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Does parent-child connectedness influence substance use among Bhutanese adolescents: evidence from a national survey?

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Abstract

Background Adolescent substance use is recognized as a global health crisis that threatens adolescents' physical and mental health worldwide. Alcohol is the most available one; WHO findings suggest that more than 155 million adolescents, representing over a quarter of the adolescent population aged between 11 and 15, use alcohol-based drinks worldwide. Since adolescents are the future of the world, protecting them from substance use is of paramount importance.

Objectives This study aimed to explore the prevalence of adolescent substance use (alcohol, marijuana, and tobacco) among Bhutanese adolescents and examine the association with parent-child connectedness as a protective factor while controlling sociodemographic, socio-emotional distress, and other contextual factors.

Methods A total of 7576 school-going adolescents' data from the 2016 Global School-based Student Health Survey (GSHS) Bhutan dataset were used in this study. To analyze the relationship between predictor and outcome variables, both univariate and multivariate binary logistic regression models were constructed utilizing the "complex samples" tool of SPSS 25. A significance level of $p \leq 0.05$ was used for the analyses.

Results An estimated 30.7% of the Bhutanese school-going adolescents used tobacco, 25.8% consumed alcohol, and 12.7% used marijuana. Parent-child connectedness: (i) child's homework supervision and (ii) child's free time supervision by parents significantly lower the odds of using tobacco and alcohol consumption, while parents understanding child's problem showed no significant association with substance use among the respondents. However, no significant association was found between parent-child connectedness and marijuana use. Besides parental connectedness, anxiety, bullying, passive smoking, school truancy, being involved in fights, or being attacked were also significantly associated with adolescents' substance use.

Conclusion Parental connectedness has been found to be an important factor that can lead to a substantive reduction in substance use among the adolescents of Bhutan. However, the lesson is pertinent for any global initiatives aiming to prevent the harmful use of substances among global adolescents.

Highlights

• Tobacco use was highest, followed by alcohol and marijuana use.

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- The prevalence of substance use was higher in male than female adolescents.
- Parental homework supervision significantly lowered the odds of alcohol and tobacco use.
- Parental free-time supervision significantly reduced the odds of alcohol and tobacco use.
- No significant association was found between parent-child connectedness and marijuana use.

Keywords Parental connectedness, Adolescent, Alcohol, Marijuana, Tobacco, Bhutan

Introduction

Worldwide, adolescents are susceptible to numerous behaviors that place their health at risk. There is a wide range of adverse health and societal effects linked with substance use, which also leads to a wide variety of risky behaviors [1], for instance, experimenting with cigarettes, alcohol, and illicit drugs [2, 3]. According to the World Health Organization (WHO), over a quarter of individuals aged 15 to 19 drink alcohol-based beverages worldwide, representing 155 million adolescents. At least one in ten adolescents ages 13 to 15 use tobacco; however, the rate is much higher in developing countries. Moreover, cannabis is the most commonly used psychoactive substance among adolescents, with 4.7% of 15–16 year-olds having used it at least once in 2018 [4].

Many factors increase the risk of substance use among adolescents, including social pressure, lack of knowledge about the dangers of drug use, problems within the family (e.g., lack of supervision or communication between parents and their children), and the ease with which substances can be obtained [5–7]. The family context in terms of the psychological development of adolescents has been acknowledged widely in numerous literatures [8–11], and several studies worldwide reflected the notion that low levels of parental support and connection, as well as a lack of parental affection and interaction directly influence substance use among adolescents [9, 12, 13]. Hence, adolescent substance use prevention may benefit from a change in parental communication with their children [14]. Several studies suggested that adolescent substance use is inversely related to the number and quality of conversations between parents and their children [15, 16]. In fact, good within-family communication [17], as well as parental attitude towards substance and cautionary statements regarding substance use, can significantly reduce the possibility of indulging in substance during adolescence years [18].

In Bhutan, a small country nestled in the Himalayas, people of all ages and walks of life suffer from a high rate of substance use, especially the youths (11–24 years of age), who constitute about 24% of the entire population [19, 20]. For instance, the average adult Bhutanese consumes 8.47 L of pure alcohol yearly, significantly more than the global average of 6.4 L [21–23]. Alcohol is widely available in Bhutan, and according to a report, there are at least 5407 alcohol outlets in Bhutan, many of which rarely comply with the alcohol-selling policy [22]. The national policy and strategic framework to reduce the harmful use of alcohol (2015–2020) was adopted in 2015 in Bhutan, which identifies alcohol as not an ordinary commodity and enforces careful regulations on the production, sales, and promotion of alcohol throughout the country [24]. The mean age of onset of alcohol use was found to be 15.5 years in a study, the majority of whom are school-going adolescents [25]. Additionally, despite Bhutan's anti-smoking agendas and policies, two consecutive nationwide surveys portrayed a grim image of high tobacco use among the population, including the adolescents of Bhutan [26]. Therefore, there is a need for comprehensive studies on the determinants that trigger adolescent substance use and to explore potential preventive measures. However, there is a dearth of studies assessing the prevalence of substance use among Bhutanese adolescents and the possible factors that might be influencing or restraining substance use among them. Also, there is a lack of studies examining the effects of parent-child connectedness on adolescents' substance use in Bhutan. Our study aimed to fulfill this research gap using nationally representative data from the 2016 Global School-based Student Health Survey (GSHS) by considering several control variables, including sociodemographic characteristics, socioemotional distress, and other contextual factors.

