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The association between child sexual abuse and mental health in Chinese vocational high school students

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To explore the associations between verbal/visual and physical child sexual abuse (CSA) and mental health outcomes among vocational high school students (VHSS), who are at-risk populations of CSA and have mental health problems. A cross-sectional study using cluster sampling was conducted from April to June 2021 in China. Data were collected from VHSS using an anonymous self-administered online questionnaire. A five-item scale was used to measure different forms of CSA ranged from unwanted sexual harassment to forced sexual intercourse by adults before the age of 18. Mental health was assessed using the patient health questionnaire for depression and anxiety (PHQ-4), as well as two single-item questions to assess self- injury ideation and suicide ideation. A total of 3180 participants (49.0% male), with a mean age of 16.9 ± 1.3 years. Approximately 24.7% of male and 14.4% of female VHSS had experienced at least one form of CSA ($p < 0.001$). Physical CSA was associated with an increased risk of anxiety symptoms (OR = 2.21, 95% CI 1.40–3.50), self-injury ideation (OR 2.01, 95% CI 1.05–3.83) and suicide ideation (OR = 2.90, 95% CI 1.31–6.40) in boys, and anxiety symptoms (OR 1.69, 95% CI 1.05–2.71) and depressive symptoms (OR 1.75, 95% CI 1.23–2.50) in girls. Verbal/visual CSA was associated with an increased risk of self-injury ideation (OR 1.67, 95% CI 1.17–2.38) in girls only. Boy reported higher prevalence of CSA than girls. Physical CSA and mental health problems are significantly associated with some gender difference. It is imperative to take comprehensive strategies to address the challenges related to CSA, with particular attention to the needs of boys.

Keywords Adolescent, Vocational high school, Mental health, Sexual abuse, Gender differences

In the intricate tapestry of adolescent development, the mental well-being of adolescents emerges as a critical issue, not only shaping their immediate experiences but also laying the foundation for their adult life[1]. Adolescence is the period of transition from childhood to adulthood, which is characterized by rapid hormonal, physical, and psychological changes that can lead to various mental health problems. Globally, one in eight adolescents experience mental disorders, contributing to 20.27% of the disability-related burden, particularly due to anxiety and depression[2]. Suicide is the fourth leading cause of death for adolescents aged 15–19, following road injury, tuberculosis, and interpersonal violence[3]. In China, the prevalence of depression symptoms and self-injury among adolescents is 19.85% and 25.8%, respectively[4,5]; and the mortality rate of adolescent suicides has increased from 1.59/100,000 in 2017 to 2.83/100,000 in 2021[6]. The Chinese government is highly concerned about adolescent mental health problems and has implemented the Special Action on Mental Health Promotion for Students (2023–2025), which focuses on comprehensive work on the core elements, key areas, and critical links affecting students' mental health[7].

Child sexual abuse (CSA) is a global human right and public health concern with severe negative consequences for victims, their families, the social environment, and society as a whole[8]. The World Health Organization (WHO) defined CSA as sexual activity involving a child who is unable to understand or give informed consent, or that violates the laws or social taboos of society[9]. The global prevalence of CSA was estimated to be 11.8%[10].

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It varied substantially by gender (girls: 2%~56%, males: 0.4%~44%) and regions, with higher rates in Asia (4.1%~67.7%) and Africa (19.3%~42.7%)[8]. In China, according to a national survey, the prevalence of CSA among boys and girls in secondary schools was 14.1% and 11.8%, respectively[11]. Individuals with a history of CSA are potentially at risk of early pregnancy, HIV infection, and drug or alcohol abuse[8]. Previous studies have also indicated that CSA, including sexual harassment, unintended sexual touching[12,13], and compulsive sexual behavior[14–20], significantly increases the risk of mental health problems.

Among the existing literature, however, most studies have mixed the experiences of verbal/visual and physical sexual abuse together in their analyses, without exploring the specific effects of verbal/visual and physical sexual abuse on mental health problems[16,19–22]. In addition, most of the studies have focused on a single psychological outcome, without considering the other potential mental health outcomes of CSA[12,15,21,22]. Furthermore, the impact of CSA on mental health may be culturally differentiated, for example, the views of chastity and patriarchal ideologies in Asian cultures may exacerbate the severity of survivors' post-traumatic stress disorder (PTSD)[23,24]. However, few studies explored the association between CSA and mental health problems among Chinese adolescents[12,16,20,25].

