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# Nonmedical Use of Cough Syrup Among Secondary Vocational School Students

## *A National Survey in China*

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**Abstract:** Nonmedical use of cough syrup (NUCS) among secondary vocational school (SVS) students has been an increasing concern for public health in China, but no data were available. This cross-sectional study aimed to investigate the epidemiological characters of NUCS as well as its risk factors among SVS students in China.

From September 2013 to December 2014, a total of 13,614 SVS students were purposively selected through multistage sampling in 6 cities of China. Information on NUCS, demographics, family background, smoking and alcohol consumption, impulsiveness, sensation seeking, and parental monitoring were collected. Logistic regression was used to explore factors related to NUCS.

The 12,923 (94.9%) valid responses (16.3 ± 1.0 years old, and 52.6% men) reported 3.47% (95% confidence interval: 3.15–3.79%) lifetime NUCS. Logistic regression indicated that smoking, part-time job experience, high level of impulsiveness, and sensation seeking were risk factors for NUCS, whereas urban living and high parental monitoring were protective ones.

NUCS was prevalent among SVS students. Interventions that target on smoking, impulsiveness and sensation seeking control, improvement on parental monitoring may have considerable impact on NUCS among SVS students.

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**Abbreviations:** BSSS-C = Chinese version of Brief Sensation Seeking Scale, CCS = codeine containing syrup, CI = confidence interval, CTC = Communities That Care<sup>®</sup>, NUCS = nonmedical

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use of cough syrup, OR = odds ratio, PM = parental monitoring, RHS = regular high school, SES = socio-economic status, SS = sensation seeking, SURP = Substance Use Risk Profile Scale, SVS = secondary vocational school.

## INTRODUCTION

Cough syrup, especially for codeine-containing syrup (CCS), has been frequently used as an antitussive agent.<sup>1</sup> Although its effects on the central nervous system are milder than heroin, the long-term use of CCS can lead to physical and psychological dependence.<sup>2</sup> Nonmedical use of cough (NUCS) had become one of the commonly used abusive substances among adolescents in Western countries<sup>3,4</sup> and some Asian countries.<sup>5–9</sup> In China, cough syrup is commonly considered as addictive,<sup>10–12</sup> given the 2 dominating types of cough syrups: 1 is codeine containing, the other is Chinese herbal cough syrup that contains components extracted from pericarpium papeda, that is, poppy shell.<sup>13</sup> There are very limited studies on the NUCS in China. A recent study in Guangdong province showed that the prevalence of nonmedical use of CCS was about 2.1% among regular high school (RHS) students,<sup>14</sup> higher than illicit drug abuse in China (1%).<sup>15</sup> However, currently there is no data on NUCS among secondary vocational school (SVS) students, a population at the same age of RHS students but usually are more prone to drug abuse and other social-behavioral problems in China.<sup>16</sup> Since May, 2015, Chinese government had labeled CCS as category II psychoactive substances, which means that if 1 person traffics illegally would be punished as a drug dealer. Therefore, it is of great interest to investigate the epidemiological characteristics of NUCS among SVS students in China, and to know its prevalence and risk factors in order to gain better control over it.

It has been reported that NUCS is closely related with illicit drug abuse, brain damages, and psychological diseases.<sup>9,17–20</sup> Studies suggested that NUCS might cause or co-exist with illicit drug use, and NUCS users are more inclined to become polydrug addicts.<sup>19,20</sup> In addition, NUCS is also associated with damages to white matter of brain,<sup>9</sup> the volume loss and aberrant functional organization in ventral medial prefrontal cortex,<sup>21</sup> folate deficiency,<sup>17,22</sup> and neural tube defects in fetus.<sup>23</sup> Furthermore, the damages to brain in NUCS users may be linked to higher impulsivity,<sup>9,21</sup> which in turn could lead to more serious drug-seeking behaviors.<sup>18</sup> Hence, a vicious circle of drug misuse, brain damage, and higher impulsivity may be set up.