Methodology

We used the 2016 Bhutan Global School-Based Student Health Survey (GSHS) dataset for the study. Middle and high school students across the country took part in the survey. The survey protocol was developed by WHO back in 2003. Demographics, substance use, sexual behavior, violence, unintentional injury, diet, hygiene, mental health, physical activity, parental homework check, parental observation, and problem-solving are some of the numerous variables that constitute the GSHS questionnaire [27].

Study design

The study was a secondary analysis of cross-sectional survey data from Bhutan GSHS 2016. The survey used a self-administered questionnaire to obtain data on adolescents' health behavior and protective factors related to the leading causes of adolescent morbidity and mortality worldwide. Details of the methodology and description of data are available on the WHO website [28].

Study setting and sampling

The survey was conducted in Bhutan, situated in the eastern Himalayas and bordered by China and India. The total population of this landlocked nation in South Asia was 749,761 at the time of 2016 GSHS. The sample consisted of Bhutanese students enrolled in classes 7 to 11, who were aged between 13 and 17. Utilizing a two-stage cluster sample design, data representative of all Bhutanese students in grades 7 through 11 were generated. Schools were initially chosen using a probability method that was proportional to their enrollment size. In the second stage, classes were chosen at random, and participation was open to all students in those classes. The student response rate was 95%, while the school response rate was 100%. All secondary school-going adolescents aged 13 −17 were considered the population, and the total sample size was 7576. However, 982 data appeared to have missing values under the study variables. Therefore, the multiple imputation method replaced those missing values with plausible ones.

Study variables

Predictor variables

The main predictor variables used for this study were (i) parental homework supervision, (ii) parents' understanding of their children's problems, and (iii) parental supervision of their children's free time activities. These three variables were selected to define the parental connectedness [29–31]. These were measured using the following three questions: percent of students who reported that their parents routinely checked their homework (during the 30 days before the survey), percent of students who reported that their parents made efforts to understand their problems and worries (during the 30 days before the survey), percent of students who said that their parents knew what they were doing with their free time (during the 30 days before the survey). Students' responses were recorded as either *yes* or *no*. The description of the variables used in this study is presented in Supplementary Materials, Table A1.

Outcome variables

We perceived the use of alcohol, marijuana, and tobacco among adolescent students as outcome (dependent) variables. Students were asked about their use of alcohol, marijuana, and tobacco at least one or more times during the 30 days before the day they took part in the survey. The survey focused on substance use rather than substance abuse, which are two different terminologies referring to two different circumstances. While substance use defines a comfortable level of drug consumption, the American Psychological Association (APA) characterizes substance abuse as a repetitive and uncontrollable use of substances that leads to negative consequences in various areas of life, such as social, occupational, legal, or interpersonal issues. The outcome variables were included in the dataset using the following questions: (i) percent of current alcohol drinkers (defined as having consumed alcohol at least once in the 30 days prior to the survey), (ii) percent of current marijuana users (defined as having used marijuana on at least one occasion in the 30 days prior to the survey), and (iii) percent of current tobacco users (defined as using tobacco at least once in the last 30 days prior to the survey). The responses were recoded to *yes* (coded as 1) or *no* (coded as 0) for the analyses (see Supplementary Materials, Table A1).

Control variables

Some control variables were incorporated into the study to enhance the validity of the findings and to account for potential confounding factors. We identified the control variables based on the suggestions from earlier studies on relevant subject matter. We used control variables as potential impact factors of alcohol, marijuana, and tobacco usage. Lack of close friends, anxiety, being bullied in school, physical assault, peer support, being involved in fights, loneliness, passive smoking, and school truancy were some of the control variables used in the analysis of this study (see Supplementary Materials, Table A1).

Data processing and analysis

A weighting factor was applied to each in-school adolescent record to reflect the likelihood of sampling each in-school adolescent and reduce bias by compensating for different patterns of nonresponse. The weighting formula used for the estimation is as follows:

$$W = W1 * W2 * f1 * f2 * f3.$$

In which:

W1 - The inverse of the probability of selecting each school.