Vocational high school students (VHSS) are a group that is often overlooked in China. VHSS usually rank in the bottom 50% of the National Senior High-school Entrance Examinations, receive skills training for employment purposes, and are placed in internships in enterprises during their final/third school year. Most VHSS come from low-income families with parents who have high divorce rates and low educational levels and have poor family support and monitoring[26,27], which are risk factors for the occurrence of CSA[28]. In contrast to their counterparts in general high school, VHSS often have more problem behaviors (e.g., drinking and smoking), and a higher risk of mental health problems (e.g., depressive symptoms and self-injury)[29,30]. It is imperative to gain an understanding of the CSA experiences and their association with mental health issues among VHSS. However, there have been few studies that have focused on CSA among VHSS in China.

This study aims to fill a gap by investigating the prevalence of CSA among VHSS and exploring the associations between verbal/visual and physical CSA and mental health outcomes, including anxiety and depression symptoms, self-injury ideation, and suicide ideation. We hypothesized that: (1) The prevalence of CSA among Chinese VHSS is higher than that among their peers with gender difference; (2) CSA exposure is positively associated with mental health outcomes, especially physical CSA; (3) There are gender differences in the associations between different types of CSA and mental health outcomes.

Materials and methods

Study design, participants and procedure

We conducted a cross-sectional study from April to June 2021 in Shanghai Municipality and Shaanxi Province, which differ in geographical environment and economic development. Shanghai is an economically developed provincial-level city located on the eastern coast of China, while Shaanxi is an underdeveloped province in northwest China. This study includes six vocational high schools, three of which are located in central, suburban, and exurban areas of Shanghai, and the other three in cities with high, medium, and low economic levels in Shaanxi, respectively. Subjects were selected using cluster sampling by class, ensuring that in each school students from three or more faculties with different majors were surveyed with balanced gender and grade distributions. The sample size was calculated using the following formula:

$$\mathrm{n} = \frac{Z^2_{1-\alpha/2} \times p(1-p)}{d^2} \times DE$$

The significance level $\alpha = 0.05$, the expected prevalence of mental health outcomes $p = 19.8–43.5\%$[4,5,31], the allowable error $d = 0.1p$, and the design effect of cluster sampling $DE = 1.5$. The estimated refusal rate is 5%, and the theoretical maximum sample size is 2457.

Anonymous self-administered questionnaires were used to collect data via an online platform during school time. The questionnaire includes personal characteristics (age, gender, etc.), lifestyle (smoking, drinking, etc.), family characteristics (marital status, siblings, family economic status, etc.), feelings at school, bullying, and sexual-related behaviors. Two trained investigators presented at each school to facilitate the process by survey introduction, e-questionnaire link release, questionnaire interpretation, and data verification. Informed consent was obtained from the participants and their legal guardians, and all procedures were conducted in accordance with the principles of the Declaration of Helsinki. The study protocol was reviewed and approved by the Medical Ethics Committee of the Shanghai Institute of Biological and Pharmaceutical Technologies (formerly the Shanghai Institute of Planned Parenthood Research, No. PJ2021-24).

Initially, questionnaires were distributed to 3,253 eligible subjects, and 3,237 filled questionnaires were returned. After excluding 57 duplicates, a total of 3180 records were included in the final analysis (effective response rate was 97.8%). This study was reported in accordance with the strengthening the reporting of observational studies in epidemiology (STROBE) guideline for cross-sectional studies (https://www.strobe-statement.org/checklists/)[32]. The completed STROBE checklist is provided as Supplementary file 1.

