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Observational Study

Influence of childhood trauma on adolescent internet addiction: The mediating roles of loneliness and negative coping styles

Dong WL *et al*. Influence of childhood trauma on adolescent

Abstract

BACKGROUND

In the information age, the use of the internet and multimedia tools has large effects on the life of middle school students. Improper use of the internet may result in internet addiction (IA). Thus, actively exploring the factors influencing adolescent and the mechanism of addiction as well as promoting adolescent physical and mental health and academic development are priorities that families, schools, and society urgently need to address.

AIM

To explore the effect of childhood trauma on adolescent IA and to consider the roles of loneliness and negative coping styles.

METHODS

A total of 11310 students from six junior high schools in Henan, China, completed the child trauma questionnaire, IA test, loneliness scale, and simple coping style questionnaire. In addition, data were collected from 1044 adolescents with childhood trauma for analysis with IBM SPSS 26.0 and AMOS 28.0; we examined the relationships among childhood trauma, IA, loneliness, and negative coping styles.

RESULTS

We found that childhood trauma not only directly affected adolescents' IA but also affected IA through loneliness and negative coping styles.

CONCLUSION

Therefore, this study has theoretical implications regarding adolescent mental health and may inform interventions for IA.

Key Words: Addictive behavior; Mental health; Coping styles; Trauma; Loneliness

Dong WL, Li YY, Zhang YM, Peng QW, Lu GL, Chen CR. Influence of childhood trauma on adolescent internet addiction: The mediating roles of loneliness and negative coping styles. *World J Psychiatry* 2023; In press

Core Tip: This study is concluded: (1) Childhood trauma has a positive predictive effect on teenagers' internet addiction (IA); (2) Childhood trauma has a negative psychological and behavioral impact on teenagers; (3) Loneliness and negative coping styles play a chain intermediary role in the influence of childhood on IA among teenagers; and (4) IA.

INTRODUCTION

In the information age, the use of the internet and multimedia tools has a large effect on the lives of middle school students. Improper use of the internet may result in internet addiction (IA). IA is often defined as problematic, compulsive internet use (for gaming, social networks, pornography, *etc.*) that results in severe impairment of an individual's functioning in all aspects of life over a long period[1,2]. Worldwide, the current prevalence rate of IA is 7.02%; alarmingly, the age of IA onset is dropping, and the prevalence rate is increasing[3]. From 2004 to 2019, a questionnaire survey of 92171 middle school students in Shanghai, China, reported that the prevalence rate of IA was 4.3%, that students with high levels of loneliness exhibited IA, and that academic pressure aggravated IA[4]. Studies have shown that IA causes mental health problems in individuals and impairs psychosocial functioning, such as an inability to concentrate for long periods, isolation, anxiety, social withdrawal, depression, interpersonal avoidance, and sleep disorders[5-8]. Physical health problems such as dry eye, mouse hand, and cervical and lumbar spine pain can also occur[9,10]. Moreover, some studies have shown that IA is related to non-suicidal self-injury and suicide in adolescents[11-13]. Thus, actively exploring the factors influencing adolescent IA and the mechanism of addiction

as well as promoting adolescent physical and mental health and academic development are priorities that families, schools, and society urgently need to address.

Childhood trauma and IA

Childhood trauma is often described as serious adverse childhood experiences, mainly involving neglect and abuse[14], which have a series of negative effects on physical and mental health[15,16]. Unfortunately, childhood trauma is very common. According to Koenen *et al*[17], 38.48% of children have been exposed to at least one traumatic event before the age of 13. Childhood trauma is associated with the development of various addictive behaviors, which have become an increasingly serious public health problem[18-20]. For example, a study proved that childhood trauma is an important predictor of gambling disorder; physical neglect is the single trauma subtype that significantly increases the incidence of gambling disorder in adulthood[21]. It remains unclear whether childhood trauma is common among adolescents with IA. Therefore, we hypothesized that childhood trauma positively predicts adolescent IA (H1).