W2 - The inverse of the probability of selecting each classroom.

f1 - A school-level nonresponse adjustment factor.

f2 - A student-level nonresponse adjustment factor calculated by classroom.

f3 - A post-stratification adjustment factor calculated by sex within grade.

We used SPSS 25 and Jamovi 2.3.21 software for data analysis. Frequency and weighted percentage were utilized to describe the categorical variables. Univariate analyses were performed to examine the sample characteristics and assess the prevalence of substance use (Table 1). Univariate Logistic Regression (ULR) and Multivariate Logistic Regression (MLR) were used to determine the effects of parent-child connectedness on

Table 1 Characteristics and prevalence of substance use among the respondents ($n = 7576$)

Study Variables	Sample *n* (%) [a]	Substance Abuse					
		Alcohol		Marijuana		Tobacco	
		n (%) [a]	*P*–value	*n* (%) [a]	*P*–value	*n* (%) [a]	*P*–value
Total	7576 (100)	1917 (25.8)		937 (12.7)		2240 (30.7)	
Explanatory variables							
Parental Homework Supervision							
Yes	1992 (26.8)	404 (21.0)	0.001***	191 (9.8)	0.001***	496 (23.7)	0.001***
No	5584 (73.2)	1513 (27.5)		746 (13.8)		1744 (32.4)	
Parents Understand Problems							
Yes	3353 (44.2)	743 (22.5)	0.001***	343 (10.5)	0.001***	877 (27.0)	0.001***
No	4223 (55.8)	1174 (28.4)		594 (14.5)		1363 (33.6)	
Parental Free Time Supervision							
Yes	2714 (36.4)	505 (18.9)	0.001***	234 (9.0)	0.001***	643 (24.5)	0.001***
No	4862 (63.6)	1412 (29.7)		703 (14.9)		1597 (34.3)	
Socio-demographics							
Sex							
Male	3428 (48.1)	1226 (35.5)	0.001***	759 (21.8)	0.001***	1523 (44.5)	0.001***
Female	4148 (51.9)	691 (16.7)		178 (4.3)		717 (17.9)	
Age							
≤13	1047 (14.8)	137 (13.9)	0.001***	60 (6.0)	0.001***	176 (18.4)	0.001***
14–16	3761 (49.0)	868 (23.6)		423 (11.6)		1053 (29.2)	
≥16	2768 (36.2)	912 (33.5)		454 (17.0)		1011 (37.8)	
Socio-emotional distress							
No close friends							
Yes	699 (9.1)	136 (20.3)	0.005**	66 (9.8)	0.031*	171 (25.4)	0.008**
No	6877 (90.9)	1718 (26.3)		871 (13.0)		2069 (31.2)	
Anxiety							
Yes	628 (8.2)	221 (35.3)	0.001***	107 (17.0)	0.006**	252 (40.7)	0.001***
No	6948 (91.8)	1696 (24.9)		830 (12.3)		1988 (29.8)	
Bullied							
Yes	1968 (26.3)	603 (30.9)	0.001***	266 (13.6)	0.201	690 (36.3)	0.001***
No	5608 (73.7)	1314 (23.9)		671 (12.4)		1550 (28.7)	
Physically Attacked							
Yes	2871 (38.3)	942 (33.3)	0.001***	508 (17.8)	0.001***	1101 (39.3)	0.001***
No	4705 (61.7)	975 (21.1)		429 (9.5)		1139 (25.4)	
Physical Fights							
Yes	2930 (39.0)	1038 (35.7)	0.001***	598 (20.6)	0.001***	1234 (43.4)	0.001***
No	4646 (61.0)	879 (19.4)		339 (7.7)		1006 (22.6)	
Contextual Factors							
Peer Support							
Yes	3196 (42.2)	746 (23.7)	0.002**	330 (10.5)	0.001***	852 (27.7)	0.001***
No	4380 (57.8)	1171 (27.3)		607 (14.4)		1388 (32.9)	
Loneliness							
Yes	1011 (13.1)	304 (29.9)	0.009**	152 (15.3)	0.020*	346 (34.8)	0.008**
No	6565 (86.9)	1613 (25.1)		785 (12.3)		1894 (30.1)	
Passive Smoking							
Yes	3675 (49.9)	1432 (39.0)	0.001***	813 (22.1)	0.001***	1800 (49.8)	0.001***
No	3901 (50.1)	485 (12.5)		124 (3.3)		440 (11.6)	
School Truancy							
Yes	1882 (25.3)	731 (39.1)	0.001***	432 (23.1)	0.001***	872 (47.2)	0.001***
No	5694 (74.7)	1186 (21.2)		505 (9.2)		1368 (25.1)	

