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Association between childhood adversities and adolescent mental health problems a school-based cross-sectional research

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Abstract

This school-based cross-sectional study aimed to investigate the effects of childhood adversity (CA) on adolescents' Diagnostic and Statistical Manual of Mental Disorders 4th Edition (DSM-IV) mental disorders and overall psychopathologies in Korean adolescents.

A total of 927 adolescents aged 10 to 19 years were recruited from April to December 2017. Adolescents and their parents completed the Early Trauma Inventory Self-Report-Short Form (ETISR-SF) for CA, the Diagnostic Interview Schedule for Children predictive scales (DPS) for mental disorders, the Child Behavior Checklist (CBCL) and Youth Self Report (YSR) for internalizing and externalization problems, the Center for Epidemiological Studies Depression Scale for Children (CES-DC) for depression, the Screen for Child Anxiety Related Emotional Disorders (SCARED) for anxiety, Korean Internet Addiction Proneness Scale (K-scale) for internet addiction, and suicide questionnaire for suicidality. Parental surveys also provided demographic, pregnancy, perinatal and early developmental data.

Approximately 40% of all adolescents reported one or more CA experiences (odds ratio (OR) = 1.34 – 1.50). CA increased the overall risk of developing DSM-IV mental disorders, except for tic disorders (OR = 1.34 – 1.50), and among the CA subtypes, emotional abuse was the highest risk factor (OR = 1.92 – 2.98), followed by physical abuse (OR = 1.36 – 2.05), and general traumatic experience (OR = 1.43 – 1.79).

CA increased adolescents' internalizing/externalizing problems (β = 0.13 – 0.35), and among CA subtypes, emotional abuse (β = 0.18 – 0.30), and physical abuse (β = 0.12 – 0.38) were significantly correlated. CA increased depression and anxiety, and among CA subtypes, emotional abuse was significantly correlated with depression (β = 0.16) and anxiety (β = 0.13). CA increased the risk of internet addiction among boys (β = 0.20), whilst emotional abuse increased the risk of suicide ideation (OR = 1.74), plan (OR = 1.76), and non-suicidal self-injury (OR = 1.95) among girls.

This study is the first comprehensive analysis of the effects of CA on DSM-IV mental disorders and psychopathologies in Korean adolescents. This study is valuable in identifying the overall pattern of the effects of CA on mental health.

Keywords: Childhood adversity, adolescent, mental disorder, psychopathology.

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Introduction

Childhood adversity (CA) is a concept encompassing various negative experiences of children and adolescents due to family dysfunction (1). According to the National Survey of Children's Health (NSCH), 45% of the U.S. population experiences at least one type of CA (2). In one study of CA incidence rates in 21 countries around the world, Kessler et al. reported that 39% of all adults experience CA, and incidence rates are similar across high, middle and low-income countries (3). In Korea, more than half of adults reported CA experiences (4).

CA has an adverse effect on mental health throughout one's life (5). Since the "Adverse Childhood Experience" (ACE) study by the Centers for Disease Control and Prevention first reported adverse mental health effects (6), various supporting evidence has been accumulated. Individuals who experience CA are more likely to develop mental health problems, such as depression, anxiety, suicide, and substance abuse, from childhood (7-11) to adulthood (3, 12-15), compared to individuals who do not.

Individuals exposed to CA also tend to be exposed to multiple experiences simultaneously rather than one particular CA. They exhibit a dose-response relationship in which exposure to multiple CA types increases the negative impact on mental health (16). Many of the

participants in the ACE study were exposed to multiple types of CA, and participants who experienced three or more CA had a significantly higher risk of developing mental disorders than those who experienced one CA (17). In addition, Copeland et al. in 2018 reported in a prospective cohort study, that greater the number of CA types experienced, greater was the likelihood of mental disorder incidence in adulthood (15).

Rather than being a risk factor for specific mental disorders, CA increases the risk of mental disorders as a whole. Previous studies have shown that CA increases the risk of mental disorders such as depressive disorder, substance use disorder, anxiety disorder, and behavioral disorder, however, the difference in odds ratio (OR) by disorder was not significant (3, 12). Nolen-Hoeksema and Watkins suggested a transdiagnostic model in which the CA experience probabilistically causes dysfunction of emotional processing and executive functioning, which increases the risk of developing overall mental disorders in adolescence and adulthood (18).

The main consensus of researchers is that repetitive stress is harmful to the brain, particularly to developing brains. The biological hypothesis of the effect of CA on mental health began with the idea that repeated exposure to stress could negatively affect the development of the limbic system (19). This led to a more expanded hypothesis: CA could induce a cascade of neurotransmitters and hormones that alter the fragile brain structures (20). The first phase of the cascade involves the stress-

induced release of neurotransmitters, which affect brain developmental processes including neurogenesis, synaptic overproduction and pruning, and myelination during sensitive periods (21). These effects would target specific stress-susceptible brain regions including hippocampus (22), amygdala (23), neocortex, cerebellum (22, 24), and white matter tracts (25). From this viewpoint, CA induced brain damage, which may result in psychopathology (26).

In Korea, there is a paucity of research investigating the impact of CA on mental health problems, especially the onset of mental disorders in youth. This paucity is largely due to the sparse epidemiological data on child-adolescent mental disorders in Korea (27). To date, studies have investigated the effects of CA on individual mental health problems in adulthood, such as adult depression, anxiety (28, 29), and suicide (30, 31). However, the majority of these studies compare individuals who experience CA and those who do not, or examine their correlation with specific mental health problems (32). Thus, a more comprehensive investigation of the effect of CA on mental disorders and psychopathologies in Korean adolescents is needed.

This study will investigate the impact of CA exposure on mental disorders and overall psychopathologies among Korean adolescents, with the following topics:

1. How does CA affect adolescent mental disorders? Are there any

differences between CA subtypes or groups of mental disorders?

2. How does CA affect adolescents' overall psychopathologies (e.g. internalization/externalization problems, depression, anxiety, suicidality, Internet addiction)?

3. Is there any difference by gender and age in the effects of CA on mental disorders and psychopathologies?

Methods

1. Study design

This was a school-based cross-sectional study designed to investigate the association between experience of CA and mental health problems in adolescence

2. Participants

This study used data from the "Prevalence and risk factors of psychiatric disorders in child and adolescent population" (Ministry of Health and Welfare, HM16C1994). Participants were adolescents between the ages of 10 and 19 who were recruited from four regions (Seoul, Goyang, Daegu, and Jeju) from April to December 2017. Using the multistage cluster sampling method, this study randomly selected elementary, middle, and high schools by region and randomly selected 1-2 classes per grade. Subsequently, after distributing the newsletter and explaining the purpose of the study, we recruited the adolescents who agreed to participate in the study. Written consent from adolescents and their parents, and approval by the Institutional Review Board of the local recruiting agency (Seoul National University Hospital, Inje University Ilsan Paik Hospital, Daegu Catholic University Hospital, and Jeju National University Hospital) were obtained.

3. Measure

3.1. CA

A. The Early Trauma Inventory Self Report–Short Form (ETISR–SF)

ETISR–SF was used to assess CA experience (33). ETISR–SF consists of 27 questions and evaluates CA experience with four CA subtypes: physical abuse (5 items), emotional abuse (5 items), sexual abuse (6 items), and general trauma experience (11 items). ETISR–SF includes a total of 11 CA classifications, excluding family economic difficulties, used in ACE study (Table S1), and is a tool focused on maltreatment among CA subtypes. In 2018, Park (34) reported fair to good validity and internal integrity in the standardization study of the Korean version of ETISR–SF (Cronbach's α =0.803, test–retest relativity=0.776).

In this study, CA experience was used as a categorical variable and the number of CA types experienced was used as a continuous variable.

3.2. Mental disorders and psychopathologies

A. The Diagnostic Interview Schedule for Children predictive scales (DPS)

To screen adolescents with mental disorders, the DPS was conducted. The DPS is the primary screening tool for Diagnostic Interview Schedule for Children Version–IV (DISC) (35, 36), a tool developed to

diagnose child–adolescent mental disorders according to the Diagnostic and Statistical Manual of Mental Disorders, 4th Edition (DSM–IV) criteria (37). Although the DPS is a measure of self–reporting by parents, it is effective in screening mental disorders, with good validity and reliability (38). Preliminary validation data of the Korean of the version DPS is detailed in Table S2, S3, and Figure S1.