The potential mediating role of loneliness

Loneliness refers to complex feelings when the intimate relationship and social needs of individuals are not fully satisfied and are often accompanied by negative emotional experiences such as isolation, helplessness, and pain[22,23]. Abuse and neglect are severe childhood traumatic events and are lonely experiences. It is difficult for people without the same experience to truly understand these feelings. The traumatized person may have friends who support him or her, but because the friends cannot understand these feelings, the traumatized person may not be willing to share his or her experiences[24]. Therefore, even with the support of friends, they may feel lonely after the trauma. According to the social compensation hypothesis, lonely people may compensate for emotional or social needs through self-disclosure, self-catharsis, and interpersonal communication through the internet[25]. Adolescents with high levels of loneliness have a higher risk of IA[26,27]. However, it is unclear whether childhood trauma affects IA

through loneliness. We hypothesized that loneliness influences the impact of childhood trauma on IA (H2).

The potential mediating role of negative coping styles

Coping styles are the cognitive and behavioral styles adopted by individuals in the face of setbacks and pressures. They are usually divided into positive coping styles (problem-solving, cognitive reassessment, social support, *etc.*) and negative coping styles (avoiding or denying problems or attributing solutions to external factors)[28,29]. Childhood is an important period of development, and traumatic experiences during this period will have a long-term impact on cognition and emotion regulation[30]. Some studies have shown that adolescents with childhood trauma mainly exhibit negative coping styles[31,32]. A reasonable explanation for using a negative coping style is that continuous exposure to childhood trauma may lead to changes in one's neurobiology that lead to increased vigilance and perceived environmental threat, thus changing one's perceived stress[33]. Traumatic events will result in negative coping styles, which is consistent with the stress response model[34]. Some studies have indicated that addictive behaviors are closely related to the selected coping style, especially negative coping styles[35-37]. Adolescents may exhibit negative coping methods on the internet such as venting, avoiding, or denying difficulties encountered in reality[38]. Based on previous theories and studies, we propose that negative coping styles mediate the relationship between childhood trauma and IA (H3).

Moreover, some studies have shown that loneliness affects coping styles[39,40], and negative coping styles positively predict IA[41,42]. However, few studies have shown that negative coping styles play an intermediary role in the relationship between loneliness and IA. In this study, we proposed that negative coping styles may mediate between loneliness and IA, and loneliness and negative coping styles have a chain mediating role in the relationship between childhood trauma and IA (H4).

Study framework

Childhood trauma, IA, loneliness, and negative coping styles interact with each other. Nevertheless, it remains unclear how these variables interact to lead to IA in adolescents. In this study, we proposed the conceptual framework shown in Figure 1. From the perspective of adolescents, we discuss the influence of childhood trauma on IA and investigate the role of loneliness and negative coping styles to provide empirical support and guidance for related research and interventions for adolescent mental health.

MATERIALS AND METHODS

Data collection and ethical considerations

From May to June 2023, volunteers were recruited from six junior and senior high schools in Henan Province, China, using a convenient sampling method. The inclusion criteria were as follows: (1) Enrolled in secondary school; and (2) Provided informed consent and volunteered to participate in this study. The exclusion criterion was the failure to complete all of the questionnaires, regardless of reason. This study was approved by the Institutional Review Committee of Henan Provincial Key Laboratory of Psychology and Behavior (20230516001), and all participants signed informed consent forms.

Questionnaire

General demographic data: We collected sociodemographic information including gender, age, parental marital status, only-child status, left-behind child status, family residential location, and relationships with teachers and classmates.

Childhood trauma questionnaire: We used the childhood trauma questionnaire compiled by Bernstein et al[43] and revised by Zhao et al[44]. The questionnaire consists of 28 questions, of which 3 are validity items designed to detect false-negative trauma reports. The questionnaire assesses five dimensions of childhood maltreatment. Each question is answered on a Likert scale, from 1 "never correct" to 5 "often correct". A

higher overall score indicates a greater severity of trauma. The Cronbach's α coefficient of this study scale was 0.817.

IA test: The IA test is a self-report scale compiled by young that contains 20 items[45]. Each entry is scored according to the degree of compliance on a scale of 1-5, and the total score range is 20-100 points. The higher the score is, the more severe the IA. A score ≥ 50 points indicates the presence of IA. The Cronbach's α coefficient was 0.909 in this study.

Loneliness scale: We used the University of California-Los Angeles Loneliness Scale compiled by Russell *et al*[46] in 1978. The scale consists of 20 items with 4 response options, 11 questions, and 9 reverse-scored questions. The higher the score is, the stronger the individual's experience of loneliness. The Cronbach's α coefficient in this study was 0.815.