Measurements

Mental health outcomes

Mental health outcomes assessed in this study included anxiety symptoms, depressive symptoms, self-injury ideation, and suicide ideation. Depressive and anxiety symptoms were measured by the Patient Health Questionnaire for Depression and Anxiety (PHQ-4)[33], which consisted of four items, two of which were designed to screen for depressive symptoms and the other two for anxiety symptoms in the previous two weeks. Each item has four options (not at all-almost daily) and is scored on a scale of 0–3; if the total anxiety or depressive

score is >2, the respondent is considered to have anxiety or depressive symptoms. Self-injury ideation and suicide ideation were measured by two questions in which participants were asked whether they had seriously considered self-injury or suicide in the past 12 months (Yes/No).

CSA

The CSA scale was adapted from Zhang's seven-item CSA scale, with the item "touched genital or forced to touch genital by mouth" integrated into item 3 described below, and the last two items (attempted to have sexual intercourse, and forced to have sexual intercourse) combined into a single item[11]. The participants answered "yes" or "no" if they had the following experiences with an adult before the age of 18 under circumstances they did not want or understand: (1) unwanted sexual harassment, such as being told dirty jokes or shown pornographic pictures, publications or supplies; (2) being forced or persuaded to take off clothes or show private parts; (3) being touched on privates/genital/breasts or forced to touch his/her privates/genital/breasts; (4) being rubbed on the body with his/her genitals; (5) being attempted or forced to engage in sexual intercourse. The Cronbach's alpha of the present scale was 0.77. In this study, item 1 was considered as verbal/visual CSA, while the remaining items were regarded as physical CSA. Based on their experience of each item of CAS (yes or no) and considering the limited number of them reported the experience of physical CSA only (n = 71), the participants were categorized into three groups: without CSA (n = 2562), verbal/visual CSA only (n = 355), physical CSA with or without verbal/visual CSA (n = 263).

Covariates

Covariates assessed in this study include age, sex, region (Shanghai/Shaanxi), living with parents for most of their lifetime or not, parents' marital status (married and living together /others), family socioeconomic status (good/average/ poor), feelings about school life (good/average/ poor), ever smoked (yes/no), ever consumed alcohol (yes/no), being bullied in the past 12 months (yes/no), and experience of a romantic relationship (yes/no) and heterosexual intercourse (yes/no). The covariates were selected based on the evidence of potential confounders from existing literatures[14,18,34,35].

Data analysis

All data were managed and analyzed using Stata/SE 15.1 (StataCorp LLC, College Station, TX, USA). Means/standard deviations and percentages were used to describe socio-demographic characteristics and experience of CSA. A chi-squared test was used to compare gender differences in CSA, as well as differences in mental health problems among subgroups of CSA (without CSA, verbal/visual CSA, and physical CSA).

Multivariable binary logistic regression analyses were used to estimate associations between CSA and anxiety symptoms, depressive symptoms, self-injury, and suicide ideation, adjusted for covariates. Considering cluster sampling method was used in this study, multilevel mixed-effects logistic regression (Command *melogit*) analyses were used to adjust the standard errors for clustering at region-school level when the outcome indicators exhibit intra-cluster correlation. If clustering effect was observed, adjustments were implemented based on the lower level, such as the school level. In the study, self-injury ideation and suicide ideation exhibit clustering effect at both the region and school levels ($p < 0.01$), and depressive symptoms exhibit clustering effect only at the school level ($p = 0.038$), while anxiety symptoms do not exhibit clustering effect. Diagnostic tests (Command *vif*) indicated low multicollinearity among the independent variables, with a mean variance inflation factor (VIF) of 1.20 (range: 1.02–1.52). The Hosmer-Lemeshow test (Command *lfit*) for the model yielded p-values ranging from 0.110 to 0.761, suggesting that the model fits the data well. To explore whether gender acts as a potential effect modifier in the association between CSA and mental health outcomes, stratified analyses by sex were conducted. Results at $p \leq 0.05$ were considered statistically significant, and odds ratios (ORs) and 95% confidence intervals (CI) were reported for all models.