In this study, the DPS was admininstered by distributing questionnaires to the parents of adolescents. Through meetings within the research team, the mental disorders were divided into six disorder groups such as anxious, depressive, behavioral, tic, psychotic, and substance use disorder (Table S4).

B. The Child Behavior Checklist (CBCL) and Youth Self Report (YSR)

The CBCL and YSR are tools for evaluating the internalization and externalization problems of children–adolescents, developed by Achenbach et al (39, 40). The CBCL evaluates child–adolescent emotional and behavioral problems based on reports from parents, and the YSR evaluates these characteristics based on reports from the adolescents themselves. The CBCL and the YSR's Syndrome and Total Problem Scales consist of a total of 119 questions on a three–point Likert scale. Oh et al. carried out standardization studies of Korean versions of CBCL and YSR (41, 42).

In this study, the CBCL was administered to participants aged 10–13 and the YSR for those aged 14–19. By distributing the questionnaire to parents and adolescents, the CBCL and YSR were administered, and T scores of total, internalization, and externalization problems were used for analysis as a continuous variable.

C. The Center for Epidemiological Studies Depression Scale Children (CES-DC)

The CES-DC (20-item) was used to assess depression in adolescents. The CES-DC is a tool Weissman modified from the Center for Epidemiologic Studies Depression Scale (CES-D) for young children and reported good validity and reliability (43, 44). A Korean version of CES-DC's standardization study on children and adolescents has not been implemented yet, however, one study of middle school students (45) reported good reliability (Cronbach's alpha = 0.90). CES-DC consists of 20 questions related to symptoms of depression over the past week and evaluates data on a four-point Likert scale. The sum score of CES-DC ranges from 0 to 60 and the higher score indicates a higher level of depression.

In this study, the CES-DC was administered by distributing the questionnaire to the adolescents themselves. The CES-DC total score was used as a continuous variable and the score of 16 or more was defined as

depression (categorical variable).

D. The Screen for Child Anxiety Related Emotional Disorders (SCARED)

The SCARED was used to assess the anxiety of the adolescents. Developed by Birmaher et al (46, 47), the SCARED is a self-reporting measure for child-to-adolescent anxiety, with high feasibility and reliability reported (48). The standardization study of the Korean version of the SCARED is currently in progress (49). The SCARED consists of 41 questions and evaluates child-adolescent anxiety over the past three months on a three-point Likert scale. The sum score of SCARED ranges from 0 to 82, and a higher score indicates a higher level of anxiety.

In this study, the SCARED was administered by distributing the questionnaire to the adolescents themselves. The SCARED total score was used as a continuous variable and the score of 25 or more was defined as anxiety (categorical variable).

E. The Internet Addiction Proneness Scale for Youth: Observer Rating Scale (K-Scale)

The K-scale was used to evaluate Internet addiction among adolescents. The K-Scale was developed by the Korea National Information Society to evaluate the problem of child-adolescent internet

use by observers, such as parents and teachers (50). The K-Scale consists of 15 items on a four-point Likert scale related to teenagers' internet use. The sum score ranges from 15-60 points, with a higher K-Scale score indicating the deepening of Internet addiction.

In this study, K-scale was administered by distributing the questionnaire to the parents of adolescents. The K-scale total score was used as a continuous variable. In addition, scoring more than 32 points on the scale was used as a categorical variable defined as internet addiction.

F. Suicidality

To obtain information about suicidality in adolescents, a survey about suicide problems in the past year was conducted. The questionnaire consisted of suicide ideation, plan, attempt, and non-suicidal self-injury (NSSI). The questionnaire used in this study is detailed in Table S5.

3.3. Demographic, pregnancy, peripartum, and early developmental information

The questionnaire was distributed to the parents. The information collected included basic demographics (gender, age, and region), pregnancy (parental age at birth, duration of gestation, mother's physical health problems), peripartum (peripartum blue of mother, method of

childbirth, peripartum complication of mother and baby), and early developmental (early development delay, change in primary caregiver) data. In terms of the peripartum blue, answering "yes" to the question "Did you experience a depressive mood lasting more than two weeks before and after childbirth?" was defined as peripartum blue.

4. Statistical analyses

4.1. Association between CA and the onset of mental disorders (Analysis 1)

Logistic regression analysis was performed to determine whether CA experience is a risk factor for adolescent mental disorders. If significant effects ($p < 0.05$) were observed in both models, CA was defined as affecting the onset of mental disorder. In Model 1, we analyzed whether the number of CAs experienced (continuous variables; All CA: range 0 – 27, general traumatic experience: range 0 – 11, physical abuse: range 0 – 5, emotional abuse: range 0 – 5, and sexual abuse: range 0 – 6) is a risk factor for mental illness. In Model 2, we analyzed whether CA experience (category variable) acts as a risk factor for mental illness. To determine the OR, the results obtained in Model 1 were used.

4.2. Association between CA and psychopathologies (analysis 2)

Logistic regression analysis was used to determine whether CA experience is a risk factor for adolescent depression (CES-DC ≥ 16), anxiety (SCARED ≥ 25), internet addiction (K-scale ≥ 32), and suicide problems (ideation, plan, attempts, and NSSI). As with Analysis 1, CA was defined as affecting psychopathologies only if significant effects were observed for both Models 1 and 2. To determine the OR, the results obtained in Model 1 were used.

Using linear regression, we analyzed whether CA experience affects adolescents' internalization/externalization problems (CBCL, YSR), depression (CES-DC), anxiety (SCARED), and internet addiction (K-scale) levels. Model 1 was used for linear regression analysis.

4.3. Subgroup analysis by gender/age (Analysis 3)

Subgroup analysis was performed to determine whether the effects of CA experience on adolescent mental disorders and psychopathologies differed by gender and age. All adolescents were divided into gender (boys and girls) and age groups (10-13 years and 14-19 years) and logistic and linear regression analysis was performed. Model 1 was used for subgroup analysis.

4.4. Covariate selection

We included the following items in the covariate to rule out their

effects: basic demographic characteristics (gender, age, region) and risk factors for adolescent mental disorders reported in previous studies, such as peripartum blue, advanced maternal age, fetal health problem at birth, and premature birth. In addition, the participants were limited to adolescents who responded to the ETISR-SF, and so there is a possibility of selection bias in this process. Demographic and clinical variables whose significant differences between the ETISR-SF responder/non-responder groups were observed ($p < 0.1$), were included in covariates to exclude their effects.

4.5. Statistical program and significance level

Statistical analysis was performed using SPSS 18.0 for Windows. The significance level was set at <0.05.

Results

1. Demographic and clinical characteristics

1.1. Demographic, characteristics

A total of 2702 adolescents were recruited from April to December 2017, of which 927 (34.3%) responded to the ETISR-SF. When comparing demographic characteristics of respondents and non-responders (Table 1), there were significant differences in age (15.15 ± 2.55 vs 12.56 ± 2.22, p <0.001), gender (boys: 38.2% vs 51.5%, p <0.001), region (Seoul 68.2%, Jeju 29.1%, and Goyang 2.7% vs Seoul 3.9%, Jeju 16.6%, Daegu 54.2%, and Goyang 25.4%, p <0.001), and early development delay (7.7% vs 10.1%, p = 0.058). These variables were included in covariates in subsequent analyses to control their effects.

1.2. CA incidence rate

It was found that 40.7% of subjects experienced more than one CA in childhood (Table 2). Adolescents experienced physical abuse the most (22.2%), followed by general trauma (21.8%), emotional abuse (12.7%), and sexual abuse (0.9%). Sexual abuse was reported by a total of eight subjects and was excluded from further analysis because the sample size was insufficient.

1.3. Mental disorder and psychopathologies of subjects

Mental disorders of adolescents screened by the DPS are described in Table 3. Anxiety disorders were the most prevalent (17.7%), followed by behavioral (15.9%), depressive (4.4%), tic (4.2%), substance use (3.1%), and psychotic disorders (1.1%). Only 10 adolescents (1.1%) were screened for psychotic disorders, and psychotic disorder was excluded from further analysis because of the insufficient sample size. In addition, in the 10−13 years old group, only 6 adolescents for depressive, 3 for psychotic, and 2 for substance use disorder were screened, and due to an insufficient sample size, the effect of CA on mental disorders was not subgroup analyzed by age.