Note *$p \leq 0.05$, **$p \leq 0.01$, ***$p \leq 0.001$; n = unweighted count; (%) [a] = weighted percentage

adolescents' substance use (Tables 2, 3 and 4). Multicollinearity in multivariate regression models was assessed using a correlation matrix, Variation Inflation Factors (VIFs), and tolerance values (TVs). We found a significant correlation between tobacco use and alcohol consumption (r=0.538) as well as tobacco use and marijuana use (r=0.523) (see Supplementary Materials, Table A2). Therefore, the tobacco use variable was excluded from the multivariate regression models of alcohol consumption (Table 2) and marijuana use (Table 3). No unaccepted values of VIF and TV were found in the models [32, 33]. Each MLR analysis in this study included a crude model (Model 1) representing the association between explanatory variables and outcome variables alone and a control model (Model 2) incorporating the crude model and the control variables, i.e., sociodemographic, socio-emotional distress, and contextual factors. Adjusted odds ratio (AOR) with 95% CI and p-values were reported in the tables. In the logistic regression models, all estimates were adjusted for the complex survey design of GSHS, including sampling weights, clustering, and stratification using the "complex samples" tool of SPSS 25 software (Tables 2, 3 and 4).

Ethical considerations

The World Health Organization and the Bhutan Government approved the ethical aspect of this study. Participants were well informed about the purpose of the study, its importance, and its extensiveness on a global and national scale. Moreover, participation in this survey was voluntary, and informed consent was taken from the respondents and their parents before the survey.

Results

Participants' characteristics

In the total sample of 7576 individuals, approximately 52% were female, and 48% were male. Around half were between 14 and 16 years old, with 36% being 16 or older, and the remaining were 13 or younger. Approximately 9% of the participants reported having no close friends,

Table 2 Bivariate and multivariate logistic regression examining the association of parent-child connectedness and covariates with alcohol consumption among the sample studied

Study Variables	Bivariate Analysis		Multivariate Analysis			
			Model 1		Model 2	
	AOR (95% CI)	*P*-Value	AOR (95% CI)	*P*–Value	AOR (95% CI)	*P*–Value
Explanatory Variable						
Parental Homework Supervision (Yes) ¥	0.699 [0.627 – 0.780]	0.001***	0.812 [0.721 – 0.914]	0.001**	0.859 [0.760 – 0.971]	0.017**
Parents Understand Problems (Yes) ¥	0.730 [0.638 – 0.836]	0.001***	0.890 [0.777–1.018]	0.086	0.943 [0.821–1.082]	0.389
Parental Free Time Supervision (Yes) ¥	0.552 [0.486 – 0.626]	0.001***	0.600 [0.525 – 0.686]	0.001***	0.685 [0.594 – 0.791]	0.001***
Other Substance Use						
Marijuana (Yes) ¥	13.254 [10.494–16.740]	0.001***			6.686 [5.352–8.352]	0.001***
Socio-Demographics						
Sex						
Female	Ref.				Ref.	
Male	2.735 [2.344–3.192]	0.001***			1.535 [1.288–1.828]	0.001***
Age						
≤13	Ref.				Ref.	
14–16	1.913 [1.524–2.399]				1.803 [1.443–2.254]	0.001***
≥16	3.125 [2.477–3.943]	0.001***			2.802 [2.274–3.3454]	0.001***
Socioemotional Distress						
No close friends (Yes) ¥	0.713 [0.568 – 0.896]	0.005**			0.741 [0.573 – 0.959]	0.024*
Anxiety (Yes) ¥	1.646 [1.435–1.889]	0.001***			1.333 [1.102–1.612]	0.005**
Bullied (Yes) ¥	1.419 [1.210–1.665]	0.001***			1.165 [0.991–1.366]	0.058
Physically attacked (Yes) ¥	1.862 [1.628–2.130]	0.001***			1.224 [1.068–1.402]	0.005**
Physical Fight (Yes) ¥	2.298 [1.975–2.674]	0.001***			1.364 [1.188–1.566]	0.001***
Contextual Factors						
Peer Support (Yes) ¥	0.826 [0.736 – 0.928]	0.002**			1.022 [0.910–1.144]	0.721
Loneliness (Yes) ¥	1.267 [1.065–1.508]	0.009**			1.020 [0.826–1.258]	0.854
Passive Smoking (Yes) ¥	4.466 [3.930–5.075]	0.001***			2.614 [2.292–2.981]	0.001***
School Truancy (Yes) ¥	2.386 [2.110–2.697]	0.001***			1.429 [1.227–1.665]	0.001***

Note *$p \leq 0.05$, **$p \leq 0.01$, ***$p \leq 0.001$; AOR = Adjusted Odds Ratio. ¥ = Indicates Reference Category is NO

Model 1: Crude Model (Explanatory variables)

Model 2: Model 1 + Control variables (Other Substance Use + Sociodemographic, Socio-emotional Distress + Contextual Factors)

All models were adjusted for the complex survey design, including sampling weights, clustering, and stratification

