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# Association between school bullying victimization and e-cigarette use and its sex difference: evidence from Chinese adolescents

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## Abstract

Emerging evidence links school bullying victimization with e-cigarette use among adolescents, yet most research focuses on Western populations. This study aims to assess this association among Chinese adolescents, examines bullying types (verbal, physical, social, and property-related), and explores potential sex differences. A cross-sectional survey of 63,205 middle school students from 76 schools assessed bullying victimization using the Multidimensional Peer Victimization Scale. Covariates included demographics, traditional cigarette smoking, and mental distress. Logistic regression models and subgroup analyses evaluated associations. The prevalence of e-cigarette use was 4.8%. Students with mild (OR = 1.38; 95% CI: 1.21–1.56), moderate (OR = 2.20; 95% CI: 1.94–2.49), and severe (OR = 3.98; 95% CI: 3.55–4.46) bullying experiences were increasingly likely to report e-cigarette use (all $p < 0.001$). Physical victimization showed the strongest association (adjusted OR = 1.53; 95% CI: 1.40–1.68), particularly among girls. School bullying victimization is significantly associated with e-cigarette use among Chinese adolescents, with physical bullying showing the strongest link, especially in girls. Comprehensive anti-bullying programs are needed to reduce bullying and support victims to prevent substance use.

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## Introduction

e-cigarette use has rapidly gained popularity among adolescents globally, with recent surveys indicating a concerning rise in prevalence. The Global Youth Tobacco Survey, which included 485,746 adolescents aged 12–16 from 68 countries, reported that approximately 9.2% of adolescents had used e-cigarettes in the past 30 d, with rates varying significantly across regions (ranging from 1.9% to 33.2%)[1]. In China, a recent large-scale national study indicated that 9.5% of adolescents report current e-cigarette use[2]. e-cigarette use is closely associated with a wide range of negative consequences, including mental health challenges such as depression and anxiety, respiratory problems, and an increased likelihood of using other tobacco products[3–6]. Despite these dangers, the prevalence of e-cigarette use continues to rise among adolescents, highlighting the need to identify the underlying factors contributing to this behavior.

Simultaneously, school bullying continues to be a pervasive issue among adolescents worldwide. The global prevalence of bullying victimization ranges from 15% to 45%, with regional differences in the magnitude of the problem[7–9]. A recent meta-analysis further estimated that 22.7% of Chinese adolescents suffer from peer bullying, underscoring the widespread nature of this issue within the country[10]. Recent studies consistently indicate a positive relationship between school bullying victimization and substance use behaviors, including e-cigarette use, among adolescents[11–16]. For example, Azagba et al. reported that Canadian students who experienced bullying, especially daily bullying, were significantly more likely to use e-cigarettes than their non-bullied peers[11]. Similarly, Hansen et al. found a positive correlation between bullying victimization and e-cigarette use among German adolescents, with higher bullying severity linked to increased e-cigarette use[13]. Additionally, gender differences have been observed, with female adolescents often showing greater vulnerability to the effects of bullying on substance use compared to males[11,14,16]. Studies on the association of specific bully type with e-cigarette use remained limited. Only one study reporting that all forms of bullying—verbal, physical, and cyberbullying—were associated with a higher likelihood of nicotine vaping among Florida adolescents, though the strength of these associations varied by bullying type[16].

While existing literature has explored the relationship between bullying victimization and e-cigarette use, most research has focused on Western populations, particularly in North America and Europe. There is a notable lack of studies examining this association in non-Western contexts, especially in Asian countries where social dynamics and cultural attitudes toward bullying and e-cigarette use may differ substantially. In China, which has one of the largest adolescent populations globally, there has been a significant increase in e-cigarette use[2]. However, research on its correlates remains limited[17]. Understanding how different forms of bullying relate to e-cigarette use and whether these associations vary by sex is essential for developing targeted prevention strategies.

This study aims to address these gaps by: (1) assessing the association between school bullying victimization and e-cigarette use among a large sample of Chinese adolescents; (2) examining the relationship between various forms of bullying victimization—verbal, physical, social manipulation, and property-related—and e-cigarette use; and (3) exploring potential sex differences in these associations. We hypothesize that: (1) adolescents who experience peer bullying are at a higher risk of engaging in e-cigarette use; (2) the relationship between different types of bullying victimization

(e.g., physical, verbal, relational) and e-cigarette use may vary; and (3) there is a sex difference in this association, with a stronger relationship expected in girls.