Psychopathologies of adolescents is described in Table 4. Of the participants, 41.8% reported depression (CES−DC ≥ 16), 23.3% anxiety (SCARED ≥ 25), 14.9% reportedinternet addiction (K−scale ≥ 32), and 17.5% reported suicide ideation. The CBCL total problem scores for the 10 − 13 year old group were 50.71 ± 2.314 (range 50 − 67) and the YSR total problem scores for the 14 − 19 year old group were 44.35 ± 13.528 (range 7 − 92).

2. Association of CA with adolescent mental disorders.

Logistic regression analysis was used to analyze the association between CA and adolescent mental disorders (Table 5). As a result, overall CA acted as a risk factor for mental disorders on the whole except for tic disorder (OR = 1.34 – 1.50). In terms of subtypes of CA, emotional abuse had an OR of 1.92 – 2.98, physical abuse had OR of 1.36 – 2.05, and general traumatic experience had OR of 1.43 – 1.79 for the onset of all mental disorders except tic disorders. However, general traumatic experience showed no significant correlation with behavioral disorders (OR = 1.19, p = 0.112 in model 1, p = 0.023 in model 2).

3. Association of CA with adolescent psychopathologies

3.1. Internalization and externalization problems

Linear regression analysis was used to analyze the correlation between CA and internalization/externalization problem levels (Table 6). The overall CA experience served as a significant predictor of the entire subscale of CBCL/YSR (β = 0.13 – 0.35), except for the CBCL internalization problem. In terms of CA subtypes, emotional abuse acted as a significant predictor (β = 0.18 – 0.30), as well as physical abuse (β = 0.12–0.38), except the YSR internalization problem. However, there was no significant correlation between general trauma experience and internalized/externalized problem scores.

3.2. Depression

Using linear regression, we analyzed the correlation between CA and depression levels (Table 6). No significant correlation was observed between overall CA experience and depression levels (β = 0.14, p = 0.060). Among the types of CA, emotional abuse acted as a significant predictor of depression level (β = 0.16, p < 0.001). Logistic regression analysis (Table 7) showed that the overall CA experience increased the risk of developing depression (CES-DC ≥ 16) (OR = 1.13, p = 0.007 in model 1, p = 0.003 in model 2) and emotional abuse among the CA subtypes and depression was significantly correlated (OR = 1.57, p <0.001 in model 1, p = 0.003 in model 2).

3.3. Anxiety

Linear regression analysis was used to investigate the correlation between CA and adolescent anxiety levels (Table 6). Among CA subtypes, overall CA (β = 0.07, p = 0.047) and emotional abuse (β = 0.13, p <0.001) were significant predictors of adolescent anxiety levels. Logistic regression analysis (Table 7) showed no significant correlation between overall CA and anxiety occurrence (SCARED ≥ 25) (OR = 1.05, p = 0.303), and significant correlation was found in emotional abuse among the CA subtypes. (OR = 1.39, p = 0.011).

3.4. Internet addiction

Using linear regression analysis, we investigated the correlation between CA and adolescent internet addiction level (Table 6). Overall CA experience (β = 0.20, p <0.001) and all CA subtypes (general traumatic experience: β = 0.09, p < 0.012, physical abuse: β = 0.15, p < 0.001, emotional abuse: β = 0.17, p < 0.001) were significant predictors of adolescent internet addiction levels. Logistic regression analysis (Table 7) showed overall CA (OR = 1.28, p < 0.001) and all CA subtypes (general trauma experience: OR = 1.92, p = 0.008, physical abuse: OR = 1.48, p <0.001, emotional abuse: OR = 1.90, p < 0.001) were significant risk factors for the development of adolescent internet addiction (SCARED ≥ 32).

3.5 Suicidality

Using logistic regression, we analyzed the correlation between CA and suicidality (Table 7). No significant correlation was observed between overall CA and suicidality. In terms of subtypes of CA, emotional abuse acted as significant risk factor for suicide ideation (OR = 1.38, p = 0.022 in model 1, p = 0.019 in model 2), plan (OR = 2.07, p < 0.001 in model 1, p = 0.003 in model 2) NSSI (OR = 1.69, p = 0.002 in model 1, p <0.001 in model 2).

4. Subgroup analyses by gender/age

4.1. Subgroup analysis by gender

Logistic regression was used to analyze gender differences in the effects of CA on adolescent mental disorders (Table 8). Similar trends were observed in both groups, except that the correlation between general traumatic experience and the development of substance use disorder was significant only in girls (boys: OR = 1.36, p = 0.062 vs girls: OR = 1.37, p = 0.022).

Using linear regression analysis, we analyzed gender differences in the effect of CA on the internalization/externalization problem (Table 9), and gender differences were observed on the internalization problem. For example, girls' overall CA experiences correlated significantly with all scores of internalization/externalization problem of the CBCL/YSR (β = 0.16 – 0.39). On the other hand, overall boys' CA experience was correlated only with externalization (β = 0.23) and total problem score (β = 0.20) of the YSR. In girls, physical abuse with internalizing problem of the CBCL (β = 0.21, p = 0.043) and emotional abuse with internalizing problem of the YSR (β = 0.24, p < 0.001) were significantly correlated. Although in boys, there was no CA subtype correlated with the internalization problem of the CBCL/YSR.

Regarding other psychopathologies, gender differences were observed in internet addiction and suicidality (Table 9, 10). The overall

CA experience and all CA subtypes in boys served as significant predictors of internet addiction levels (β = 0.29 – 0.37), but not in girls. In addition, emotional abuse was a significant risk factor for the onset of suicide ideation (OR = 1.74, p = 0.003), plan (OR = 1.76, p = 0.016), and NSSI (OR = 1.95, p < 0.001) in girls, in contrast, emotional abuse was a risk factor only for suicide plan (OR = 2.22, p = 0.033) in boys.

4.2. Subgroup analysis by age

Using linear regression analysis, we analyzed gender differences in the effect of CA on the internalization/externalization problem, depression, anxiety a,nd internet addiction (Table 11). Among 10–13 aged adolescents, overall CA experience was correlated with the level of total/externalized problem (CBCL), depression, anxiety, and internet addiction (β = 0.17 – 0.35), and in 14–19 aged adolescents, correlated with total/internalization/externalization problem (YSR), depression, internet addiction (β = 0.09 – 0.20). Regarding subtypes of CA, emotional abuse showed significant correlation with total/internalization/externalization problem, depression, and internet addiction (β = 0.16 – 0.38) in 10–13 aged youths, and did with total/internalization/externalization problem, depression, anxiety, internet addiction (β = 0.15 – 0.22) in 14–19 aged adolescents.

Discussion

1. Summary of results

In this study, we analyzed the effect of CA on mental disorders and overall psychopathologies in Korean adolescents. The analysis results showed that CA increased the risk of developing mental disorders, except for tic disorders, and significantly correlated with overall psychopathologies internalization/externalization problems, depression, anxiety, internet addiction, and suicide.

2. Association between CA and adolescent mental disorders

CA acted as a risk factor for general mental disorders (anxiety, substance, behavior, and substance use disorder) except tic disorder, and as the number of CAs experienced increased, the risk increased. In terms of subtype of CA, emotional abuse (OR = 1.92 – 2.98) had the greatest impact on mental disorders, followed by physical abuse (OR = 1.36 – 2.05), and general trauma experience (OR = 1.43 – 1.79).

Previous studies have reported that CA increases the overall risk of mental disorders in adolescence and adulthood, rather than affecting certain mental disorders, and that the number of types of CAs experienced

has a dose–response relationship with the risk of mental disorder (3, 12, 13, 51). No study has compared the association between CA and the prevalence of adolescent mental disorders in Korea, and most studies were conducted in the United States (US) or Europe. In 2012, McLaughlin et al. (7) analyzed the association between CA and DSM–IV mental disorders in US adolescents. They reported that CA increased the incidence of overall adolescent mental disorders, with the greatest impact of sexual abuse (OR = 1.9), followed by emotional abuse (OR = 1.5), and physical abuse (OR = 1.3). Although this study did not analyze the association between CA and sexual abuse, other results are consistent with McLaughlin's findings.