Table 3 Bivariate and multivariate logistic regression examining the association of parent-child connectedness and covariates with marijuana use among the sample studied

Study Variables	Bivariate Analysis		Multivariate Analysis			
			Model 1		Model 2	
	AOR (95% CI)	*p*-value	AOR (95% CI)	*P*–Value	AOR (95% CI)	*P*–Value
Explanatory Variable						
Parental Homework Supervision (Yes) ¥	0.682 [0.555 – 0.838]	0.001***	0.794 [0.653 – 0.965]	0.022*	0.849 [0.706–1.021]	0.080
Parents Understand Problems (Yes) ¥	0.693 [0.580 – 0.829]	0.001***	0.832 [0.695 – 0.998]	0.047*	0.927 [0.748–1.148]	0.471
Parental Free Time Supervision (Yes) ¥	0.563 [0.476 – 0.666]	0.001***	0.629 [0.525 – 0.755]	0.001***	0.871 [0.714–1.062]	0.163
Other Substance Use						
Alcohol (Yes) ¥	13.254 [10.494–16.740]	0.001***			6.911 [5.531–8.634]	0.001***
Socio-Demographics						
Sex						
Female (ref.)	Ref.				Ref.	
Male	6.144 [4.869–7.754]	0.001***			3.859 [2.993–4.975]	0.001***
Age						
≤13	Ref				Ref.	
14–16	2.034 [1.520–2.721]				1.713 [1.345–2.180]	0.001***
≥16	3.182 [2.328–4.350]	0.001***			2.104 [1.591–2.782]	0.001***
Socioemotional Distress						
No close friends (Yes) ¥	0.726 [0.544 – 0.970]	0.031*			0.827 [0.558 – 0.1.225]	0.329
Anxiety (Yes) ¥	1.458 [1.125–1.889]	0.006**			1.034 [0.703–1.519]	0.861
Bullied (Yes) ¥	1.115 [0.940–1.323]	0.201			0.666 [0.549 – 0.807]	0.001***
Physically attacked (Yes) ¥	2.054 [1.707–2.471]	0.001***			1.057 [0.883–1.267]	0.530
Physically Fight (Yes) ¥	3.136 [2.614–3.761]	0.001***			1.925 [1.620–2.288]	0.001***
Contextual Factors						
Peer Support (Yes) ¥	0.698 [0.592 – 0.824]	0.001***			0.758 [0.629 – 0.914]	0.005**
Loneliness (Yes) ¥	1.287 [1.043–1.588]	0.020*			1.246 [0.933–1.664]	0.131
Passive Smoking (Yes) ¥	8.293 [6.450–10.663]	0.001***			3.751 [2.958–4.757]	0.001***
School Truancy (Yes) ¥	2.970 [2.561–3.445]	0.001***			1.726 [1.466–2.033]	0.001***

Note *$p \leq 0.05$, **$p \leq 0.01$, ***$p \leq 0.001$; AOR = Adjusted Odds Ratio. ¥ = Indicates Reference Category is NO

Model 1: Crude Model (Explanatory variables)

Model 2: Model 1 + Control variables (Other Substance Use + Sociodemographic, Socio-emotional Distress + Contextual Factors)

All models were adjusted for the complex survey design, including sampling weights, clustering, and stratification

while 8% dealt with anxiety. Additionally, more than a quarter experienced bullying, and over a third were physically attacked or engaged in fights. Moreover, 58% lacked peer support, while 87% experienced feelings of loneliness. In addition, half of the individuals were exposed to passive smoking, and a bit over 25% were truanted school (Table 1).

Prevalence of substance use and parent-child connectedness

The prevalence of tobacco use (30.7%) was the highest among Bhutanese adolescents, followed by alcohol consumption (25.8%) and marijuana use (12.7%). Regarding parental connectedness, only 26.8% of the adolescents mentioned that their parents routinely checked their homework, 44.2% indicated that their parents understood their problems, and 36.4% reported that their parents consistently supervised their free time activities. Only 21% of the adolescents who drank alcohol in the last 30 days had their homework checked by their parents, while nearly 19% had their free time activities supervised.

On the other hand, for marijuana users, only about 10% of parents checked their homework, and 9% supervised their free time activities. In addition, the data regarding tobacco users revealed that approximately 24% had parental supervision regarding homework, 27% had parents who understood their issues, and nearly 24.5% had parents who monitored their free time activities (Table 1).