Coping styles scale: Coping styles were evaluated with the simple coping style questionnaire, which was compiled by Xie[47] based on the Chinese context. It consists of two dimensions, positive response, and negative response, with a total of 20 items. Items are rated on a 4-point Likert scale (1 = not used, 4 = frequently used). This study focused on the negative response scale, which consists of 8 items and focuses on the characteristics of negative responses. The scale in this study had a Cronbach's α coefficient of 0.728.

Statistical analysis
All data were analyzed using IBM SPSS 26.0 and Amos 28.0 in this study. First, the frequency and percentage are reported for the demographic characteristics of participants. In addition, we used Harman's single-factor test to test for possible common method deviations. Normality tests were performed on continuous variables to detect skewness and kurtosis. If IA, loneliness, childhood trauma, and negative

coping styles followed a normal distribution, we used Pearson's correlation analysis to explore the relationships among these variables. Otherwise, we used Spearman correlation analysis. We then used structural equation modeling to examine the mediation effects. In this study, IA was the dependent variable, childhood trauma was the independent variable, and loneliness and negative coping styles were the mediating variables. Based on previous item parceling studies[48], we used a "project-building balance" approach to package entries on loneliness and coping styles. Finally, bootstrapping was used to test the mediation effect, and if $P < 0.05$, the mediation effect was considered significant.

RESULTS

Sample results

We recruited a total of 11310 participants. Of these, 190 dropped out halfway and 11120 questionnaires were returned. After excluding questionnaires with incomplete data, we finally obtained 10819 valid questionnaires. Then, 9775 false-negative trauma reports were excluded. Finally, we analyzed the data of 1044 adolescents with childhood trauma, constituting 9.3% of the total number of participants in the survey, as shown in Figure 2. Bentler and Chou[49] proposed that the sample size should be more than 10 times the number of observed variables; therefore, 1044 samples met the requirements for testing the hypothesized model.

The demographic characteristics of the 1044 adolescents are shown in Table 1. Among them, 612 were male (58.6%), and 432 were female (41.4%). The students were in junior high school or high school, and the age range was 12-18 years. Among the sample, 937 were from two-parent families, and 105 were from single-parent families. A total of 70 (6.7%) students were only children, and the remaining 89.8% had siblings. In this survey, there were 458 (43.9%) left-behind children (students living with their grandparents, attending boarding school, or living alone), and there were 586 (56.1%) children living with their parents. Of these children, 56.6% were from rural areas, and the remaining 43.4% were from urban areas. A total of 48.8% of the students reported

that they had a good relationship with their classmates, and 31.5% of the students reported that they had a good relationship with their teachers.

Bias test of common method

Because all data were collected with questionnaires, we used Harman's single-factor test to test for possible common method bias. The test results showed that there were 19 variables with eigenvalues greater than 1. The first variable explained 14.85% of the total variation, which is below the critical standard of 40%[50]. Hence, there were no serious common methodological biases in this study.

Descriptive statistics and correlations among variables

SPSS was used to examine the distributions of these variables, and all continuous variables had normal distributions. Therefore, we used Pearson correlation analysis to assess the correlations between variables. Means, standard deviations, and Pearson correlation coefficients of each variable are shown in Table 2. In this exploratory analysis, correlations between variables were examined with Pearson correlation analysis; there were significant correlations between each variable in this analysis at the significance level of 99%. Regarding the correlation coefficients, the r values were greater than 0. Thus, there was a significant positive correlation between the four dimensions of childhood trauma and each variable. The independent-sample t test results showed that there was a significant influence of parental marital relationship on IA (t = -4.252, P < 0.001). One-way ANOVA was used for variables with homogeneity of variance. The results showed that there were significant differences in IA among different ages (F = 16.86, P < 0.001). In addition, there were significant differences in IA according to relationships with peers and teachers (F = 9.837, P < 0.001). Considering that parent martial relationship (harmonious/disharmonious), age (12-18 years old), and relationship with teachers (poor/average/good) may influence IA, we decided to control for these variables in the subsequent mediation analysis.

SEM of factors influencing IA

Parents' marital relationship, age, and relationship with teachers were selected control variables because IA is significantly affected by these three variables. The model fit results are shown in Table 3; in accordance with Hu and Bentler[51], we provide several representative model fit indices. The CMIN/DF value of the model (4.616) was less than 5. The root mean square error of approximation value (0.059) was less than 0.08, and the root mean square residual value (0.040) was less than 0.05. In addition, the comparative fit index and goodness of fit index test results indicated excellent fit (0.9 or more). Therefore, the results of this analysis show that the SEM of factors influencing IA was satisfactory.