Results

Socio-demographics of study participants

As shown in Tables 1 and 49.7% and 50.3% of the participants were from Shanghai and Shaanxi, respectively. The participants had a mean age of 16.9 ± 1.3 years with an equal distribution of males and females (49.0% vs. 51.0%). The prevalence of smoking, drinking, and being bullied in the past 12 months among participants was 20.9%, 53.7%, and 6.3%, respectively. More than half of them had a sibling(s) (56.6%), lived in families with average economic level (63.4%), reported their parents were in marriage and living together (78.4%), and were living with both parents for most of their lifetime (76.6%). Approximately half of the participants reported having ever been involved in a romantic relationship, while 5.8% reported ever engaging in heterosexual sexual intercourse (Table 1).

Prevalence of CSA

Approximately 19.4% of VHSS had experienced at least one type of CSA. The most common type was unwanted sexual harassment (17.2%), followed by being touched or forced to touch privates/breast, being forced to remove clothes/ show privates, and being rubbed on the body by genitals (6.1, 4.3, and 3.8%, respectively), and being attempted or forced to have sexual intercourse (2.4%) (Table 2). The prevalence of each type of CSA reported by boys was higher than that reported by girls ($p < 0.05$). There was no significant difference in the prevalence of CSA between students in Shanghai and Shaanxi, except for forced exposure of private body parts (Table 2).

Association between CSA and mental health problems

The prevalence of anxiety symptoms, depressive symptoms, self-injury ideation, and suicide ideation in the VHSS was 15.3, 18.7, 9.3, and 7.5%, respectively (Table 3), with a higher prevalence of anxiety symptoms, self-

Variables	x ± s/ %
Age, years	16.9 ± 1.3
Sex, Boy	49.0
Only child, Yes	43.4
Region	
Shanghai	49.7
Shaanxi	50.3
Feeling about school life	
Good	48.1
Average	44.3
Poor	7.6
Family economic status	
Good	26.0
Average	63.4
Poor	10.6
Parental marital status	
Married and living together	78.4
Others	21.6
Living with parents	
Both	76.6
Father only	5.7
Mother only	8.1
None	9.7
Smoking, Yes	20.9
Drinking, Yes	53.7
Bullied in the past 12 months, Yes	6.3
Romantic relationship, Yes	50.0
Heterosexual intercourse, Yes	5.8

Table 1. Socio-demographic characteristics of participants ($n = 3180$).

Variables	Total ($n = 3180$)	Sex			Region		
		Boy ($n = 1557$)	Girl ($n = 1623$)	p-value	Shanghai ($n = 1580$)	Shaanxi ($n = 1600$)	p-value
Any form of CSA	19.4	24.7	14.4	< 0.001	20.6	18.2	0.090
CSA subtypes							
Unwanted sexual harassment	17.2	22.9	11.7	< 0.001	18.3	16.1	0.106
Forcing you to take off your clothes or show your privates	4.3	5.1	3.5	0.019	5.4	3.1	0.001
Touching your privates/breasts or forcing you to touch his/her privates/breasts	6.1	7.1	5.1	0.021	6.9	5.3	0.052
Rubbing genitals on your body	3.8	5.3	2.4	< 0.001	4.5	3.2	0.055
Forced sex	2.4	3.5	1.3	< 0.001	2.9	1.9	0.056

Table 2. Prevalence of CSA, by sex and region (%).

injury ideation, and suicide ideation among girls than boys ($p < 0.01$). The prevalence of the above-mentioned mental health outcomes was significant differences among subgroups of CSA with the lowest prevalence among the group without CSA (13.2, 16.8, 8.0, and 6.1%, respectively), and the highest prevalence among the group of physical CSA (30.0, 30.4, 16.2, and 15.6%, respectively) (Table 3).

Multivariable logistic regression analysis indicates that CSA was associated with mental health outcomes with some gender differences after controlling for covariates (Table 4). Verbal/visual CSA was only associated with self-injury ideation in girls (OR = 1.67, 95% CI: 1.17–2.38). Physical CSA was significantly associated with an increased risk of anxiety symptoms (OR = 1.98, 95% CI: 1.44–2.72) and depressive symptoms (OR = 1.49, 95% CI: 1.06–2.10). Additionally, physical CSA was significantly associated with self-injury ideation (OR = 2.01, 95% CI: 1.05–3.83) and suicide ideation (OR = 2.90, 95% CI: 1.31–6.40) in boys but not in girls (Table 4).