It is notable that in this study, no significant association was observed between CA and the onset of tic disorder. Tic disorders are characterized by sudden, recurrent, nonrhythmic, and stereotyped motor movements and are known to be associated with brain circuits that express and control the tic (52). In 2017, Dinkler et al. (53) found that CA experience increased symptoms of attention–deficit/hyperactivity disorder (ADHD), but not in tic disorders, and girls who experienced CA reported fewer tic symptoms. Our results are consistent with the findings of Dinkler et al. It may be due to the independent pathophysiology of tic disorders that are distinct from other emotional and behavioral diseases. Another possible interpretation is that in the pathologic family, parents may have suppressed or neglected the child's tic symptoms. Thus, further

research is needed for this interpretation.

3. Association between CA and adolescent psychopathologies

CA aggravated adolescent internalization/externalization, depression, anxiety, internet addiction, and suicide problems. In addition, the greater the number of CAs experienced increased, the greater the risk.

Many studies have been conducted to investigate the relationship between CA and depression/anxiety/suicide. In 2017, Hughes et al. (7) meta-analyzed 37 studies, including studies in China and Vietnam, and reported that CA exacerbated future mental health problems, particularly those at risk of experiencing multiple CA subtypes simultaneously.

In the CBCL/YSR, studies on the relationship between child-adolescent internalization and externalization problems have been conducted mainly in the US and Europe, and few studies have been conducted in Asia. In 2014, Greenson et al. (54) reported that CA increased the risk of internalization/externalization problems measured by the CBCL in the US. The results of this study are also in accordance with Greenson et al.

In contrast, the research on the effect of CA on adolescents' internet addiction is still limited. Hsieh et al. (55) reported that physical

abuse (β = 0.04) and emotional abuse (β = 0.17) increase the risk of internet addiction to fourth-year Taiwanese students. This study is also in agreement with Hsieh et al., But there is not enough evidence to draw conclusions. Further research on this topic is needed.

4. Differential association by gender and age

In this study, there was no significant gender difference in the effect of CA on mental disorders, but there was a distinct difference in the effect on psychopathologies. In particular, the effect of CA on the internalization problem in girls, and the internet addiction problem in boys were significant. The gender differences in the effect of CA on mental disorders are still controversial. For example, Meadows et al. and Adkins et al. (56, 57) reported significant differences in the effects of CA on the development of depressive disorder, but Fernandez et al. (58) reported no gender differences. On the other hand, previous studies focused on the internalization/externalization dimension reported gender differential effect of CA. For example, Keyes et al. (59) reported a marked gender difference as men who have experienced physical abuse have increased externalization disorders and women have increased internalization disorders. In addition, structural brain imaging studies reported that CA can have a gender-specific effect on morphological alterations of brain structure such as hippocampal volume or corpus callosal thickness (22).

The results of our study supported gender-specific effect of CA on internalization/externalization problems, and follow-up studies are needed.

In our study, although the effect of emotional abuse on externalization problem was nearly twice as high as those on internalization problem (on internalization problem, β = 0.19; on externalization problem, β = 0.38) on the 10 - 13 aged population, there was no apparent difference in 14-19 aged population (on internalization problem, β = 0.19 vs on externalization problem, β = 0.18). The parent-adolescent disagreement of internalization problem may cause this discrepancy. Rescorla et al. reported a moderate level of discrepancy between YSR and CBCL in 25 Societies (60). Furthermore, Lee et al reported that Korean parents may be less sensitive to their children's mood symptoms than behavior problems (61).

5. Limitations and strengths of this study

This study has the following limitations. First, this study is a retrospective cross-sectional study and may have recall bias related to CA information. This study was conducted on adolescents, and the recall bias was judged to be relatively lower than that of adult studies, but the effects could not be completely excluded. Second, this study assumes that the various types of CAs have the same effect on mental health, but it is unlikely. Two models were applied to the analysis to minimize the

possibility of false positives. Third, this study used epidemiological research data from four regions of the country, but most of the ETISR-SF responders were concentrated in Seoul/Jeju area, so representativeness of this data is limited. Further nation-wide epidemiologic studies are needed. Fourth, the incidence of sexual abuse was low, and no relevant analysis was conducted. This study collected CA information through the distribution of questionnaires through the school, and it is possible that parents concerned about stigma have evaded the report. Subsequent studies need to be supplemented by individual interviews with parents. Finally, information on the socioeconomic status of parents and the timing of exposure to CA were not collected, so their impact was not able to be investigated.

Nevertheless, this study is the first in Korea to analyze the effects of CA on mental illness and overall psychopathologies. It is meaningful to confirm the pattern of the impact of CA on the overall adolescent mental health problems. To address the limitations of this study, more follow-up studies, including longitudinal studies are needed.

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Table 1. Comparison between responder and non-responder to the ETISR-SF

	Mean or n (%)			
	ETISR-SF responder (n = 927)	ETISR-SF non-responder (n = 1775)	t or x^2	p
Age in year	15.2 ± 2.6	12.6 ± 2.2	26.2	<0.001
Gender, Boys (%)	354 (38.2)	914 (51.5)	43.0	<0.001
Region				
Seoul	632 (68.2)	69 (3.9)	1696.4	<0.001
Jeju	270 (29.1)	294 (16.6)		
Daegu	0 (0)	962 (54.2)		
Goyang	25 (2.7)	450 (25.4)		
Parent's age at birth	(n = 853)	(n = 1185)		
Mother	29.8 ± 4.3	30.0 ± 4.3	-1.0	0.298
Father	32.7 ± 5.0	32.7 ± 4.7	-0.3	0.786
Mother's peripartum blue	(n = 853)	(n = 1181)		
	123 (14.4)	190 (16.1)	1.1	0.303
Duration of gestation	(n = 894)	(n = 1198)		
Premature birth	51 (5.7)	91 (7.6)	2.9	0.089
Postmature birth	42 (4.7)	41 (3.4)	2.2	0.143
Methods of Childbirth	(n = 623)	(n = 1137)		
Induced labor	91 (14.6)	168 (14.8)	0.1	0.924
Caesarean section	216 (34.7)	423 (37.2)	1.1	0.291
Perinatal complication of mother	(n = 809)	(n = 1165)		
Any problem	186 (23.0)	304 (26.1)	2.5	0.117
Premature rupture of membranes	69 (8.5)	111 (9.5)	0.6	0.448
Vaginal bleeding	92 (11.4)	137 (11.8)	0.1	0.791
Rubella infection	8 (1.0)	21 (1.8)	2.2	0.139
Preeclampsia	24 (3.0)	40 (3.4)	0.3	0.565
Eclampsia	5 (0.6)	16 (1.4)	2.6	0.108
Perinatal complication of baby	(n = 625)	(n = 1143)		
Any problem	68 (10.9)	118 (10.3)	0.1	0.716
Respiratory distress	9 (1.4)	13 (1.1)	0.3	0.583
Cardiac abnormality	2 (0.3)	9 (0.8)	1.4	0.232

Placental abnormalities	7 (1.1)	11 (1.0)	0.1	0.752
Umbilical cord abnormalities	11 (1.8)	21 (1.1)	0.0	0.907
Use of incubator	45 (7.2)	84 (7.3)	0.0	0.908
Early developmental delay	(n = 882)	(n = 1215)		
Any delay	68 (7.7)	123 (10.1)	3.6	0.058
motor development	47 (5.3)	86 (7.1)	2.6	0.105
speech development	35 (4.0)	69 (5.7)	3.2	0.075
Changes in primary caregiver	(n = 627)	(n = 1148)		
	82 (13.1)	143 (12.5)	0.1	0.707

ETISR-SF, The Early Trauma Inventory Self-Report–Short Form.

Table 2. Prevalence of Childhood adversities among participants

	Experience of CA n (%)	Number of experienced CA mean (range)
ETISR-SF		
General trauma	193 (21.8%)	0.3 ± 0.8 (range 0-11)
Physical abuse	196 (22.2%)	0.4 ± 0.9 (range 0-5)
Emotional abuse	112 (12.7%)	0.2 ± 0.7 (range 0-5)
Sexual abuse	8 (0.9%)	0.0 ± 0.2 (range 0-4)
any adversity	374 (40.7%)	1.0 ± 1.9 (range 0-17)

CA, Childhood Adversity; ETISR-SF, The Early Trauma Inventory Self-Report–Short Form.