Factors hypothesized to influence IA

According to the results shown in Figure 3, childhood trauma positively predicted loneliness (β = 0.50, P < 0.001), childhood trauma positively predicted negative coping style (β = 0.25, P < 0.001), loneliness positively predicted negative coping style (β = 0.21, P < 0.001), loneliness positively predicted IA (β = 0.14, P < 0.001), negative coping style positively predicted IA (β = 0.30, P < 0.001), and childhood trauma positively predicted IA (β = 0.17, P < 0.001).

Finally, we used 5000 bootstrap samples to determine the 95% confidence interval, and assessed the mediating effects of loneliness and negative coping style on the relationship between childhood trauma and IA. The results are shown in Table 4; loneliness mediated in the relationship between childhood trauma and IA. Negative coping styles also mediated the relationship between childhood trauma and IA. In addition, loneliness and negative coping styles had a chain mediating role in the relationship between childhood trauma and IA. In short, childhood trauma not only directly affected IA but also indirectly affected IA through loneliness and negative coping style in a chain mediation effect (Table 4).

DISCUSSION

Among the 1044 adolescents with childhood trauma, there were 473 (45.6%) students with IA, and the prevalence rate was as high as 45.6%, which is higher than the Hu *et al*[52] reported. Among these participants, 75 had severe IA. This may be related to the unique study population (adolescents with childhood trauma). We explored the relationship between childhood trauma and IA in adolescents. The mediating roles of loneliness and negative coping styles were determined through a chain mediation model. To address IA in adolescents with childhood trauma, it is of practical and theoretical importance to study the relationships among these variables.

Childhood trauma and IA

The results of this study revealed a direct relationship between childhood trauma and IA, suggesting that physical and emotional neglect/abuse in childhood are important predictors of adolescent IA, which is consistent with previous findings and supports H1. Studies have shown that childhood trauma can lead to poor behavior in adolescents[53,54]. For example, childhood trauma can directly predict adolescent mobile phone addiction as well as IA[55,56]. The present study showed that childhood trauma is significantly associated with IA, which is consistent with previous research results[57]. Importantly, this study also showed that adolescents with IA accounted for 45.6% of the sample, which differs from previous findings, suggesting that adolescents with childhood trauma are more likely to have IA. Traumatic childhood experiences have various adverse effects on adolescents in physical, psychological, emotional, and behavioral dimensions. Studies have shown that children who have experienced childhood trauma are often in a clinical or subclinical psychological state, and they will be more inclined to use the internet to express their sadness, depression, and other psychological states and obtain comfort[58]. Thus, we should pay attention not only to the health and academic needs of adolescents but also to their psychological and emotional needs. School-based health care centers and education systems are key resources for adolescent trauma interventions. Schools can identify students with

childhood trauma through screening, focusing on their health. This will be more conducive to adolescents' healthy growth and reduce problem behaviors such as IA.

Mediation through loneliness

This study explored the mechanism underlying the association between childhood trauma and adolescent IA and showed that loneliness plays a mediating role in this relationship, supporting hypothesis 2. The results showed that childhood trauma significantly predicted adolescent loneliness, which is consistent with previous studies[59,60]. Loneliness is a common experience in adolescence. According to a survey, 11%-20% of those aged 12-15 years reported that they felt lonely at least "sometimes"[61]. Childhood trauma aggravates adolescents' depression and inferiority complexes, limits their social communication, and thus aggravates loneliness. Moreover, loneliness is a negative emotional state and is closely related to some mental disorders. For example, loneliness and depression are associated[62]. This study showed that loneliness has an impact on adolescent IA, which is consistent with previous research results[63]. Adolescents with high levels of loneliness tend to use the internet instead of offline social interactions to meet the need to belong[64]. However, IA aggravates the loneliness of adolescents. Therefore, we suggest that schools organize more recreational activities for spare time to meet the social needs of adolescents. We should also prioritize the identification of students with communication barriers, emphasize the restoration of interpersonal relationships with time, help students actively integrate into the community, and prevent or reduce adolescent loneliness.