Association between parental connectedness and alcohol consumption

In Table 2, the univariate analysis reflected that the adolescents whose homework was supervised by their parents had 0.699 times lower odds [aOR = 0.699, 95%CI: 0.627–0.780] of consuming alcohol than those whose parents did not bother to supervise homework. Parental understanding of their children's problems [aOR = 0.730, 95%CI: 0.638–0.836] and supervising their children's

Table 4 Bivariate and multivariate logistic regression examining the association of parent-child connectedness and covariates with tobacco use among the sample studied

Study Variables	Bivariate Analysis		Multivariate Analysis			
			Model 1		Model 2	
	AOR (95% CI)	*P*–Value	AOR (95% CI)	*P*–Value	AOR (95% CI)	*P*–Value
Explanatory Variable						
Parental Homework Supervision (Yes) ¥	0.741 [0.655 – 0.837]	0.001***	0.844 [0.746 – 0.954]	0.009**	0.864 [0.760 – 0.983]	0.028*
Parents Understand Problems (Yes) ¥	0.729 [0.651 – 0.817]	0.001***	0.849 [0.758 – 0.951]	0.006**	0.931 [0.815–1.063]	0.278
Parental Free Time Supervision (Yes) ¥	0.622 [0.560 – 0.692]	0.001***	0.683 [0.617 – 0.756]	0.001***	0.752 [0.674 – 0.838]	0.001**
Socio-Demographics						
Female	Ref.				Ref.	
Male	3.693 [3.255–4.189]	0.001***			2.803 [2.476–3.173]	0.001***
Age						
≤13	Ref.				Ref.	
14–16	1.825 [1.483–2.246]				1.995 [1.617–2.462]	0.001***
≥16	2.696 [1.975–3.680]	0.001***			2.920 [2.149–3.967]	0.001***
Socioemotional Distress						
No close friends (Yes) ¥	0.749 [0.608 – 0.923]	0.009**			0.767 [0.601 – 0.978]	0.034*
Anxiety (Yes) ¥	1.620 [1.372–1.911]	0.001***			1.344 [1.050–1.719]	0.021*
Bullied (Yes) ¥	1.412 [1.183–1.684]	0.001***			0.959 [0.818–1.125]	0.595
Physically attacked (Yes) ¥	1.899 [1.645–2.194]	0.001***			1.166 [1.049–1.295]	0.006**
Physically Fight (Yes) ¥	2.630 [2.206–3.136]	0.001***			1.803 [1.530–2.125]	0.001***
Contextual Factors						
Peer Support (Yes) ¥	0.779 [0.698 – 0.870]	0.001***			0.892 [0.796–1.000]	0.050*
Loneliness (Yes) ¥	1.241 [1.063–1.488]	0.008**			1.086 [0.872–1.352]	0.447
Passive Smoking (Yes) ¥	7.559 [6.541–8.735]	0.001***			5.932 [5.106–6.890]	0.001***
School Truancy (Yes) ¥	2.673 [2.350–3.042]	0.001***			1.780 [1.544–2.053]	0.001***

Note *$p \leq 0.05$, **$p \leq 0.01$, ***$p \leq 0.001$; AOR = Adjusted Odds Ratio. ¥ = Indicates Reference Category is NO

Model 1: Crude Model (Explanatory variables)

Model 2: Model 1 + Control variables (Other Substance Use + Sociodemographic, Socio-emotional Distress + Contextual Factors)

All models were adjusted for the complex survey design, including sampling weights, clustering, and stratification

activities during their free time [aOR = 0.552, 95%CI: 0.486–0.626] also significantly reduced the odds of substance use among the in-school adolescents. However, marijuana use in the last month was significantly associated [aOR = 13.25, 95%CI: 10.494–16.740] with alcohol consumption. It was also observed that male adolescents had significantly higher odds [aOR = 2.735, 95%CI: 2.344–3.192] of alcohol consumption than female school-going adolescents.

The adjusted model in the multivariate analyses showed that adolescents with a good relationship and connectedness with their parents had significantly lower odds of consuming alcohol than their counterparts. Among them, parental free time supervision of children's activities significantly lowered the odds [aOR = 0.685, 95%CI: 0.594–0.791] of having alcohol than those parents who did not supervise their free time activities. However, marijuana use was associated with alcohol consumption in the adjusted model as well, resulting in 6.686 higher odds [aOR = 6.686, 95%CI: 5.352–8.352] than the adolescents who did not consume alcohol. Some covariates were also significantly associated with alcohol consumption in the univariate and the adjusted regression models. For example, adolescents who were exposed to passive smoking [aOR = 2.614, 95%CI: 2.292–2.981] had higher odds of alcohol consumption, and similarly, students who were likely to be truant [aOR = 1.429, 95%CI: 1.227–1.665] were more likely to consume alcohol than those who were not. Adolescents who had no close friends were 0.741 times less likely to consume alcohol [aOR = 0.741, 95%CI: 0.573–0.959] than those who had close friends. In addition, adolescents aged 16 or older were highly likely to consume alcohol, with higher odds than the other age groups (≤13 and 14–16).