Table 3. Prevalence of mental disorders among participants

	n (%)					
	Age 10-13 (n=223)	Age 14-16 (n=284)	Age 17-19 (n=420)	Boys* (n=354)	Girls* (n=572)	Total (n=927)
DPS						
Anxiety disorders	47 (21.1)	52 (18.3)	65 (15.5)	53 (15.0)	111 (19.4)	164 (17.7)
Depressive disorders	6 (2.7)	12 (4.2)	23 (5.5)	14 (4.0)	26 (4.5)	41 (4.4)
Tic disorders	12 (5.4)	13 (4.6)	14 (3.3)	25 (7.2)	14 (2.4)	39 (4.2)
Psychotic disorders	3 (1.3)	2 (0.7)	5 (1.2)	3 (0.8)	7 (1.2)	10 (1.1)
Behavior disorders	36 (16.1)	56 (19.7)	55 (13.1)	63 (17.8)	84 (14.7)	147 (15.9)
Substance use disorders	2 (0.9)	5 (1.8)	22 (5.2)	19 5.4)	10 (1.7)	29 (3.1)

* One participant has no sex information.

DPS, the Diagnostic Interview Schedule for Children predictive scales.

Table 4. Clinical characteristics of participants

	n (%)	mean (range)
CES-DC (n = 811)	339 (41.8) [a]	15.9 ± 10.8 (0 - 67)
SCARED (n = 887)	207 (23.3) [b]	16.8 ± 13.3 (0 - 72)
K-scale (n = 865)	129 (14.9) [c]	23.2 ± 7.4 (0 - 43)
Suicide questionnaire (n = 658)		
Ideation	115 (17.5)	
Plan	24 (3.6)	
Attempt	12 (1.8)	
NSSI	37 (5.6)	
CBCL (n = 214)		
Total		50.7 ± 2.3 (50 - 67)
Int		50.9 ± 2.6 (50 - 68)
Ext		50.8 ± 2.5 (50 - 66)
YSR (n = 665)		
Total		44.4 ± 13.5 (7 - 92)
Int		47.6 ± 12.9 (23 - 93)
Ext		42.8 ± 11.5 (22 - 91)

a: CES-DC ≥ 16, b: SCARED ≥ 25, c: K-scale ≥ 32.

CBCL, Child Behavior Checklist; CES-DC, The Center for Epidemiological Studies Depression Scale for Children; Ext, Externalizing problem subscale; Int, Internalizing problem subscale; K-scale, Internet Addiction Proneness Scale for Youth: Observer Rating Scale; NSSI, Non-Suicidal Self-injury; SCARED, The Screen for Child Anxiety Related Disorders; Total, total problem scale; YSR, Youth Self Report.

Table 5. Association between childhood adversities and mental disorders in adolescence (Logistic regression analysis)

	Odds Ratio (95% CI)			
	General	Physical	Emotional	Any CA
(Model 1)				
Anxiety disorders	1.79 (1.40-2.28)***	1.36 (1.13-1.65)***	1.92 (1.49-2.47)***	1.34 (1.22-1.47)***
Depressive disorders	1.43 (1.10-1.85)**	1.91 (1.47-2.49)***	2.32 (1.70-3.17)***	1.50 (1.32-1.71)***
Tic disorders	0.73 (0.38-1.39)	1.08 (0.75-1.57)	1.30 (0.83-2.05)	1.08 (0.93-1.26)
Behavior disorders	1.19 (0.96-1.47)	2.05 (1.69-2.50)***	2.98 (2.12-4.01)***	1.46 (1.32-1.62)***
Substance use disorders	1.52 (1.18-1.95)***	1.98 (1.46-2.70)***	2.09 (1.45-3.01)***	1.36 (1.19-1.55)***
(Model 2)				
Anxiety disorders	2.95 (1.93-4.52)***	2.08 (1.36-3.19)***	3.43 (2.09-5.63)***	2.89 (1.96-4.26)***
Depressive disorders	3.56 (1.71-7.40)***	3.43 (1.64-7.19)***	6.26 (2.90-13.50)***	4.15 (1.88-9.18)***
Tic disorders	0.73 (0.27-2.00)	1.02 (0.43-2.40)	3.103 (1.35-7.14)**	2.62 (1.26-5.45)*
Behavior disorders	1.72 (1.08-2.75)*	4.07 (2.63-6.32)***	8.05 (4.83-13.40)***	3.83 (2.52-5.81)***
Substance use disorders	3.58 (1.49-8.59)**	8.75 (3.42-22.40)***	4.25 (1.73-10.44)**	8.54 (2.84-25.70)***

Note: adjusted for age, gender, region, parent's age, peripartum blue, preterm birth, perinatal complication of baby, and early developmental delay.

* <0.05, ** <0.01, *** <0.001

CA, Childhood Adversity; DPS, the Diagnostic Interview Schedule for Children predictive scales.

Table 6. Association between childhood adversities and psychiatric problems in adolescence (Linear regression analysis)

	B (SE), β, *p*			
	General	Physical	Emotional	Any CA
CBCL				
Total	0.04 (0.18), 0.02	0.84 (0.23), 0.27***	1.81 (0.44), 0.30***	0.41 (0.11), 0.28***
Int	-0.12 (0.20), -0.05	0.58 (0.27), 0.17*	1.34 (0.52), 0.19*	0.24 (0.13), 0.14
Ext	0.04 (0.19), 0.02	1.26 (0.23), 0.38***	2.46 (0.46), 0.38***	0.55 (0.11), 0.35***
YSR				
Total	1.11 (0.78), 0.06	1.77 (0.67), 0.12**	4.10 (0.82), 0.22***	1.24 (0.30), 0.18***
Int	0.66 (0.75), 0.04	0.83 (0.64), 0.06	3.55 (0.79), 0.19***	0.86 (0.28), 0.13**
Ext	0.82 (0.65), 0.06	2.52 (0.54), 0.21***	2.73 (0.68), 0.18***	1.07 (0.25), 0.18***
CES-DC	0.30 (0.50), 0.02	0.79 (0.48), 0.07	2.61 (0.63), 0.16***	0.59 (0.21) 0.11
SCARED	0.55 (0.59), 0.04	-0.06 (0.60), -0.00	2.73 (0.77), 0.13***	0.52 (0.26), 0.07*
K-scale	0.79 (0.31), 0.09*	1.15 (0.30), 0.15***	1.81 (0.40), 0.17***	0.76 (0.14), 0.20***

Note: adjusted for age, gender, region, parent's age at birth, peripartum blue, preterm birth, perinatal complication of baby, and early developmental delay.

* <0.05, ** <0.01, *** <0.001

CBCL, Child Behavior Checklist; CES-DC: The Center for Epidemiological Studies Depression Scale for Children; Ext, externalizing problem subscale; Int, internalizing problem subscale; K-scale, Internet Addiction Proneness Scale for Youth: Observer Rating Scale; NSSI, Non-Suicidal Self-Injury; SCARED, The Screen for Child Anxiety Related Disorders; Total, Total problem scale; YSR, Youth Self Report.

Table 7. Association between childhood adversities and psychiatric problems in adolescence (Logistic regression analysis)

	Odds Ratio (95% CI)			
	General	Physical	Emotional	Any CA
(Model 1)				
CES-DC	1.66 (1.10-2.50)*	1.00 (0.41-2.47)	1.57 (1.20-2.07)***	1.13 (1.03-1.23)**
SCARED	1.16 (0.74-1.80)	0.90 (0.70-13.14)	1.39 (1.08-1.79)*	1.05 (0.96-1.16)
K-scale	1.92 (1.18-3.10)**	1.48 (1.21-1.79)***	1.90 (1.47-2.45)***	1.28 (1.17-1.41)***
Suicide				
Ideation	0.94 (0.71-1.24)	1.04 (0.79-1.35)	1.38 (1.05-1.81)*	1.06 (0.95-1.19)
Plan	0.74 (0.30-1.83)	1.11 (0.61-2.05)	2.07 (1.35-3.17)***	1.16 (0.95-1.40)
Attempt	1.15 (0.36-4.63)	0.95 (0.42-2.16)	1.54 (0.88-2.67)	1.08 (0.82-1.42)
NSSI	0.83 (0.48-1.45)	1.19 (0.82-1.73)	1.69 (1.22-2.34)**	1.11 (0.96-1.27)
(Model 2)				
CES-DC	1.11 (0.92-1.35)	1.77 (1.19-2.62)**	2.09 (1.28-3.43)**	1.65 (1.19-2.30)**
SCARED	1.08 (0.88-1.32)	1.17 (0.76-1.82)	2.06 (1.24-3.41)**	1.21 (0.84-1.74)
K-scale	1.27 (1.03-1.55)*	2.14 (1.35-3.39)***	3.68 (2.20-6.16)***	2.16 (1.43-3.28)***
Suicide				
Ideation	1.12 (0.64-1.96)	1.35 (0.79-2.33)	2.05 (1.12-3.74)*	1.49 (0.95-2.33)
Plan	0.61 (0.17-2.22)	1.67 (0.59-4.71)	5.00 (1.74-14.34)*	1.58 (0.61-4.09)
Attempt	0.98 (0.20-4.86)	1.73 (0.44-6.74)	3.03 (0.77-11.98)	2.00 (0.60-6.70)
NSSI	1.01 (0.41-2.47)	0.94 (0.38-2.31)	3.77 (1.72-8.25)***	1.91 (0.93-3.93)

Note: adjusted for age, gender, region, parent's age at birth, peripartum blue, preterm birth, perinatal complication of baby, and early developmental delay.