## Method

### Study procedure and participants

This school-based study was conducted in November 2020 in Zigong City, Sichuan Province, China. Detailed information regarding the baseline sampling, data collection, and quality control procedures has been previously published[18,19]. Briefly, 63,487 middle and high school students (grades 7–12) from 76 schools across two districts and one county were recruited using cluster sampling. Participants completed an electronic survey in school computer centers during class hours, supervised by trained head teachers and mental health professionals to ensure protocol adherence. After excluding invalid responses (e.g., incorrect identification numbers, age inconsistencies, or insufficient response times), the final analysis included 63,205 students.

The study protocol was approved by the Ethics Committee of Zigong Mental Health Center (No. 2020-8-01). Informed consent was obtained from all participants, with parental consent for those under 18. Participation was voluntary, and students could withdraw at any time.

### Measurements

#### *Peer bullying*

Peer bullying was assessed using the Multidimensional Peer-Victimization Scale (MPVS)[20], which includes 16 items that ask participants to report the frequency of specific bullying experiences over the past six months. Responses ranged from 0 (not at all) to 2 (more than once), with higher scores indicating more severe bullying experiences. The MPVS measures four types of bullying: physical, verbal, social manipulation, and property attacks, with four items dedicated to each type. For this study, a factor score of ≥ 1 was used to indicate the experience of each bullying subtype. The Chinese version of MPVS has demonstrated excellent psychometric properties[21]. It is widely used for measuring peer bullying in the Chinese population[22,23].

#### *e-cigarette use*

e-cigarette use was assessed with a binary question: 'Within the last 28 d, have you ever used an e-cigarette (even one puff )?'. This measure has been widely used in prior surveys to assess e-cigarette use[24].

#### *Covariates*

Demographic variables included age, gender, education level (middle school/high school), residence (urban/rural), family type (nuclear/non-nuclear), single-child status (yes/no), left-behind children status (yes/no), alcohol use, traditional smoking experience, and parental smoking status, all assessed via self-reported questionnaires. Mental health was assessed using the 9-item Patient Health Questionnaire (PHQ-9, cutoff point: 10) for depression[25], the 7-item Generalized Anxiety Disorder Scale (GAD-7, cutoff point: 10) for anxiety[26], and the Pittsburgh Sleep Quality Index (PSQI, cutoff point: 6) for sleep disturbance[27]. These instruments are validated and widely used in Chinese populations[28,29].

### Statistical analysis

Descriptive statistics summarized the demographic characteristics and the prevalence of e-cigarette use. Group comparisons between adolescents with and without e-cigarette use were performed using chi-square tests for categorical variables and independent t-tests for continuous variables.

To examine the association between bullying severity and e-cigarette use, univariate and multivariable logistic regression models with enter methods were employed. The dependent variable was e-cigarette use (yes/no), and the primary independent variable was bullying severity, categorized into mild, moderate, and severe based on MPVS quartiles. Demographics (age, gender, education level, residence, family type, single-child status, left-behind children status, alcohol use, traditional smoking experience, and parental smoking status) and mental health problems (depression, anxiety, and sleep problems) were controlled in the logistic regression model to test the independent association between bullying experience and e-cigarette use. Odds ratios (ORs) with 95% confidence intervals (CIs) were calculated. Additionally, separate logistic regression models assessed the independent contribution of each bullying subtype (physical, verbal, social manipulation, and property-related attacks) to e-cigarette use.

To explore sex differences in the associations between bullying victimization and e-cigarette use, interaction terms between sex and bullying type were included in the fully adjusted logistic regression models. Separate logistic regression analyses were conducted for boys and girls to evaluate the independent association of each bullying type with vaping, controlling for demographics and mental health problems.

All statistical analyses were performed using SPSS (version 27.0). All tests were 2-tailed, with p-value < 0.05 indicating statistical significance.

## Results

### Sample characteristics

The final sample included 63,205 adolescents, with 3,014 reporting e-cigarette use (Table 1). e-cigarette users were older (mean age 14.83 vs 14.30 years, $p < 0.001$) and more likely to be male (74.6% vs 48.1%, $p < 0.001$). Users were also more likely to attend junior high school, come from single-parent or remarried families, and have higher rates of alcohol and traditional cigarette use compared to non-users (all $p$-values < 0.001). No significant differences were found in left-behind status, but significant differences were observed in urban vs rural residence, being an only child, and parental smoking habits (all $p$-values < 0.001). Additionally, e-cigarette users reported higher rates of depression (45.06% vs 21.92%), anxiety (30.23% vs 13.13%), sleep disturbances (53.68% vs 28.29%), and were more likely to have experienced all forms of bullying (physical, verbal, social manipulation, property attacks) compared to non-users (all $p$-values < 0.001).