Mediating effect of negative coping styles

This study showed that negative coping styles have a mediating role in the effects of childhood trauma on IA, supporting hypothesis 3. The family risk factor model suggests that living in abusive or neglectful family environments can exacerbate or impose risks of poor self-perception, negative emotions, and coping styles as they adapt to social environments[65,66]. The results of this study are consistent with the family risk

model, showing that childhood trauma positively predicts negative coping styles. Coping styles play an important role as mediating variables in an individual's stress process[67-69]. Positive coping styles are conducive to regulating negative emotions when facing difficulty. In contrast, individuals with negative coping styles are more likely to choose to avoid difficulties. The results of this study also showed that negative coping styles positively predict adolescent IA behavior, which is consistent with previous studies[70]. However, IA can lead to additional stressful events, increased mental health problems, and decreased academic performance. Therefore, negative coping styles and IA form a negative cycle. At schools, we should guide adolescents to select positive and healthy coping styles, which are highly important for preventing or reducing adolescent IA.

Chain mediating effect of loneliness and negative coping styles

This study also indicated that loneliness can positively predict negative coping styles, which is consistent with previous studies[39,71]. In addition, we found that loneliness and negative coping style act as chain mediators of the relationship between childhood trauma and IA, supporting hypothesis 4. Adolescents with childhood trauma will inevitably have some negative emotions[72-74]. The coping style selected reflects the emotion regulation strategies of adolescents facing difficulty. Adolescents with negative coping styles tend to internalize their emotions with self-blame and avoidance. Engaging in internet use is a way of venting after trauma. Previous studies have shown that high levels of loneliness and negative coping styles are more likely to produce IA problems[75,76]. Overall, childhood trauma can predict loneliness, and loneliness can predict IA by influencing negative coping styles. Importantly, loneliness and coping styles can be changed. We can formulate intervention measures focusing on alleviating loneliness and cultivating positive coping styles, especially among adolescents with childhood trauma. We can help students enhance their mental health and psychological adjustment, develop a healthier and positive coping style, learn to reduce loneliness, and reduce the occurrence of IA among adolescents.

Limitations

First, this study investigated only six schools in one province, which somewhat reduces the generalizability of the conclusions. A study with a nationally representative sample and a multicenter design is needed. Second, this study used self-report data, which may have some problems, such as recall bias. Although no common method bias was found in this study, more objective assessments should also be considered in subsequent studies. Finally, this study had a cross-sectional design, and further longitudinal studies are needed to investigate causality.

CONCLUSION

This study constructed a chain mediation model from the perspective of adolescents to explore the process and mechanisms by which childhood trauma influences IA. Childhood trauma had a positive predictive effect on adolescent IA, and loneliness and negative coping styles had a chain mediating role in the influence of childhood on IA among adolescents. The path of childhood trauma® loneliness® negative coping styles® IA in adolescents was confirmed. This study provides empirical support and guidance for research and interventions for adolescent IA. In addition, it provides important insights into the mental health of middle school and the development of harmonious school life.

ARTICLE HIGHLIGHTS

Research background

Internet addiction (IA) refers to a compulsive or excessive use of the internet that interferes with daily life activities, relationships, and overall well-being. It is characterized by an individual's inability to control or limit their online behavior, leading to negative consequences.

Research motivation

This study aimed to explore the effect of childhood trauma on adolescent IA and to consider the roles of loneliness and negative coping styles.

Research objectives

The study hypothesized that childhood trauma would be positively associated with adolescent IA, and this relationship would be partially mediated by loneliness and negative coping styles. Negative coping styles refer to maladaptive strategies used to deal with stress, such as avoidance, substance use, and self-blame.

Research methods

This study constructed a chain mediation model from the perspective of adolescents to explore the process and mechanisms by which childhood trauma influences IA. Childhood trauma had a positive predictive effect on adolescent IA, and loneliness and negative coping styles had a chain mediating role in the influence of childhood on IA among adolescents.

Research results

The results showed that childhood trauma was positively associated with both loneliness and negative coping styles. Moreover, loneliness and negative coping styles were found to mediate the relationship between childhood trauma and adolescent IA. The findings suggest the importance of addressing childhood trauma and its subsequent impact on mental health and addictive behaviors.

Research conclusions

This study provides empirical support and guidance for research and interventions for adolescent IA, and it also provides important insights into the mental health of middle school and the development of harmonious school life.

Research perspectives

This study used self-report data, which may have some problems, such as recall bias. Although no common method bias was found in this study, more objective assessments should also be considered in subsequent studies.

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