Discussion

In this study, we found that the prevalence of CSA reporting was higher among boys than among girls. Physical CSA was significantly associated with anxiety symptoms and depressive symptoms. However, gender differences

Experience of CSA	*N*	Anxiety symptoms	Depressive symptoms	Self-injury ideation	Suicide ideation
Total	**3180**	**15.3**	**18.7**	**9.3**	**7.5**
No	2562	13.2*	16.8*	8.0*	6.1*
Verbal/visual	355	19.2	23.7	13.5	11.6
Physical	263	30.0	30.4	16.0	15.6
Boys	**1557**	**13.3**	**17.3**	**6.4**	**5.3**
No	1173	11.1*	15.4*	5.1*	3.8*
Verbal/visual	240	16.7	22.9	7.5	7.1
Physical	144	25.7	23.6	14.6	14.6
Girls	**1623**	**17.2**	**20.0**	**12.1**	**9.6**
No	1389	15.1*	18.0*	10.5*	8.0
Verbal/visual	115	24.4	25.2	26.1	20.9
Physical	119	35.3	38.7	17.7	16.8
$^*p < 0.01$					

Table 3. Prevalence of mental problems, by experience of CSA (%).

Group	Anxiety symptoms			Depressive symptoms		
	Total	Boys	Girls	Total	Boys	Girls
No CSA	ref.	ref.	ref.	ref.	ref.	ref.
Verbal/visual CSA	1.12 (0.83–1.52)	1.34 (0.90–2.01)	1.09 (0.66–1.78)	1.13 (0.88–1.45)	1.30 (0.92–1.83)	1.07 (0.89–1.29)
Physical CSA	1.98 (1.44–2.72)	2.21 (1.40–3.50)	1.69 (1.05–2.71)	1.49 (1.06–2.10)	1.18 (0.78–1.79)	1.75 (1.23–2.50)
	Self-injury ideation			Suicide ideation		
	Total	Boys	Girls	Total	Boys	Girls
No CSA	ref.	ref.	ref.	ref.	ref.	ref.
Verbal/visual CSA	1.16 (1.00-1.36)	1.18 (0.89–1.55)	1.67 (1.17–2.38)	1.34 (0.87–2.05)	1.53 (0.95–2.48)	1.68 (0.86–3.27)
Physical CSA	1.21 (0.83–1.76)	2.01 (1.05–3.83)	0.66 (0.42–1.03)	1.64 (0.87–3.07)	2.90 (1.31–6.40)	0.85 (0.35–2.06)

Table 4. The association between CSA and mental health problems [OR (95% CI), $N = 3180$] Adjusted for region, age, family economic status, parental marital status, living with parents, feeling about school life, smoking, drinking, bullied in the past 12 months, romantic relationship and heterosexual intercourse.

were observed in other mental health outcomes. Specifically, physical CSA was associated with increased risks of self-injury and suicide ideation among boys, whereas it was associated with depressive symptoms among girls. Additionally, girls who experienced verbal/visual CSA exhibited higher levels of self-injury ideation.

The prevalence of CSA varies significantly across different countries and regions, depending on the definition of CSA, measurements, culture, and characteristics of study population, and with notable gender differences[8]. The overall prevalence of CSA in this study was 19.4%, which is comparable to that of Sichuan general high school students (16.6%)[36]. Both studies demonstrated a higher prevalence in boys than in girls, which is consistent with previous research conducted in Poland and Lebanon[8]. It is commonly believed that girls are exposed to CSA earlier and more frequently than boys[37]. Previous research in China indicates that approximately half of Chinese parents believe their children are at low risk of sexual abuse under the supervision of family and school, particularly boys[38]. Furthermore, it is obvious that girls may suffer more serious physiological consequences (e.g. unintended pregnancies and abortions) than boys when they are sexually abused. Consequently, parents in China tend to raise the safety awareness of girls and provide them with information about self-protection but neglect boys, thereby increasing boys' risk of CSA[39]. Additionally, due to fear of dishonor, stigmatization, and reprisals, girls may be inclined to conceal their experiences of CSA after weighing the potential consequences[23,40].