In China, SVS students are a special population with several features. First, mainly middle school graduates with poor academic performance will attend SVS, whereas others



**FIGURE 1.** The distribution of secondary vocational (SVS) students and sampled areas. The mounts of SVS students in areas circled by a red line accounted for 84.9% of the nation. The red points marked the selected areas and cities where participants were sampled. Data from National Bureau of Statistics of China (<http://data.stats.gov.cn>). SVS = secondary vocational.

will attend RHS. Therefore, SVS students, owing to their poor academic performances at junior high schools, often feel inferior and lost.<sup>24</sup> Second, problematic behaviors are common among SVS students, such as smoking, bullying, and addictive to internet or cell phone.<sup>25</sup> Third, drug education among SVS students could not be effectively implemented.<sup>26</sup> Based on these factors, we hypothesized that SVS students were more prone to develop substance abuse including NUCS. However, very few studies had focused on the problem among SVS students in China, and currently there are no epidemiological data of NUCS among them. This study aims: to assess the prevalence of NUCS among SVS students in China thorough a national survey, and to investigate factors (including demographics, problematic behaviors, and several psychological traits) that may be associated with NUCS in SVS students.

## METHODS

### Study Population

In our cross-sectional study, students at SVS in China were expected to enroll in the study. But data from National Bureau of Statistics of China showed that the amounts of SVS students in the marked region in Figure 1 were account for 84.9% (13,040 million out of 15.365 million) of the whole country in 2013.<sup>27</sup> So students in the far-western region and northeast of China were not included because of small amounts of students. We adopted multistage clustering sampling strategies to select participants in the present study. In stage 1, the area in the red circle was divided into 5 blocks as North, South, East, West, and Center areas. Given Special Economic Zone (SEZ) as an extraordinary entity in Chinese economic construction, it was treated as the 6th block. Six cities were purposively sampled, including Shenzhen, Zhaohing (South), Ningbo (East), Chongqing (West), Taiyuan (North), and Wuhan (Center) (as red points shown in Figure 1). In stage 2, given the variance of students number in each school, 2 or 3

schools were purposely sampled from each of the 6 selected cities, and 14SVSs were selected in total. In stage 3, students in year 1 and 2 were selected by cluster sampling from the 14 schools (students in grade 3 were not sampled because of graduation practice out of school). At last, 386 classes and a total of 14,195 students were sampled. However, 581 of them (4.1%) did not participate in the study because of illness or other reasons. This resulted in 13,614 participants, with 12,923 (94.9%) students provided valid information. The whole survey lasted from September 2013 to December 2014.

### Background Characters

Background information on participants' demographics, academic performance, and monthly personal consumption expenditure were collected. The demographic variables included age, gender, race, habitual residence, and part-time job experience. Academic performance was assessed by average scores in the last semester and rated as 3 levels: (1) <60; (2) average (60–79); and (3) above average (80–100). The monthly expenditure was rated as the following categories: (1) <600 Yuan; (2) 600 to 999 Yuan; and (3) 1000 Yuan or more.

### Living Arrangement and Socio-economic Status (SES)

Information on living arrangement was collected by the question of "Who do you live with most of the time from childhood till now?" Living arrangement was classified as 3 types: (1) living with both parents (parents); (2) living with a single parent (single parent); and (3) living with other relatives (others).

SES is a comprehensive indicator being composed of parents' education level and occupation. Because household income is difficult to collect, the item was omitted in the study. Information on parents' education and occupation was ascertained through questionnaire. Education was rated as the

following 3 levels: no more than junior high school, senior high school, and junior college and above. The 3 education levels were assigned the value 1, 2, and 3, respectively. Occupation was collected by 12 items including 11 close-ended items and 1 open-ended item. And according to the National Occupation Classification,<sup>28</sup> occupations in this study were divided into the following 6 categories: unit leader (managerial), professionals, clerk, common merchant or service personnel, farmer, and other occupations difficult to categorize, which were assigned the value of 6, 5, 4, 3, 2, and 1, respectively. Finally, the family SES was assessed by summing the value of parents' education and occupation according to a literature.<sup>29</sup>

### Smoking, Drinking, and NUCS

Smoking was assessed by asking "How many cigarettes a typical day do you smoke?" Daily cigarette consumption was divided into 4 levels: not at all, 1 to 9 cigarettes, 10 to 20 cigarettes, and >20 of cigarettes. Alcohol consumption was assessed by asking how many cups they had per drinking occasion. The alcohol in the study included beer, liquor, and wine. The unit of cup was used to measure alcohol consumption, and 1 cup defined as half bottle (250 mL) or 1 tin of beer, 25 mL distilled spirit, 100 mL wine, or 100 mL rice wine. The alcohol consumption was classified into 3 levels: not at all, 1 to 4 cups, and 5 cups or more.