### Association of bullying victimization with e-cigarette use

Adolescents experiencing moderate (Q2), high (Q3), and severe (Q4) levels of bullying had progressively higher odds of e-cigarette use compared to those with no or mild bullying (Q1) (Table 2). In the crude analysis, the odds ratios were 1.38 (95% CI: 1.21–1.56) for Q2, 2.20 (95% CI: 1.94–2.49) for Q3, and 3.98 (95% CI: 3.55–4.46) for Q4, compared to Q1. After adjusting for demographics, alcohol and traditional cigarette use, and mental health distress, the associations remained significant, with adjusted odds ratios of 1.26 (95% CI: 1.11–1.44) for Q2, 1.60 (95% CI: 1.40–1.82) for Q3, and 2.11 (95% CI: 1.86–2.40) for Q4.

Regarding specific bullying types, physical victimization was most strongly associated with e-cigarette use (Table 3). Adolescents who experienced physical bullying had 2.78 times higher odds of e-cigarette use in the crude analysis (OR = 2.78, 95% CI: 2.59–3.00), which remained significant after adjustment (adjusted OR = 1.53,

**Table 1.** Sample characteristics by e-cigarette use.

| Variables | Total (n = 63205) | Without vaping (n = 60191) | With vaping (n = 3014) | Statistic | *p* |
|---|---|---|---|---|---|
| Age, mean ± SD | 14.33 ± 1.65 | 14.30 ± 1.64 | 14.83 ± 1.64 | t = −17.28 | < 0.001 |
| Gender, n (%) | | | | $\chi^2$ = 805.68 | < 0.001 |
| Boys | 31198 (49.36) | 28950 (48.10) | 2248 (74.59) | | |
| Girls | 32007 (50.64) | 31241 (51.90) | 766 (25.41) | | |
| School, n (%) | | | | $\chi^2$ = 145.91 | < 0.001 |
| Senior high school | 43373 (68.62) | 41605 (69.12) | 1768 (58.66) | | |
| Junior high school | 19832 (31.38) | 18586 (30.88) | 1246 (41.34) | | |
| Family, n (%) | | | | $\chi^2$ = 35.39 | < 0.001 |
| Nuclear | 50414 (79.76) | 48138 (79.98) | 2276 (75.51) | | |
| Single parent or remarried | 12791 (20.24) | 12053 (20.02) | 738 (24.49) | | |
| Alcohol use, n (%) | | | | $\chi^2$ = 2548.90 | < 0.001 |
| Without | 56487 (89.37) | 54627 (90.76) | 1860 (61.71) | | |
| With | 6718 (10.63) | 5564 (9.24) | 1154 (38.29) | | |
| Traditional cigarette use, n (%) | | | | $\chi^2$ = 16306.91 | < 0.001 |
| Without | 58251 (92.16) | 57312 (95.22) | 939 (31.15) | | |
| With | 4954 (7.84) | 2879 (4.78) | 2075 (68.85) | | |
| Residence, n (%) | | | | $\chi^2$ = 11.21 | < 0.001 |
| Urban | 21146 (33.46) | 20053 (33.32) | 1093 (36.26) | | |
| Country | 42059 (66.54) | 40138 (66.68) | 1921 (63.74) | | |
| Only child, n (%) | | | | $\chi^2$ = 55.93 | < 0.001 |
| Yes | 13904 (22.00) | 13075 (21.72) | 829 (27.50) | | |
| No | 49301 (78.00) | 47116 (78.28) | 2185 (72.50) | | |
| Left-behind status, n (%) | | | | $\chi^2$ = 0.01 | 0.929 |
| Yes | 22202 (35.13) | 21141 (35.12) | 1061 (35.20) | | |
| No | 41003 (64.87) | 39050 (64.88) | 1953 (64.80) | | |
| Father smoking, n (%) | | | | $\chi^2$ = 33.77 | < 0.001 |
| Without | 20744 (32.82) | 19901 (33.06) | 843 (27.97) | | |
| With | 42461 (67.18) | 40290 (66.94) | 2171 (72.03) | | |
| Mother smoking, n(%) | | | | $\chi^2$ = 145.10 | < 0.001 |
| Without | 60705 (96.04) | 57936 (96.25) | 2769 (91.87) | | |
| With | 2500 (3.96) | 2255 (3.75) | 245 (8.13) | | |
| Depression, n (%) | | | | $\chi^2$ = 867.25 | < 0.001 |
| Without | 48655 (76.98) | 46999 (78.08) | 1656 (54.94) | | |
| With | 14550 (23.02) | 13192 (21.92) | 1358 (45.06) | | |
| Anxiety, n (%) | | | | $\chi^2$ = 699.24 | < 0.001 |
| Without | 54392 (86.06) | 52289 (86.87) | 2103 (69.77) | | |
| With | 8813 (13.94) | 7902 (13.13) | 911 (30.23) | | |
| Sleep disturbance, n (%) | | | | $\chi^2$ = 889.73 | < 0.001 |
| Without | 44558 (70.50) | 43162 (71.71) | 1396 (46.32) | | |
| With | 18647 (29.50) | 17029 (28.29) | 1618 (53.68) | | |
| Physical victimization, n (%) | | | | $\chi^2$ = 798.89 | < 0.001 |
| Without | 44657 (70.65) | 43217 (71.80) | 1440 (47.78) | | |
| With | 18548 (29.35) | 16974 (28.20) | 1574 (52.22) | | |
| Verbal victimization, n (%) | | | | $\chi^2$ = 395.78 | < 0.001 |
| Without | 24545 (38.83) | 23894 (39.70) | 651 (21.60) | | |
| With | 38660 (61.17) | 36297 (60.30) | 2363 (78.40) | | |
| Social manipulation, n (%) | | | | $\chi^2$ = 514.65 | < 0.001 |
| Without | 34661 (54.84) | 33613 (55.84) | 1048 (34.77) | | |
| With | 28544 (45.16) | 26578 (44.16) | 1966 (65.23) | | |
| Property attacks, n (%) | | | | $\chi^2$ = 303.67 | < 0.001 |
| Without | 25946 (41.05) | 25168 (41.81) | 778 (25.81) | | |
| With | 37259 (58.95) | 35023 (58.19) | 2236 (74.19) | | |
| MPVS scores, mean ± SD | 6.38 ± 7.52 | 6.16 ± 7.53 | 10.74 ± 9.26 | t = −32.86 | < 0.001 |