Previous research suggests that sexual harassment is more likely to occur in workplace environments due to unequal power relationships, with younger students being particularly susceptible to such incidents[41,42]. However, the present study did not observe a higher proportion of CSA among VHSS during their internships in grade three (Grade I/II/III: 20.5%/19.6%/18.0%, $p = 0.345$). This may be attributed to the relatively robust security environment in China and the enforcement of related legal and administrative provisions. The *Provision of the Administration Internships for Vocational School Students*, issued in 2016, promotes equal relationships between students and internship organizations, thereby safeguarding students' personal safety and rights. Additionally, the *Special Provisions on the Labor Protection of Female Workers*, implemented in 2012, explicitly stipulates that employers must formulate preventive measures against sexual harassment of women. The *Civil Code (2020)* extends the scope of protection against sexual harassment to include all citizens, regardless of gender.

The present study found a significant association between verbal/visual CSA and self-injury ideation in the past 12 months in girls only. Verbal/visual CSA often reflects attempts to demean or exploit female, which can have a negative impact on their mental health[35,43]. For boys, however, verbal/visual CSA is often dismissed

as a joke, thereby reinforcing their masculine authority and identity[44]. Therefore, girls may be more sensitive to verbal/visual CSA. In Asian communities that prioritize family honor and exhibit misogynistic beliefs[45], however, girls often remain silent about experiences of sexual harassment and negative emotions to avoid parental reprimand or bringing shame to their families[45,46]. In the absence of effective support, girls who have experienced verbal/visual CSA may resort to self-injury as a means of self-control and regulation, which helps to prevent catastrophic emotional eruptions, such as suicide[47]. Additionally, self-harm can be considered a socially contagious behavior, suggesting that girls may imitate peers who are in similar predicaments[48]. The present study did not find a significant association between verbal/visual CSA and emotional problems such as anxiety symptoms and depressive symptoms in the past two weeks, aligning with findings from a Swedish study[49]. The psychological effects of sexual harassment may diminish over time as individuals develop coping mechanisms and gain access to supportive resources[50]. Further investigation is needed to elucidate the specific mechanisms involved.

The association between physical CSA and adverse mental health outcomes, particularly anxiety symptoms and depressive symptoms, stands as a primary finding in this study, aligning with findings of previous research[17,21,34]. Physical CSA often results in physical injuries and long-term adverse psychological consequences, including cognitive distortions, behavioral changes, impaired psychological resilience, and triggering the expression of genetic liability[51]. From a neurocognitive perspective, physical CSA would cause neurological deficits, such as decreased thickness in the ventromedial prefrontal cortex, damage to neurons in the hippocampus, and injury to the prefrontal cortex and amygdala[52]. These neurological deficits can disrupt key cognitive functions related to emotion regulation, and worsen the individual's negative psychiatric problems[53]. In addition, adolescents who have experienced CSA may be unable to develop a stable sense of self and self-esteem, which in turn mediates the onset of anxiety symptoms and depressive symptoms[54].

The impact of physical CSA on self-injury or suicide ideation can be long-lasting and latent. Rumination of past CSA can trigger traumatic memories as the cognitive system matures[55], which can increase the risk of suicide and self-injury even in adulthood[18,22,56]. A meta-analysis suggested that neurobiological changes caused by trauma, such as CSA, lead to increased impulsivity[57], which in turn causes adolescents to have more suicidal ideation or engage in self-destructive behaviors[22]. In contrast to previous studies that have observed an association between physical CSA and self-injury ideation and suicide ideation in both sexes[22,34], the present study only found the association in boys. The failure to observe an association among girls may be attributed to underreporting and misclassification bias. In Chinese cultural beliefs, female victims of CSA are often associated with impurity and dishonor and blamed for "their own faults" [23,45]. Consequently, girls tend to underreport their experiences of severe CSA to investigators[23,40], which may result in misclassification bias and an underestimation of the true association between exposure and outcomes.