NUCS was measured by the following question: How often did you use cough syrup without illness or just for "high" felling? The available choices for the frequency were never, ever tried, several times per month, several times per week, and every day. Lifetime NUCS was used as an indicator for judging users and nonusers. Respondents who had ever used cough syrup for nonmedical purpose or getting "high" feeling were defined as lifetime users.

### Impulsiveness and Sensation Seeking

Impulsiveness is 1 dimension in Substance Use Risk Profile Scale (SURPS). The SURPS was testified to be a good psychometric instrument.<sup>30</sup> The subscale used in the study was developed by standard translation and back-translation procedures to ensure linguistic consistency. It was composed of 5 items, and the possible response on each item was scored from 1 (strongly disagree) to 4 (strongly agree).

Sensation Seeking (SS) was measured by an 8-item subscale derived from the Form V of the Sensation Seeking Scale<sup>31,32</sup> and was widely used due to its reliability.<sup>33</sup> The Chinese version of Brief Sensation Seeking Scale (BSSS-C) was testified to be reliable and valid, and suitable for health risk behaviors prediction.<sup>34</sup> A five-point Likert scale was used for scoring the BSSS-C ranged from 1 (completely disagree) to 5 (completely agree).

### Parental Monitoring (PM)

The scale of PM was extracted from the Communities That Care<sup>®</sup> (CTC) Youth Survey instrument. The instrument had been originally described by Arthur et al.<sup>35</sup> then some minor changes were made and developed into an 8-item scale.<sup>36</sup> In the present study, 2 items ("If you carried a handgun without your parents' permission, would you be caught by your parents?" and "Do your family has clear rules about alcohol and drug use?") were excluded according to the Chinese cultural background and laws. Therefore, 6 of the 8 items were adopted and revised in this study. These 6 items were: "My parents ask if I've gotten my homework done," "My parents would know if I did not come home on time," "When I am out, one of my parents knows where I am and who I

am with," "If I skipped school would be punished by my parents," "My family rules are very clear," "If I drank beer or wine or liquor without my parents' permission would be punished by my parents." The option to each item was scored from 1 (totally disagree) to 4 (totally agree).

### Statistical Methods

Data were double-entered and verified with EpiData version 3.1. Given participants came from different cities, the interclass correlation coefficient (ICC) was calculated among different cities to check whether multilevel model was conducted. However, results showed that the multilevel model was not suitable because of the low ICC ( $ICC = 0.037$ ,  $P = 0.166$ ). So Logistic regression analyses were conducted to explore factors related to NUCS. Quartile was used to divide quantitative variables into qualitative variables. All variables in the study were analyzed as dummy variables. Given the low proportion of missing data for all related variables (<1.1%), participants with missing data were not included in the non-conditional Logistic regression analysis. The statistical significance level was 2-sided at the 0.05 level. All statistical analyses were conducted with SAS version 9.4 (SAS Inc, Cary, NC).

### Ethnic Statement and Data Collection

At study design stage and before the study was conducted, Institutional Review Board (IRB) from the Medical Ethics Committee (MEC) of Tongji Medical College, Huazhong University of Science and Technology scrutinized and approved the study protocol, so that all ethical norms including the Helsinki norms were met. Given that all of the participating students are minor and that most of them are remote from their parents or guardians, we obtained agreement from the principals before the survey. Moreover, at the beginning of field survey, a well-trained investigator took several minutes to clearly elucidate the purpose and content of the survey to participants, the principles of confidentiality and voluntariness were emphasized to protect the participating students, and they could choose to refuse participating in the survey without any consequences. The students were all warranted that none of their parents, teachers, or peers would be aware of their responses. A total of 218 students refused to participate in the survey. During the survey, teachers were absent from the classroom. Data were collected during a single 40 minute classroom period by trained investigators following a standardized protocol.

## RESULTS

### Demographic characteristics of the participants

The mean age of the 12,923 individuals was 16.3 years old ( $\pm 1.0$  years), ranged from 13 to 20 years old. Among them, 52.6% were men, 58.6% were first grade students, 96.8% were Han Chinese, and 55.7% lived in urban areas in childhood. In their childhood, 76.7% of them lived with their parents and 22.9% of them lived with single parent or other relatives. As for academic achievement, 4161 (32.2%) students evaluated themselves as above average, and 6993 (54.1%) regarded themselves as average. In view of smoking and alcohol use, 79.9% of the students never smoked, and 43.9% never drank (Table 1).