t: t-test, $\chi^2$: Chi-square test, SD: standard deviation.

95% CI: 1.40–1.68). Social manipulation was also significantly associated with higher odds of e-cigarette use (crude OR = 2.37, 95% CI: 2.20–2.56; adjusted OR = 1.29, 95% CI: 1.16–1.43). Verbal victimization showed a weaker but significant association (adjusted OR = 1.13, 95% CI: 1.01–1.27), whereas property attacks were not significantly associated with e-cigarette use after adjustment (adjusted OR = 1.01, 95% CI: 0.90–1.12).

## Sex difference in the association between bullying victimization with e-cigarette use

An interaction term between sex and bullying type was included in the regression models to investigate potential sex differences. After full adjustments, only the interaction between sex and physical victimization was significant ($p < 0.001$). Consequently, separate logistic regression models were conducted for boys and girls (Tables 4 & 5). Among girls, physical victimization was strongly associated

**Table 2.** Association of bullying victimization severity with e-cigarette use.

| MPVS | Crude OR (95% CI) | *p*-value | Adjusted OR (95%CI) | *p*-value |
|---|---|---|---|---|
| Q1 | 1.00 (reference) | | 1.00 (reference) | |
| Q2 | 1.38 (1.21 ~ 1.56) | < 0.001 | 1.26 (1.11 ~ 1.44) | < 0.001 |
| Q3 | 2.20 (1.94 ~ 2.49) | < 0.001 | 1.60 (1.40 ~ 1.82) | < 0.001 |
| Q4 | 3.98 (3.55 ~ 4.46) | < 0.001 | 2.11 (1.86 ~ 2.40) | < 0.001 |

Note: OR: Odds Ratio, CI: Confidence Interval. Adjusted for demographics, alcohol and traditional cigarette use, and mental distress.