* <0.05, ** <0.01, *** <0.001

CES-DC, The Center for Epidemiological Studies Depression Scale for Children; K-scale, Internet Addiction Proneness Scale for Youth: Observer Rating Scale; NSSI, Non-Suicidal Self-injury; SCARED, The Screen for Child Anxiety Related Disorders.

Table 8. Differential association by gender between childhood adversities and mental disorders in adolescence (Logistic regression analysis)

	Odds Ratio (95% CI)			
	General	Physical	Emotional	Any CA
(Boys)				
DPS (Model 1)				
Anxiety disorders	1.39 (1.01-1.92)*	2.17 (1.07-4.38)*	1.95 (1.29-2.94)***	1.25 (1.11-1.42)***
Depressive disorders	1.41 (0.97-2.05)	3.18 (1.87-5.43)***	3.46 (1.91-6.27)***	1.62 (1.32-2.00)***
Tic disorders	0.73 (0.33-1.62)	1.21 (0.82-1.80)	1.19 (0.60-2.33)	1.12 (0.94-1.33)
Behavior disorders	1.10 (0.84-1.44)	2.30 (1.71-3.08)***	4.92 (2.78-8.72)***	1.51 (1.30-1.74)***
Substance use disorders	1.36 (0.99-1.89)	1.92 (1.35-2.73)***	2.50 (1.57-3.96)***	1.38 (1.18-1.63)***
(Girls)				
DPS (Model 1)				
Anxiety disorders	2.44 (1.59-3.18)***	1.61 (1.35-2.10)***	2.03 (1.46-2.82)***	1.49 (1.29-1.72)***
Depressive disorders	1.40 (0.96-2.04)	1.79 (1.21-2.65)**	1.97 (1.28-3.03)**	1.42 (1.15-1.75)***
Tic disorders	0.72 (0.22-2.39)	0.45 (0.08-2.38)	1.44 (0.77-2.68)	0.90 (0.58-1.41)
Behavior disorders	1.37 (0.99-1.88)	1.81 (1.36-2.41)***	2.35 (1.66-2.33)***	1.44 (1.23-1.67)***
Substance use disorders	1.97 (1.10-3.52)*	2.23 (1.20-4.15)*	1.56 (0.84-2.92)	1.40 (1.11-1.77)**

Note: adjusted for age, region, parent's age at birth, peripartum blue, preterm birth, perinatal complication of baby, and early developmental delay.

* <0.05 ** <0.01 ***<0.001

CA, childhood adversity; DPS, the Diagnostic Interview Schedule for Children predictive scales.

Table 9. Differential association by gender between childhood adversities and psychiatric problems in adolescence (Linear regression analysis)

	B (SE), β			
	General	Physical	Emotional	Any CA
(Boys)				
CBCL				
Total	-0.09 (0.15), -0.07	0.39 (0.24), 0.18	1.46 (0.63), 0.26*	0.07 (0.12), 0.07
Int	-0.24 (0.20), -0.14	0.24 (0.33), 0.08	1.40 (0.85), 0.18	-0.03 (0.17), -0.02
Ext	-0.15 (0.19), -0.10	0.84 (0.28), 0.33**	1.37 (0.77), 0.20	0.08 (0.16), 0.07
YSR				
Total	2.29 (1.08), 0.16*	1.39 (0.77), 0.13	2.63 (1.09), 0.18*	0.99 (0.35), 0.20**
Int	0.96 (1.10), 0.07	0.58 (0.78), 0.06	1.27 (1.11), 0.09	0.43 (0.35), 0.09
Ext	1.77 (0.97), 0.14	1.88 (0.68), 0.21**	3.39 (0.95), 0.26***	1.03 (0.31), 0.23***
CES-DC	0.30 (0.50), 0.02	0.73 (0.57), 0.08	1.85 (0.86), 0.14*	0.44 (0.25), 0.11
SCARED	1.37 (0.67), 0.13*	0.01 (0.70), 0.00	0.81 (1.08), 0.05	0.35 (0.31), 0.07
K-scale	1.58 (0.43), 0.22***	1.99 (0.41), 0.29***	3.13 (0.62), 0.30***	1.23 (0.19), 0.37***
(Girls)				
CBCL				
Total	0.10 (0.49), 0.02	1.38 (0.40), 0.33***	1.96 (0.61), 0.31**	0.82 (0.20), 0.39***
Int	-0.41 (0.50), -0.09	0.90 (0.44), 0.21*	1.29 (0.67), 0.19	0.46 (0.22), 0.21*
Ext	0.58 (0.48), 0.135	1.92 (0.39), 0.45 ***	3.16 (0.58), 0.49***	1.12 (0.19), 0.52***
YSR				
Total	0.59 (1.05), 0.03	2.47 (1.02), 0.13*	4.77 (1.13), 0.23***	1.47 (0.45), 0.18***
Int	0.60 (0.98), 0.03	1.33 (0.96), 0.08	4.72 (1.06), 0.24***	1.22 (0.42), 0.16**
Ext	0.30 (0.86), 0.02	3.33 (0.81), 0.22***	2.17 (0.94), 0.13*	1.10 (0.37), 0.16**
CES-DC	0.30 (0.76), 0.02	0.93 (0.76), 0.06	3.19 (0.86), 0.18***	0.78 (0.33), 0.12*
SCARED	-0.45 (0.94), -0.02	0.11 (0.95), 0.01	3.72 (1.07), 0.17***	0.61 (0.41), 0.07
K-scale	-0.03 (0.46), -0.00	0.19 (0.44), 0.02	1.00 (0.53), 0.09	0.28 (0.20), 0.07

Note: adjusted for age, region, parent's age at birth, peripartum blue, preterm birth, perinatal complication of baby, and early developmental delay.

* <0.05, ** <0.01, ***<0.001

CBCL, Child Behavior Checklist; CES-DC, The Center for Epidemiological Studies Depression Scale for Children; Ext, Externalizing problem subscale; Int, Internalizing problem subscale; K-scale, Internet Addiction Proneness Scale for Youth: Observer Rating Scale; SCARED, The Screen for Child Anxiety Related Disorders; Total, total problem scale; YSR, Youth Self Report.

Table 10. Differential association by gender between childhood adversities and suicidality in adolescence (Logistic regression analysis)

	Odds Ratio (95% CI)			
	General	Physical	Emotional	Any CA
(Boys)				
Suicide (Model 1)				
Ideation	0.91 (0.47-1.76)	0.61 (0.31-1.20)	0.50 (0.14-1.66)	0.93 (0.74-1.16)
Plan	1.79 (0.60-5.31)	1.12 (0.36-3.50)	2.22 (1.07-4.62)*	1.28 (0.93-1.76)
Attempt	(-)	(-)	(-)	(-)
NSSI	0.93 (0.44-1.99)	1.38 (0.85-2.22)	1.09 (0.51-2.33)	1.07 (0.84-1.36)
(Girls)				
Suicide (Model 1)				
Ideation	0.93 (0.66-1.31)	1.25 (0.90-1.71)	1.74 (1.22-2.50)**	1.15 (0.99-1.33)
Plan	0.23 (0.03-1.66)	1.03 (0.47-2.24)	1.76 (1.11-2.79)*	1.09 (0.83-1.43)
Attempt	1.15 (0.61-2.18)	0.95 (0.42-2.16)	1.54 (0.88-2.67)	1.08 (0.82-1.42)
NSSI	0.68 (0.29-1.64)	0.99 (0.55-1.79)	1.95 (1.33-2.87)***	1.12 (0.93-1.35)

Note: adjusted for age, region, parent's age at birth, peripartum blue, preterm birth, perinatal complication of baby, and early developmental delay.