Mental health problems among Chinese adolescents have been increasing in recent years[31], and CSA is an important potential risk factor. In this study, the prevalence of mental health outcomes among both male and female VHSS who experienced physical CSA (15.6%~30.4%) was approximately twice as high as that of those without CSA exposure (6.1%~16.8%). It is imperative to take comprehensive strategies to address the challenge related to CSA in order to achieve substantial improvements in adolescent mental health. Previous evidence suggests that comprehensive sexuality education (CSE) is an effective strategy for preventing CSA[58], however, both school and family sexuality education for VHSS is inadequate in China[59]. Sexuality remains a sensitive topic that is often not discussed, especially between parents and children. Additionally, the content of sexuality education in schools is typically limited to topics such as puberty development, interpersonal relationships, and the prevention of HIV/AIDS[59]. Fortunately, the *Law on the Protection of Minors* adopted on October 17, 2020, explicitly stipulates that schools and kindergartens shall carry out sexuality education for minors appropriate for their age, and improve their awareness and ability of self-protection against sexual abuse. Despite these policies, efforts are needed to promote school and family sexuality education for VHSS. Moreover, fostering an environment conducive to open dialogues regarding CSA is important for destigmatization and dispelling the myths related to CSA, e.g. boys can't be sexually abused, it is the victim's responsibility to be sexually abused. This supportive environment should be complemented by accessible psychological support services, ensuring that victims receive the necessary care and assistance.

The strengths of this study lie not only in focusing on the previously overlooked population of VHSS, but also in exploring the associations between CSA and multiple mental health outcomes with a gender lens. Furthermore, this study builds upon previous studies of mixing the different types of CSA together by examining the mental impact of verbal/visual and physical CSA separately.

However, several limitations exist in this study. Firstly, the nature of the cross-sectional study makes it generally only reveal associations between CSA and mental health outcomes and cannot establish causality. Secondly, this study employed a self-administered questionnaire, which may be susceptible to reporting bias. Participants may be inclined to underreport sensitive information or socially disapproved behaviors. However, this study sought to ensure the credibility of the data by employing an anonymous questionnaire and emphasizing confidentiality prior to the survey. Thirdly, the measurement of CSA did not account for CSA perpetrated by peers or minors, and it used single-item measure to capture both verbal (e.g., being told dirty jokes) and visual (e.g., being shown pornographic images) CSA. Future research could benefit from multi-item scales to disentangle these different harassment experiences, which enable clearly elucidate the differential impact of these forms of CSA on mental health. Fourthly, although the study sample size exceeds 3,000, some subgroups, particularly in subgroup analyses by gender, have small sample size and small outcome events, leading to less stable results in the multivariate analyses which should be interpreted with caution. Fifthly, since the data of the study was collected from 2021, the patterns of CSA and its association with mental health may have changed during recent years. Future studies could confirm these patterns with more recent data. Finally, due to the failure to collect detailed family information from participants who did not reside with their parents for most of their

lifetime, we did not adjust for parental education levels in the multivariable logistic regression models, which was a potential confounder[28,60]. Nevertheless, we conducted sensitivity analyses in subsample that did live with their parents for most of their lifetime. The results remained consistent before and after adjusting for parental education levels (Supplementary Tables 1 and 2), indicating that the findings from our main analysis with the whole sample are robust.

In conclusion, boy reported higher prevalence of CSA than girls. CSA was positively associated with mental health outcomes among VHSS with gender difference. Boys experienced physical CSA were associated with an increased risks of self-injury ideation and suicide ideation, while girls were more susceptible to self-injury ideation from verbal/visual CSA. Parents, schools, and policymakers should address the vulnerabilities of VHSS, challenge gender myths about CSA, and enhance their CSA awareness and coping skills through sexuality education and mental health support services to reduce the risk of mental health problems.

Data availability

The datasets used and/or analyzed in the current study are available from the corresponding author upon reasonable request.

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Author contributions

X.T. conceptualized and designed the study; Y.F., Y.Z. and Y.J. collected and cleaned the data; Y.F. conducted the statistical analysis and drafted the manuscript; C.Y., Q.L. and S.X. interpreted the results; C.L., X.Z., and X.T. contributed to discussion; L.L. and P.H. were involved in project administration; and all authors read and approved the final manuscript.

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Declarations

Competing interests
The authors declare no competing interests.

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