Association between parental connectedness and marijuana use

According to the univariate analyses in Table 3, Bhutanese adolescents whose parents supervised their free time activities had 0.563 times lower odds [aOR = 0.563, 95%CI: 0.476–0.666] of using marijuana than their counterparts, and the same was observed when parents regularly checked their children's homework and tried to understand whether they were going through any difficulties in life. However, adolescents who consumed alcohol had 13.25 times higher odds of marijuana use

[aOR=13.254, 95%CI: 10.494–16.740] than those who did not consume alcohol. Male students had significantly higher odds of marijuana use than female students [aOR=6.144, 95%CI: 4.869–7.754], and respondents aged 16 or above had higher odds of using marijuana than the other two age groups. Passive smoking was significantly associated with higher odds [AOR=8.293, 95%CI: 6.450–10.663] of marijuana use among school-going adolescents.

The crude model (model 1) in multivariate regression analysis also showed significant associations between explanatory variables and marijuana use (Table 3), where adolescents were less likely to use marijuana if they had a good connection with their parents; for instance, parental free time supervision was associated with 0.629 times lower odds of marijuana use among the students [aOR=0.629, 95%CI: 0.525–0.755]. However, after adjusting all the other control variables of the study, the multivariate analysis in Model 2 presented an insignificant association between parental connectedness and marijuana use. However, several contextual factors in the adjusted model, such as passive smoking and school truancy, physical fights, and being bullied by others, were statistically significantly associated with higher odds of using marijuana among the respondents. The association was significant for the age groups as well. Additionally, the model also represented that instances of drinking alcohol significantly increased the odds of using marijuana [aOR=6.911, 95%CI: 5.531–8.634] among adolescents.

Association between parental connectedness and tobacco use

Adolescents having parents who understood their problems were less likely to use tobacco [aOR=0.729, 95%CI: 0.651–0.817] than their counterparts, as presented in the univariate analysis in Table 4. The other two explanatory variables also showed similar trends. Additionally, male adolescents were more prone to tobacco use with 3.693 times higher odds [aOR=3.693, 95%CI: 3.255–4.189] than female adolescents. Students aged 16 or above also had higher odds of tobacco use than the other age groups. In addition, respondents having no close friends had 0.749 times lower odds [aOR=0.749, 95%CI: 0.608–0.923] of marijuana use than the respondents who had close friends.

Although the crude model in the multivariate analyses represented strong associations between all three explanatory variables with tobacco use illustrating parental connectedness leading to lower odds of tobacco use among the adolescents, the adjusted model (Model 2) showed significant association with tobacco use for the "parental free time supervision" [aOR=0.752, 95%CI: 0.674–0.838] and "parental homework supervision" [aOR=0.864, 95%CI: 0.760–0.983] variables only. In addition, male adolescents had significantly higher odds [aOR=2.803, 95%CI: 2.476–3.173] of tobacco use than the female adolescents in the adjusted model. In the crude multivariate model, being bullied and having loneliness were significantly associated with higher odds of tobacco use; however, there were no significant associations of these two variables with tobacco use among the respondents in the adjusted controlled model.

Discussion

The primary focus of this study was to examine the prevalence of substance use and its association with parent-child connectedness: (i) parental supervision of homework, (ii) parents understanding problems, and (iii) parental free time supervision among Bhutanese adolescents. Tobacco use appeared to be the most prevalent form of substance use among the respondents, with a prevalence rate of 30.7%. In contrast, marijuana use appeared to be the least prevalent, with a prevalence rate of 11.9%, significantly higher (tobacco 3.6%, alcohol 3.4%) than another GSHS-based study conducted in Sri Lanka in 2016 [34]. The findings revealed that adolescents' homework supervision and free time activities supervision by parents significantly lowered the odds of using tobacco and consuming alcohol. However, no significant association was found between parent-child connectedness and marijuana use among Bhutanese adolescents.

The results of our study indicated a substantial inverse (protective) relationship between parent-child connectedness and the likelihood of alcohol usage among the study participants. This particular finding was consistent with some previously conducted studies [35–37], which have also suggested a similar phenomenon and indicated that insufficient parental supervision and lack of emotional support are linked to earlier initiation of alcohol use and greater levels of alcohol engagement. Another study finding suggested that parental communication has an impact on the substance use of adolescents and that the presence of at least one open-minded parental figure significantly diminishes the likelihood of substance use [14, 15]. Additionally, a study conducted in Thailand utilizing the GSHS dataset indicated that current alcohol use is correlated with inadequate parental or guardian supervision and bonding [38]. Several other studies also shed light on this particular issue, where it was found that initiation of drugs among adolescents is often triggered by a low bonding to family, characterized by a lack of closeness between parents and child [39–41].