* <0.05, ** <0.01, ***<0.001

NSSI, Non-Suicidal Self- Injury.

Table 11. Differential association by age between childhood adversities and psychiatric problems in adolescence (Linear regression analysis)

	B (SE), β			
	General	Physical	Emotional	Any CA
(age 10-13)				
CBCL				
Total	0.04 (0.18), 0.02	0.84 (0.23), 0.27***	1.81 (0.44), 0.30***	0.41 (0.11), 0.28***
Int	-0.12 (0.12), -0.05	0.58 (0.27), 0.17*	1.34 (0.52), 0.19*	0.24 (0.13), 0.14
Ext	0.04 (0.19), 0.02	1.26 (0.23), 0.38***	2.46 (0.46), 0.38***	0.55 (0.11), 0.35***
CES-DC	0.69 (0.72), 0.09	1.94 (0.92) 0.19*	4.66 (1.97), 0.21*	1.31 (0.44), 0.26**
SCARED	1.58 (0.85), 0.14	1.25 (1.20) 0.08	1.57 (2.38), 0.05	1.27 (0.57), 0.17*
K-scale	0.93 (0.41), 0.17*	2.15 (0.56) 0.27***	2.51 (1.15), 0.16*	1.02 (0.27), 0.27***
(age 14-19)				
YSR				
Total	1.11 (0.78), 0.06	1.77 (0.67), 0.12**	4.10 (0.82), 0.22***	1.24 (0.30), 0.18***
Int	0.66 (0.75), 0.04	0.83 (0.64), 0.06	3.55 (0.79), 0.19***	0.86 (0.28), 0.13**
Ext	0.82 (0.65), 0.06	2.52 (0.54), 0.21***	2.73 (0.68), 0.18***	1.07 (0.25), 0.18***
CES-DC	0.40 (0.64), 0.03	0.47 (0.55), 0.04	2.49 (0.67), 0.16***	0.49 (0.24), 0.09*
SCARED	0.12 (0.80), 0.01	-0.28 (0.69), -0.02	2.91 (0.83), 0.15***	0.36 (0.30), 0.05
K-scale	1.06 (0.40), 0.11**	1.03 (0.33), 0.13**	1.73 (0.42), 0.17***	0.75 (0.15), 0.20***

Note: adjusted for gender, region, parent's age at birth, peripartum blue, preterm birth, perinatal complication of baby, and early developmental delay.

* <0.05, ** <0.01, ***<0.001

CBCL, Child Behavior Checklist; CES-DC, The Center for Epidemiological Studies Depression Scale for Children; Ext, externalizing problem subscale; Int, internalizing problem subscale; K-scale, Internet Addiction Proneness Scale for Youth: Observer Rating Scale; SCARED, The Screen for Child Anxiety Related Disorders; Total, total problem scale; YSR, Youth Self Report.

Table S1. Comparison of items between ETISR-SF and ACE study items

ETISR-SF	ACE
General trauma	
T1. Natural disaster	
T2. Serious accident	
T3. Serious personal injury	
T4. Serious injury/illness of parent	Parental death (interpersonal loss) Parental divorce (interpersonal loss)
T5. Separation of parents	Loss of contact with parents (interpersonal loss)
T6. Serious illness/injury	
T7. Serious injury of friend	
T8. Witnessing violence	Parental violence (parental maladjustment)
T9. Family mental illness	Parental mental illness (parental maladjustment)
T10. Alcoholic parents	Parental substance abuse (parental maladjustment)
T11. Seeing someone murdered	Criminality (parental maladjustment)
Physical abuse	Physical abuse (maltreatment)
P1. Slapped in the face	
P2. Burned with cigarette	
P3. Punched or kicked	
P4. Hit with thrown object	
P5. Pushed or shoved	
Emotional abuse	Emotional abuse, Neglect (maltreatment)
E1. Often put down or ridiculed	
E2. Often ignored or made to feel you didn't count	
E3. Often told you are no good	
E4. Most of the time treated in cold or uncaring way	
E5. Parents fail to understand your needs	
Sexual abuse	Sexual abuse (maltreatment)
S1. Touched in intimate parts in way that was uncomfortable	
S2. Someone rubbing genitals against you	
S3. Forced to touch intimate parts	

S4. Someone had genital sex against your will
S5. Forced to perform oral sex
S6. Forced to kiss someone in sexual way

Family economic adversity*

* This item is not included to ETISR-SF

ACE, Adverse Childhood Experiences study; ETISR-SF, The Early Trauma Inventory Self-Report–Short Form.

Table S2. Preliminary validation data of DPS for mental disorders with prevalence greater than 1%

	Sensitivity	Specificity	PPV	NPV	AUROC
Anxiety disorders	91.3%	54.2%	16.7%	98.4%	
Social phobia	66.7%	93.9%	11.8%	99.6%	0.820
SAD	75.0%	98.0%	37.5%	99.6%	0.960
Depressive disorders	25.0%	95.6%	8.3%	98.8%	
Major depressive disorder	25.0%	95.6%	8.3%	98.8%	0.777
Tic disorders	66.7%	99.6%	66.7%	99.6%	
Tic disorder	66.7%	99.6%	66.7%	99.6%	0.790
Behavior disorders	66.7%	78.1%	24.2%	95.7%	
ADHD	77.8%	87.5%	18.9%	99.1%	0.817
ODD	16.3%	96.1%	46.7%	84.6%	0.806
Substance use disorders	100.0%	96.4%	10.0%	100.0%	

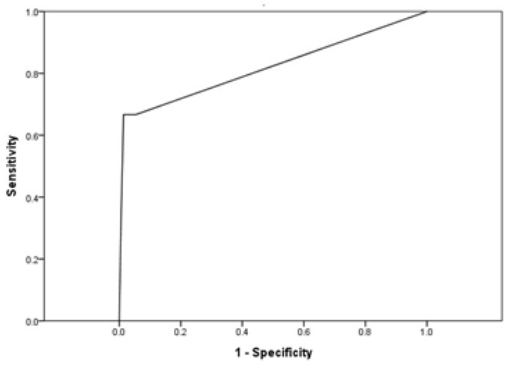
ADHD, Attention-Deficit/Hyperactivity Disorder; AUROC, Area Under Receiver Operating Curve; DPS, the Diagnostic Interview Schedule for Children predictive scales; NPV, Negative Predictive Value; ODD, Oppositional Defiant Disorder; PPV, Positive Predictive Value; SAD, Separation Anxiety Disorder.

Table S3. Correlation between DPS and previously standardized scales for mental disorders with prevalence greater than 1%

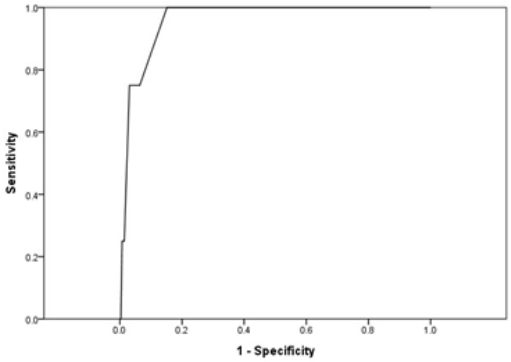
	Compared scale	r	p-value
Anxiety disorders			
Social phobia	SCARED social phobia	0.154	<0.001
SAD	SCARED SAD	0.319	<0.001
Depressive disorders			
Major depressive disorder	CES-DC	0.225	<0.001
Tic disorders			
Tic disorder	(-)		
Behavior disorders			
ADHD	YSR ADHD T	0.283	<0.001
ODD	YSR ODD T	0.200	<0.001

ADHD, attention-deficit/hyperactivity disorder; CES-DC, the Center for Epidemiological Studies Depression Scale for Children; the Diagnostic Interview Schedule for Children predictive scales; ODD, oppositional defiant disorder; SAD, separation anxiety disorder; SCARED, The Screen for Child Anxiety Related Disorders; YSR, Youth Self Report.

