Internet, and this effect reinforces excessive use of the Internet among adolescents.[9] At the same time, excessive Internet use interferes with physical and mental health behaviors in adolescents, causing mental illnesses such as depression.[8,19] In this study, adolescents with more ACEs were more likely to engage in problematic internet use. Considering the results of previous studies, there could be diverse relationships among ACEs, depression and problematic internet use. This study found that depression is a mediator of the relationship between ACEs and problematic Internet use.

There are several limitations of this study. First, we used a simple questionnaire to measure depressive symptoms and symptoms of problematic internet use. Therefore, the interpretation of the results is limited. Second, the cross-sectional characteristics of the survey limit the testing of causal paths. Third, the subjects did not have a balanced age distribution in this study. Fourth, there could be other variables that mediate the relationship between ACEs and IGUESS scores, for example, age, sex, socioeconomic status, parental marital status, past psychiatric history, and comorbid psychiatric diseases of the participants and their parents. However, we only considered the CDI score as a mediator in this study. Therefore, future studies should be conducted using specific measurements, structured interviews, and prospective data.

Despite these limitations, the results of this study could help improve our understanding of the relationships among ACEs, problematic internet use and depressive symptoms. Additionally, it can be assumed that the treatment of depressive symptoms may represent an effective target of interventions to prevent problematic internet use in adolescents with ACEs.

ETHICS STATEMENT

Consent for participation was obtained from the subjects' parents. This study was approved by the Institutional Review Board (IRB) of Eulji University Hospital (IRB No. EMCS 2018-06-014).

REFERENCES

1. Chapman DP, Whitfield CL, Felitti VJ, Dube SR, Edwards VJ, Anda RF. Adverse childhood experiences and the risk of depressive disorders in adulthood. *J Affect Disord* 2004;82(2):217-25.
   PUBMED | CROSSREF

2. Flaherty EG, Thompson R, Dubowitz H, Harvey EM, English DJ, Proctor LJ, et al. Adverse childhood experiences and child health in early adolescence. *JAMA Pediatr* 2013;167(7):622-9.
PUBMED | **CROSSREF**

3. Bellis MA, Lowey H, Leckenby N, Hughes K, Harrison D. Adverse childhood experiences: retrospective study to determine their impact on adult health behaviours and health outcomes in a UK population. *J Public Health (Oxf)* 2014;36(1):81-91.
PUBMED | **CROSSREF**

4. Kessler RC, McLaughlin KA, Green JG, Gruber MJ, Sampson NA, Zaslavsky AM, et al. Childhood adversities and adult psychopathology in the WHO World Mental Health Surveys. *Br J Psychiatry* 2010;197(5):378-85.
PUBMED | **CROSSREF**

5. Schimmenti A, Bifulco A. Toward a better understanding of the relationship between childhood trauma and psychiatric disorders: measurement and impact on addictive behaviors. *Psychiatry Investig* 2015;12(3):415-6.
PUBMED | **CROSSREF**

6. Schimmenti A, Passanisi A, Gervasi AM, Manzella S, Famà FI. Insecure attachment attitudes in the onset of problematic Internet use among late adolescents. *Child Psychiatry Hum Dev* 2014;45(5):588-95.
PUBMED | **CROSSREF**

7. Dalbudak E, Evren C, Aldemir S, Evren B. The severity of Internet addiction risk and its relationship with the severity of borderline personality features, childhood traumas, dissociative experiences, depression and anxiety symptoms among Turkish university students. *Psychiatry Res* 2014;219(3):577-82.
PUBMED | **CROSSREF**

8. Elhai JD, Dvorak RD, Levine JC, Hall BJ. Problematic smartphone use: a conceptual overview and systematic review of relations with anxiety and depression psychopathology. *J Affect Disord* 2017;207:251-9.
PUBMED | **CROSSREF**

9. Kim JH, Seo M, David P. Alleviating depression only to become problematic mobile phone users: Can face-to-face communication be the antidote? *Comput Human Behav* 2015;51:440-7.
CROSSREF

10. Jo SJ, Yim HW, Lee HK, Lee HC, Choi JS, Baek KY. The Internet Game Use-Elicited Symptom Screen proved to be a valid tool for adolescents aged 10–19 years. *Acta Paediatr* 2018;107(3):511-6.
PUBMED | **CROSSREF**

11. Shin K, Kim D, Jung Y. *Development of Korean Smart Phone Addiction Proneness Scale for Youth and Adults.* Seoul: Korean National Information Society Agency; 2011.

12. Felitti VJ, Anda RF, Nordenberg D, Williamson DF, Spitz AM, Edwards V, et al. Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults: The Adverse Childhood Experiences (ACE) Study. *Am J Prev Med* 2019;56(6):774-86.
PUBMED | **CROSSREF**

13. Saylor CF, Finch AJ Jr, Spirito A, Bennett B. The children's depression inventory: a systematic evaluation of psychometric properties. *J Consult Clin Psychol* 1984;52(6):955-67.
PUBMED | **CROSSREF**

14. Cho SC, Lee YS. Development of the Korean form of the Kovacs' Children's Depression Inventory. *J Korean Neuropsychiatr Assoc* 1990;29(4):943-56.

15. Yen JY, Ko CH, Yen CF, Wu HY, Yang MJ. The comorbid psychiatric symptoms of Internet addiction: attention deficit and hyperactivity disorder (ADHD), depression, social phobia, and hostility. *J Adolesc Health* 2007;41(1):93-8.
PUBMED | **CROSSREF**

16. Yen JY, Ko CH, Yen CF, Chen SH, Chung WL, Chen CC. Psychiatric symptoms in adolescents with Internet addiction: comparison with substance use. *Psychiatry Clin Neurosci* 2008;62(1):9-16.
PUBMED | **CROSSREF**

17. Yang L, Sun L, Zhang Z, Sun Y, Wu H, Ye D. Internet addiction, adolescent depression, and the mediating role of life events: finding from a sample of Chinese adolescents. *Int J Psychol* 2014;49(5):342-7.
PUBMED | **CROSSREF**

18. Schimmenti A, Passanisi A, Caretti V, La Marca L, Granieri A, Iacolino C, et al. Traumatic experiences, alexithymia, and Internet addiction symptoms among late adolescents: a moderated mediation analysis. *Addict Behav* 2017;64:314-20.
PUBMED | **CROSSREF**

19. Thomée S, Härenstam A, Hagberg M. Mobile phone use and stress, sleep disturbances, and symptoms of depression among young adults--a prospective cohort study. *BMC Public Health* 2011;11:66.
PUBMED | **CROSSREF**