### Nonmedical use of cough syrup and its relationship with other factors

In the present study, the prevalence rate of lifetime NUCS was 3.47% (448 out of 12,923, 95% CI 3.15–3.79%). In order to

**TABLE 1.** Demographic, Behavioral, and Psychological Characteristic of Secondary Vocational School Students

Variables	n	%	Variables	n	%
Age group			Gender		
13–15	2674	20.7	Male	6805	52.6
16–18	9850	76.2	Female	6084	47.1
>18	352	2.7	Missing data	34	0.3
Missing data	47	0.4	Habitual residence		
Race/ethnicity			Urban area	7195	55.7
Han	12510	96.8	Rural area	5639	43.6
Minorities	324	2.5	Missing data	89	0.7
Missing data	89	0.7	Living arrangement		
Part-time job			Parents	9907	76.7
No	7828	60.6	Single parent	1481	11.4
Yes	5053	39.1	Others	1514	11.7
Missing data	42	0.3	Missing data	21	0.2
Academic achievement (centesimal system)			Daily cigarettes consumption		
≥80	4161	32.2	Not at all	10331	79.9
60–79	6993	54.1	1–9	1686	13.1
<60	1527	11.8	10–20	729	5.6
Missing data	242	1.9	>20	153	1.2
Monthly expenditure (Yuan)			Missing data	24	0.2
<600	7048	54.5	Alcohol use (cups)		
600–999	4327	33.5	Not at all	5668	43.9
≥1000	1482	11.5	1–4	5668	43.9
Missing data	66	0.5	≥5	1568	12.0
Social-economic status score			Missing data	19	0.2
≤7	3874	30.0	Impulsiveness score		
8–9	3138	24.3	≤10	3456	26.7
10	2907	22.5	11–12	2915	22.6
>10	2697	20.8	13–15	3498	27.1
Missing data	307	2.4	>15	2737	21.2
Parental monitoring score			Missing data	317	2.4
≤9	1346	10.4	Sensation seeking score		
9–15	5472	42.3	≤17	3384	26.2
16–18	3208	24.8	18–21	3498	27.1
>18	2735	21.2	22–25	3243	25.1
Missing data	162	1.3	>25	2592	20.0
			Missing data	206	1.6

Others = live with relatives other than parents, Parents = live with both parents, Single parents = live with a single parent.

explore the related factors associated with NUCS, univariate nonconditional Logistic regression analysis was carried out with NUCS as the dependent variable and other factors as independent variables. As Table 2 showed, without adjusting the influence of other variables, NUCS was more popular among students with characteristics of older age, male, living with people other than parents, having part-time job experiences, more monthly expenditure, more cigarettes and alcohol consumption, higher level of SS, and impulsiveness. However, students who had better academic achievements, lived in urban areas and families with high PM were less likely to use cough syrup nonmedically. No significant correlations were found between SES, ethnic, and NUCS in the present study.

**Multivariate Logistic regression analysis on factors related to NUCS**

All of the variables in Table 2 as potential predictors of NUCS were further analyzed by multivariate nonconditional

Logistic regression model with stepwise selection method. Six variables retained in the final model: habitual residence, daily cigarette consumption, impulsiveness, SS, PM, and part-time job. Students living in urban areas had lower of NUCS than those living in rural areas. Smoking was positive related with NUCS, and the more cigarettes consumption, the higher risk of NUCS, especially for students who smoked >20 cigarettes per day. High level of sensation seeking and impulsiveness, taking part-time job experience were risk factors of NUCS. However, students with high level of PM were less likely to use cough syrup nonmedically (Table 3).

**DISCUSSION**

We found that the lifetime prevalence of NUCS was 3.47% in this study; and results also showed that more daily smoking consumption, high level of SS and impulsiveness, and part-time job experience could increase the risk of NUCS, whereas living in urban areas and high level of PM played a role in NUCS reduction.