Our study's findings indicated a lack of significant correlation between parent-child connectedness and marijuana use among the participants, contrasting with the results of several similar studies [42–44]. These studies demonstrated that a heightened level of parental

supervision and connectedness was associated with reduced rates of marijuana use among adolescents. However, regarding tobacco use, our research indicated a significant reduction in the likelihood among adolescents with solid parent-child connections. Moreover, a similar research conducted on adolescents in Bangladesh also reflected that a lower level of parent-child connectedness (characterized by inadequate parental monitoring and misunderstanding with parents) elevates the probability of tobacco use among adolescents [45]. The cultural context of India and Nepal align with Bhutan's to some extent; studies found that nurturing and communicative behavior from parents [46], and increased parental involvement [47] significantly lower the odds of substance use among adolescents.

The study also uncovered a significant variation in substance use between male and female adolescents, with notably elevated prevalence rates observed for male students for alcohol, marijuana, and tobacco use at 35.5%, 21.8%, and 44.5%, respectively. Female adolescents exhibited lower rates of substance use at 16.7%, 4.3%, and 17.9% for alcohol, marijuana, and tobacco than male adolescents. A similar type of GSHS research conducted in Sri Lanka revealed a similar trend, with adolescent females using substances at a considerably lower rate (alcohol 1.1%, cigarettes 7%, and illegal drugs 1.1%) than male adolescents [34].

Production, manufacturing, and trading of tobacco and tobacco products are illegal in Bhutan due to the country's long history of sensitivity against tobacco usage, which resulted in the introduction of an act restricting tobacco and tobacco products in 2010. This study found that despite the country's strict anti-smoking policies, smoking prevalence among school-going adolescents was higher in Bhutan [26, 48]. It is imperative to prioritize implementing accommodating measures rather than solely relying on strict rules and regulations. The findings of this research are significant for Bhutanese policymakers, educators, and parents since it emphasizes the critical need for targeted interventions and preventive measures to improve parent-child relationships and promote healthy family dynamics. However, the implications of the findings may extend beyond Bhutan and apply to countries across the globe where adolescents are indulging themselves in the harmful use of alcohol and bringing forth negative consequences on them as well as their families. Moreover, parental connectedness can be emphasized as a substantive protective factor against adolescent substance use anywhere in the world. Further studies in the countries where the survey has already been conducted can be performed to accentuate or negate the relationship between parental connectedness and adolescent substance use. However, Bhutan, for instance, may lower the prevalence of substance use among its adolescent population if it invests in programs that strengthen parental skills and promote positive interactions.

Limitations of the study

The study had some noteworthy limitations. The GSHS data were collected using a self-reported questionnaire and required information on previous experiences and activities, and thus could potentially be influenced by recall bias. The study's findings might not be generalized for all the adolescents of Bhutan since only adolescents who were present at the school on that particular date completed the survey, and out-of-school adolescents were excluded. Instead of using widely adopted questionnaires and standardized rating scales to measure the adolescents' mental health (i.e., loneliness and anxiety), simple Likert-scale questions were employed in this study. Other relevant variables in determining parental connectedness, i.e., parental support, parental cautionary statements against substance use, and parental communication, would lead to a more robust finding.

Conclusion

The study underscores the critical role of parent-child connectedness in lowering the prevalence of adolescent substance use in Bhutan. Solid parental connectedness makes adolescents less likely to indulge in substances. A gender disparity in substance use was also found, as statistical analysis showed that male adolescents have higher rates of substance use than females. Despite Bhutan's stringent anti-smoking laws, tobacco use remains common among school-aged adolescents, highlighting the necessity for more comprehensive approaches beyond mere regulations. Policymakers, educators, and parents must focus on enhancing family dynamics and fostering positive parent-child relationships in order to reduce adolescent substance use. Further research could explore cultural nuances and additional parental factors that influence substance use in order to develop more effective preventive strategies for the future generations of Bhutan. However, these insights are not only pertinent for Bhutan but also provide valuable lessons for global initiatives in preventing adolescent substance use.

Supplementary Information

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Supplementary Material 1

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Author contributions
Md. Tanvir Hasan Sojib: Conceptualization, Methodology, Investigation, Formal Analysis, Writing – Original Draft, Writing – Review & Editing. Md. Habibur Rahman: Conceptualization, Methodology, Formal Analysis, Writing – Original Draft, Writing – Review & Editing. Md. Imamur Rashid Gogon: Conceptualization, Methodology, Formal Analysis, Writing – Original Draft, Writing – Review & Editing. Md. Khalid Hasan: Conceptualization, Methodology, Investigation, Formal Analysis, Writing – Original Draft, Writing – Review & Editing, Supervision.

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Data availability
The GSHS Bhutan 2016 is a public dataset that is available on the WHO website (https://extranet.who.int/ncdsmicrodata/index.php/catalog/643/study-description) and could be downloaded upon a request by a registered user.

Declarations

Competing interests
The authors declare no competing interests.

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