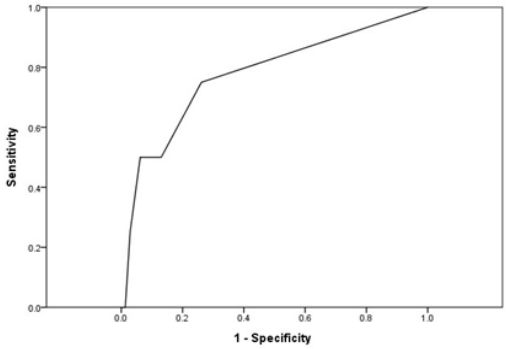
Figure S1. Receiver operating curve of DPS among Korean youths



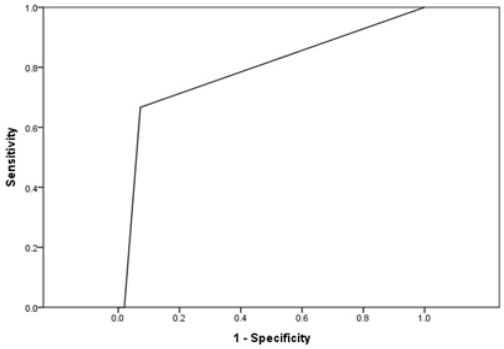
(i) Social phobia (AUROC=0.820)



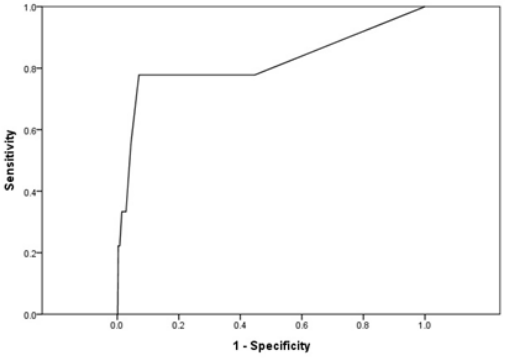
(ii) SAD (AUROC=0.960)



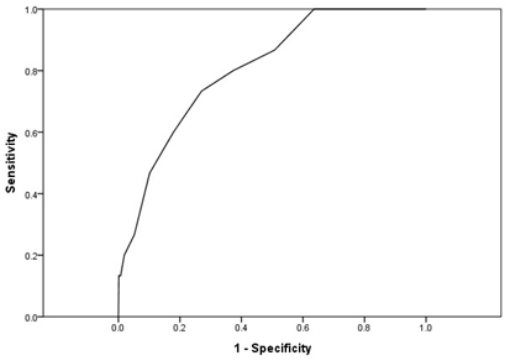
(iii) MDD (AUROC=0.960)



(iv) Tic disorder (AUROC=0.960)



(v) ADHD (AUROC=0.960)



(vi) ODD (AUROC=0.806)

ADHD, Attention-Deficit/Hyperactivity Disorder; AUROC, Area Under Receiver Operating Curve; DPS, Diagnostic Interview Schedule for Children predictive scales; MDD, Major Depressive Disorder; ODD, oppositional defiant disorder; SAD, Separation Anxiety Disorder.

Table S4. Mental disorder groups and included diagnoses using DPS

Groups	Included diagnoses
Anxiety disorders	Social anxiety disorder, Generalized anxiety disorder, Separation anxiety disorder, Panic disorder, Agoraphobia, Selective mutism, Obsessive compulsive disorder, Post-trauma stress disorder
Depressive disorders	Major depressive disorder
Tic disorders	Tic disorder
Psychotic disorders	Schizophrenia
Behavior disorders	Attention-deficit/hyperactivity disorder, Oppositional defiant disorder, Conduct disorder
Substance use disorders	Alcohol use disorder, Nicotine use disorder

DPS, the Diagnostic Interview Schedule for Children predictive scales.

Table S5 Suicide Questionnaire

자살 사고 및 행동에 대한 설문

누구든지 힘든 상황에 처하거나, 어려운 일을 겪을 때는 좋지 않은 생각, 죽고 싶다는 느낌 또는 계획을 가질 수 있습니다. 지난 1년 동안 경험했던 자신의 느낌과 생각들을 떠올려서 대답해주세요.

1	죽고 싶거나 잠든 뒤 깨어나지 않았으면 좋겠다고 바란 적이 있습니까?	예 □ 아니오 □
	1-Q. 죽고 싶거나 자살하고 싶다는 생각을 하게 된 이유는 무엇입니까? □ 다른 사람으로부터 관심이나 반응을 이끌어내기 위해서 □ 누군가에게 죽어서 복수하고 하고 싶어서 □ 고통을 끝내고 싶어서 (그런 고통이나 감정으로는 계속 살아갈 수 없었다) □ 해당 없다	
2	자살할 방법을 구체적으로 계획한 적이 있었습니까(자살 계획을 세운적이 있습니까)?	예 □ 아니오 □
3	실제 실행할 의도가 있었습니까? ("생각은 하고 있지만 절대로 그런 생각을 실행에 옮기지는 않을 것" 이라는 경우라면 **'아니오'**에 체크하시고, 그런 생각을 실행에 옮길 의도가 어느 정도 있었다면 **'예'**에 체크하세요.)	예 □ 아니오 □
4	실제로 자살을 시도한 적이 있습니까?	예 □ 아니오 □
5	자해행동이 있었습니까? 여기서 말하는 자해행동은, 죽을 의도가 전혀 없이 **다른 이유로 시행한** 자해 행동을 의미합니다. (**다른 이유의 예**: 스트레스를 풀기 위해, 기분 전환을 위해, 동정심을 얻으려고, 상황을 바꾸기 위해서 등)	예 □ 아니오 □

국문초록

한국 청소년을 대상으로, 아동기 역경(childhood adversity, 이하 CA)이 청소년의 정신장애와 전반적 정신건강 문제에 미치는 영향을 조사하기 위한 학교기반 단면조사 연구를 시행하였다.

2017년 4월부터 12월까지, 10-19세 청소년 927명이 모집되었으며, 참가자들과 부모는 CA을 평가하기 위한 Early Trauma Inventory Self-Report-Short Form (ETISR-SF), Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) 정신장애 선별을 위한 Diagnostic interview schedule for children Predictive Scales (DPS), 내면화/외현화 문제 평가를 위한 한국판 아동·청소년 행동평가척도 (CBCL/YSR) 우울 평가를 위한 Center for Epidemiological Studies-Depression Scale Children (CES-DC), 불안 평가를 위한 Screen for Child Anxiety Related Emotional Disorders (SCARED), 인터넷 중독 평가를 위한, 인터넷 중독 자가진단척도 (K-scale), 그리고 자살 평가를 위한 설문을 시행하였다. 또한 보호자 추가 설문을 통해, 인구학적 정보와, 임신, 주산기 및 초기 발달에 대한 정보를 얻었다.

전체 청소년의 약 40%가 한가지 이상의 CA 경험을 보고하였다. CA는 틱장애를 제외한 전반적인 정신장애 발생 위험을 높였으며(OR=1.34-1.50), CA의 하위유형 중에는 정서적 학대가 위험도가 가장 높고(OR=1.92-2.98), 이어 신체적 학대(OR=1.36-2.05), 일반 외상 경험(OR=1.43-1.79) 순서의 위험도를 보였다.

전체 CA 경험은 내면화/외현화 문제 수준을 증가시켰으며(β=0.13-0.35), CA 하위유형 중 정서 학대(β=0.18-0.30)와, 신체 학대(β=0.12-

0.38)가 내면화/외현화 문제 수준과 유의한 상관관계를 보였다. 또한 CA는 우울 및 불안 수준을 증가시켰는데, 특히 정서 학대가 우울(β=0.16), 불안(β=0.13)과 유의한 상관관계가 있었다. CA는 남아의 인터넷 중독 위험을 높였고(β=0.20), 정서적 학대는 여아의 자살 문제(사고: OR=1.74, 계획: OR=1.76, 비자살적 자해행동: OR=1.95)의 발생 위험을 높였다.

본 연구는 CA가 국내 청소년의 정신장애 발병 및 정신건강 문제에 미치는 영향을 통합적으로 분석한 최초의 연구이다. 이를 통해 CA가 청소년의 정신건강 전반에 미치는 영향 분석하고 그 패턴을 확인하였다는데 의미가 있다.

주요어: 아동기 역경, 청소년, 정신장애, 정신병리,

학 번: 2012-23610