**TABLE 2.** The Factors Related to Nonmedical Use of Cough Syrup by Univariate Nonconditional Logistic Regression Analysis

Variables	NUCS	%	OR	95% CI	Variables	NUCS	%	OR	95% CI
Age group					Monthly expenditure (Yuan)				
13–15	73	2.73	1.00		<600	216	3.06	1.00	
16–18	349	3.54	1.33	1.03–1.73	600–999	165	3.81	1.24	1.00–1.53
>18	24	6.82	2.74	1.70–4.27	≥1000	67	4.52	1.50	1.13–1.98
Gender					Daily cigarettes consumption				
Female	171	2.81	1.00		Not at all	311	3.01	1.00	
Male	275	4.04	1.47	1.21–1.79	1–9	70	4.15	1.41	1.08–1.85
Race/ethnicity					10–20	42	5.76	1.93	1.38–2.71
Han	432	3.45	1.00		>20	23	15.03	5.66	3.54–9.03
Minorities	14	4.32	1.30	0.75–2.24	Alcohol use (cups)				
Habitual residence					Not at all	155	2.73	1.00	
Rural area	266	4.72	1.00		1–4	203	3.58	1.26	1.02–1.57
Urban area	182	2.53	0.51	0.42–0.62	≥5	89	5.68	2.10	1.61–2.75
Living arrangement					Academic achievement (centesimal system)				
Parents	321	3.24	1.00		<60	77	5.04	1.00	
Single parent	52	3.51	1.09	0.80–1.48	60–79	237	3.39	0.68	0.52–0.90
Others	75	4.95	1.58	1.22–2.06	≥80	128	3.08	0.63	0.47–0.84
Part time job					Social-economic status score				
No	228	2.91	1.00		≤7	134	3.46	1.00	
Yes	219	4.33	1.49	1.23–1.81	8–9	109	3.47	1.01	0.77–1.30
Impulsiveness score			10		117	4.02	1.19	0.92–1.54	
≤10	87	2.52	1.00		>10	78	2.89	0.87	0.65–1.15
11–12	98	3.36	1.44	1.07–1.95	Parental monitoring score				
13–15	123	3.52	1.52	1.14–2.03	≤9	60	4.46	1.00	
>15	126	4.60	1.92	1.44–2.57	9–15	207	3.78	0.82	0.61–1.11
Sensation seeking score					16–18	94	2.93	0.61	0.43–0.86
≤17	81	2.39	1.00		>18	77	2.82	0.59	0.41–0.85
18–21	121	3.46	1.48	1.10–2.00					
22–25	115	3.55	1.45	1.07–1.97					
>25	119	4.59	1.96	1.45–2.64					

CI = confidence interval, NUCS = nonmedical use of cough syrup, OR = odds ratio, Others = live with relatives other than parents, Parents = live with both parents, Single parents = live with a single parent.

The prevalence of NUCS varied across different counties and regions. The prevalence in our study was considerably lower than one study conducted among junior and high schools students in the United States in which the rate of the current cough syrup use was 9.5%.<sup>37</sup> Two reasons may explain the difference. First, cough syrup has been popular among Chinese adolescents just for recent decades, so the prevalence may be lower. Second, psychoactive substance has been controlled rigorously by Chinese authority. Therefore, though 2 types of cough syrup were included in our study, the NUCS prevalence was still lower. However, the prevalence in our study was still higher than that of RHS students in Guangdong province, China, in which lifetime CCS misuse prevalence was 2.1%.<sup>14</sup> Two aspects may account for the variance in the prevalence difference. First, our study included not only codeine containing cough syrup, but also some addictive Chinese herbal cough syrup. But in the preceding study in China, the cough syrup was confined within codeine containing cough syrup. Second, the study samples were also heterogeneous. The participants in our study were SVS students other than RHS students. As stated in Introduction, SVS students have more problematic behaviors<sup>25</sup>.

In our study, we found that more cigarettes consumption (>20 cigarettes per day, adjusted OR 4.2, 95% CI 2.52–7.05) was closely related to NUCS. Similar results were also reported in many other researches. Wang et al argued that smokers were

more likely to report nonmedical use of prescription medicine than nonsmokers.<sup>14</sup> Another study conducted among 85,000 adolescent students in 31 European countries also found that tobacco use was associated with nonmedical tranquilizer or sedative use (OR 1.3, 95%CI 1.1–1.5).<sup>38</sup> Even among female students in grade 7 to 12, the close relationship was also found between smoking and nonmedical opioid use (OR 1.64, 95%CI 1.04–2.58).<sup>39</sup> Therefore, interventions targeting adolescents' smoking may still be effective in reducing prescription drug use, or in preventing the misuse of prescription and illicit drugs.

Experience of taking part-time jobs was found to be a risk factor and could increase the risk of NUCS in the present study. Several factors may account for the result. First, adolescents are deficit in knowledge on addictive drug,<sup>40</sup> and most of them believe cough syrup is not addictive and harmless.<sup>6</sup> Second, they have the characteristics of curiosity, emptiness, hopelessness, adventure, rebellion, and inferiority.<sup>41</sup> At last, many SVS students often take part-time jobs in their spare time at factories, bars, hotels, travel agencies, and so on, in order to meet their career development. However, taking part-time jobs under the circumstances would increase the probability of exposure to NUCS and the risk to use this drug.