**Table 3.** Association of specific type of bullying victimization with e-cigarette use.

| | Crude OR (95% CI) | *p*-value | Adjusted OR (95% CI) | *p*-value |
|---|---|---|---|---|
| Physical victimization | 2.78 (2.59 ~ 3.00) | < 0.001 | 1.53 (1.40 ~ 1.68) | < 0.001 |
| Verbal victimization | 2.39 (2.19 ~ 2.61) | < 0.001 | 1.13 (1.01 ~ 1.27) | 0.039 |
| Social manipulation | 2.37 (2.20 ~ 2.56) | < 0.001 | 1.29 (1.16 ~ 1.43) | < 0.001 |
| Property attacks | 2.07 (1.90 ~ 2.24) | < 0.001 | 1.01 (0.90 ~ 1.12) | 0.926 |

Note: OR: Odds Ratio, CI: Confidence Interval. Adjusted for demographics, alcohol and traditional cigarette use, and mental distress.

**Table 4.** Association of specific type of bullying victimization with e-cigarette use in boys,

| | Crude OR (95% CI) | *p*-value | Adjusted OR (95% CI) | *p*-value |
|---|---|---|---|---|
| Physical victimization | 2.22 (2.04 ~ 2.42) | < 0.001 | 1.45 (1.30 ~ 1.62) | < 0.001 |
| Verbal victimization | 2.23 (2.02 ~ 2.47) | < 0.001 | 1.15 (1.00 ~ 1.32) | 0.052 |
| Social manipulation | 2.33 (2.13 ~ 2.54) | < 0.001 | 1.29 (1.14 ~ 1.45) | < 0.001 |
| Property attacks | 2.05 (1.87 ~ 2.26) | < 0.001 | 0.99 (0.87 ~ 1.13) | 0.931 |

Note: OR: Odds Ratio, CI: Confidence Interval. Adjusted for demographics, alcohol and traditional cigarette use, and mental distress.

**Table 5.** Association of specific type of bullying victimization with e-cigarette use in girls.

| | Crude OR (95% CI) | *p*-value | Adjusted OR (95% CI) | *p*-value |
|---|---|---|---|---|
| Physical victimization | 3.37 (2.91 ~ 3.89) | < 0.001 | 1.79 (1.51 ~ 2.13) | < 0.001 |
| Verbal victimization | 2.76 (2.30 ~ 3.30) | < 0.001 | 1.07 (0.85 ~ 1.35) | 0.559 |
| Social manipulation | 3.06 (2.61 ~ 3.59) | < 0.001 | 1.33 (1.09 ~ 1.63) | 0.005 |
| Property attacks | 2.61 (2.19 ~ 3.12) | < 0.001 | 1.04 (0.84 ~ 1.31) | 0.701 |

Note: OR: Odds Ratio, CI: Confidence Interval. Adjusted for demographics, alcohol and traditional cigarette use, and mental distress.

with e-cigarette use (adjusted OR = 1.79, 95% CI: 1.51–2.13). Social manipulation was also significantly associated with e-cigarette use in girls (adjusted OR = 1.33, 95% CI: 1.09–1.63), while verbal victimization (adjusted OR = 1.07, 95% CI: 0.85–1.35) and property attacks (adjusted OR = 1.04, 95% CI: 0.84–1.31) were not significantly associated.

In boys, physical victimization was independently associated with e-cigarette use (adjusted OR = 1.45, 95% CI: 1.30–1.62), although the association was weaker compared to girls. Social manipulation was also significantly associated with e-cigarette use in boys (adjusted OR = 1.29, 95% CI: 1.14–1.45). However, verbal victimization (adjusted OR = 1.15, 95% CI: 1.00–1.32) and property attacks were not significantly associated with e-cigarette use in boys (adjusted OR = 0.99, 95% CI: 0.87–1.13).

## Discussion

This study investigates the association between school bullying victimization and e-cigarette use among Chinese adolescents, providing valuable insights into this emerging public health issue within a non-Western context. The key findings include: (1) approximately 5% of the adolescents report e-cigarette use, which is significantly associated with the severity of bullying victimization; (2) different types of bullying exhibit varying associations with e-cigarette use; and (3) significant sex difference is identified, with the relationship between physical victimization and e-cigarette use being more pronounced in girls than in boys.

Our results aligned with previous research conducted in Western populations[11–16], suggesting a consistent link between bullying victimization and e-cigarette use across diverse cultural contexts. Adolescents who reported experiences of bullying, whether mild, moderate, or severe, were more likely to use e-cigarettes compared to their non-bullied peers. These results supported the notion that adolescents may turn to e-cigarettes as a coping mechanism in response to the emotional distress induced by bullying, consistent with the self-medication hypothesis highlighted in prior studies[30,31].