Notably, our research found that adolescents from rural areas had higher prevalence of NUCS than those of students from urban regions (4.7% vs 2.5%), similar results were

**TABLE 3.** Factors Associated With Nonmedical Use of Cough Syrup by Multivariate Nonconditional Logistic Regression Analysis (n = 11,583)

Variables	Adjust OR*	95% CI	Variables	Adjust OR*	95% CI
Habitual residence			Part-time job		
Rural area	1.00		No	1.00	
Urban area	0.51	0.41–0.62	Yes	1.37	1.12–1.67
Daily cigarettes consumption			Parental monitoring score		
Not at all	1.00		≤9	1.00	
1–9	1.03	0.77–1.37	9–15	0.91	0.67–1.25
10–20	1.44	1.00–2.07	16–18	0.69	0.48–0.98
>20	4.19	2.52–7.05	>18	0.62	0.43–0.98
Impulsiveness score			Sensation seeking score		
≤10	1.00		≤17	1.00	
11–12	1.39	1.01–1.90	18–21	1.42	1.05–1.91
13–15	1.38	1.02–1.90	22–25	1.29	0.95–1.76
>15	1.59	1.16–2.17	>25	1.67	1.22–2.29

CI = confidence interval, OR = odds ratio

\* Adjusting for all variables in the univariate analysis

reported by other studies. One study found that 34% of the rural RHS students reported nonmedical use of prescription drugs and was higher than that of the study reported nationally.<sup>42</sup> The other national study conducted in 50 states in America showed that self-reported propoxyphene, codeine, and methadone misuse among rural residents were higher than their urban counterparts.<sup>43</sup> Two possible reasons may be responsible for the situation in China. One is that prescription medicine management in rural areas is not as strict as urban places, and prescriptions might be easy to obtain.<sup>44,45</sup> The other is that rural students know little about cough syrup, but when they went to cities and knew about it at schools, they tended to engage in overcompensation and develop NUCS behaviors.

Additionally, PM was found to be a protective factor of NUCS in our study. Namely, High level of PM is correlated with low NUCS. One study conducted among young participants aged 11 to 18 demonstrated that greater PM could reduce the likelihood of NUCS (OR 0.93, 95%CI 0.89–0.99).<sup>46</sup> The similar effect of PM against adolescent substance use has also been demonstrated in several previous studies.<sup>46–48</sup> Studies also found that parent–child bond along with PM would make adolescents feel warmth and love from their parents and be helpful in reducing substance misuse.<sup>49–52</sup> Therefore, interventions targeting on improvement of PM and parent–child bond would be more effective for NUCS prevention than that of intervention targeting any one of them.

Many studies have testified that impulsivity and SS are correlated with prescription misuse, illicit drug abuse, and others problematic behaviors.<sup>18,53–55</sup> In our study, we also found that SS and impulsiveness were closely related to NUCS among SVS students, and the risk of NUCS increased with the SS level ascent. Although SS is a stable personality determined mostly by biology genetic,<sup>56</sup> 1 research had testified the validity of personality-targeted coping skills on substance misuse.<sup>57</sup> Meanwhile, the relationship between SS and substance use may be mediated by impulsiveness, expectancies, and evaluation regarding nonmedical use of prescriptions and other substances abuse.<sup>58–61</sup> Therefore, coping skills on SS and impulsiveness may be helpful to decrease the risk of NUCS.

## Limitations

Several limitations need to be considered when evaluating the study's findings. First, given the study is cross-sectional, caution should be warranted in making causal interpretations. Longitudinal studies are necessary to clarify the relationships of these factors. Second, the nonprobability sampling strategies may affect the generalization of the result. Third, some cases were excluded from the study because of invalidity. But the difference of basic information and NUCS between valid and invalid participants did not meet the statistical significance.

## CONCLUSION

In sum, this study demonstrates that NUCS is prevalent among SVS students in China. Health education associated with psychoactive elements containing prescriptions, smoking, and narcotics should be reinforced among the population. Skills on SS and impulsiveness control may be helpful to reduce drug seeking behaviors. Given PM is negatively related with NUCS, improvement on PM especially for families in rural regions could contribute to preventing NUCS among SVS students.

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