Interestingly, our results revealed that not all types of bullying have the same impact on e-cigarette use. Physical victimization exhibited the strongest association with e-cigarette use, followed by social manipulation, while verbal victimization showed a weaker association, and property attacks were not significantly related after adjustments. A possible explanation could be the distinct nature of physical bullying, which often involves direct threats to safety, may contribute to heightened levels of depression compared to other bullying types, thereby increasing the likelihood of substance use as a form of relief. A study in European adolescents supported our hypothesis, which found physical bullying victimization showed a greater association with suicidal behaviors compared to other types[32].

Consistent with prior studies, our research revealed stronger associations between bullying victimization and e-cigarette use among girls, particularly in instances of physical victimization[11,14,16]. These gender differences may be attributed to distinct coping mechanisms employed by males and females. Females are more likely to internalize the stress resulting from bullying, leading to heightened emotional distress such as depression. This internalization may, in turn, increase the likelihood of using e-cigarettes as a means to manage negative emotions. Several empirical studies support this hypothesis, demonstrating that the mediating effect of depression on the relationship between bullying victimization and substance use is more pronounced in girls than in boys[14,33]. Although the precise mechanisms underlying these sex differences remain unclear, our findings highlight the necessity of paying particular attention to girls who experience physical bullying. Tailored interventions that address the unique emotional and behavioral responses of female adolescents may be essential in mitigating the adverse effects of bullying and preventing subsequent e-cigarette use.

The high prevalence of peer bullying victimization and e-cigarette use, along with their significant association, underscores the need for integrated interventions in school settings. Anti-bullying programs should aim to create a supportive and inclusive environment, foster peer empathy, and promote emotional resilience[34–36] while educating students about the dangers of bullying and substance use. Incorporating counseling services and peer support groups can help victims manage emotional distress, potentially reducing the likelihood of e-cigarette use as a coping mechanism. Additionally, e-cigarette prevention efforts, such as awareness campaigns and skills-building workshops, should educate students about nicotine addiction and provide healthier alternatives for stress management[37–39]. By simultaneously addressing bullying and

e-cigarette use, schools can decrease emotional distress and risky behaviors, leading to improved mental health, reduced substance use, and a safer, more positive school environment.

This study has several limitations. First, due to the cross-sectional nature of the study, we cannot determine the temporal sequence between e-cigarette use and experiences of bullying. As such, while we hypothesize that bullying victimization may contribute to increased e-cigarette use, the reverse possibility, wherein e-cigarette use exacerbates bullying experiences or mental distress, cannot be ruled out. Longitudinal studies are required to better assess the directionality and causal pathways of this association. Second, the sample was drawn from a single city in China, limiting the generalizability of the findings to other regions or countries. Third, while various forms of bullying were assessed, cyberbullying was not included, which could provide a more complete picture of bullying's impact. Additionally, other potential confounders such as family dynamics, peer influences, and mental health conditions were not fully explored, which may mediate the relationship between bullying and e-cigarette use. Future research should address these limitations to further clarify the complex association between bullying victimization and adolescent e-cigarette use.

## Conclusions

This pioneering study highlights a significant association between school bullying victimization and e-cigarette use among Chinese adolescents, with notable sex differences. Parents, teachers, and policymakers should be aware of the high e-cigarette use rates among victims of bullying, particularly girls and those experiencing severe physical or social manipulation bullying. Early and regular assessments are vital in this population, and targeting bullying might help reduce e-cigarette use among adolescents.

## Ethical statements

The study procedures were carried out in accordance with the Declaration of Helsinki. The protocol was approved by the Ethics Committee of Zigong Mental Health Center (No. 2020-8-01). Before the start of the survey, participants gave informed consent. Parents' informed consent was also obtained for those younger than 18 years old.

## Author contributions

The authors confirm contribution to the paper as follows: study design: Chen Z, Tang J, Chen X, Liao Y; data acquisition: Li J, Liao A, Zhao L, Ren S, Liu Y, He R, Liang Y, Tan Y, Liao Y; analysis and interpretation of data, statistical analysis, and the drafting of the manuscript: Peng P, Liao Y. All authors have reviewed, revised, and approved the final manuscript.

## Data availability

The data that support the findings of this study are available on request from the corresponding author, Y Liao.

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## Conflict of interest

The authors declare that they have no conflict of interest. Dr Yanhui Liao is the Editor in Chief of *Journal of Smoking Cessation* who was blinded from reviewing or making decisions on the manuscript. The article was subject to the journal's standard procedures, with peer-review handled independently of Dr. Yanhui Liao and the research groups.

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