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Abstract

Objectives: Given the difference between general high school (GHS) and vocational high school (VHS) students, this study aimed to investigate the lifetime prevalence of nonmedical use of prescription drugs (NMUPD) among high school students and the association between NMUPD and individual-level factors and school category.

Methods: A cross-sectional study was conducted in GHS and VHS in 2012 in Chongqing, and 11,906 student questionnaires were completed and qualified for the survey. Self-reported NMUPD and information regarding individual-level determinants and school category were collected. A stratified two-level logistic regression model was fitted to independent predictors of NMUPD.

Results: The total lifetime prevalence of NMUPD was 15.7%, and NMUPD was more prevalent among VHS students (20.7% in VHS and 14.1% in GHS). A two-level logistic regression analysis also indicated that VHS students were more likely to be involved in NMUPD (AOR=1.55, 95% CI=1.37-1.76). Regarding individual-level factors, students who had difficult family relationships, had below average academic stress, had poor relationships with classmates or teachers, had parents or friends who engaged in NMUPD, felt lonely more than 1 day, and considered or attempted suicide were more likely to be engaged in NMUPD. Below average family economic status was negatively correlated with NMUPD (AOR= 0.75, 95% CI= 0.62-0.92).

Conclusions: NMUPD among high school students is a multi-determined phenomenon. The current findings indicated that VHS students are an important subgroup of adolescents, identified individual-level factors that are relevant to NMUPD, and highlighted the need for additional research and targeted prevention and intervention programs for NMUPD.

Strengths and limitations of this study:

There was scarce study has been conducted to describe the prevalence and characteristics of NMUPD among GHS and VHS students separately or to examine the influence of individual-level factors and high school category on NMUPD simultaneously.

The study used a multilevel logistic regression model which individual- and school-level factors were involved in to select independent predictors of NMUPD simultaneously.

The study demonstrated that NMUPD among high school students is a multi-determined phenomenon, and both individual-level factors and school category have effects on NMUPD among adolescents.

The data are subject to potential bias introduced by the administration of sensitive behaviors via self-report surveys in a school setting.

1. Introduction

Non-medical use of prescription drugs (NMUPD) is defined as taking medications without a doctor's prescription, for periods longer than prescribed, or for reasons other than the medication's intended purpose (e.g., 'to experiment' or 'get high'). [1, 2] During the last two decades, the increase in NMUPD has been a topic of great concern. [3] Prescription drugs were the second most popular drug among adolescents in the 2013 National Survey on Drug Use and Health (NSDUH). [4] High school students, often described as individuals between 10 and 24 years of age, engage in priority health-risk behaviors, including substance use. [5] Previous studies have reported that high school students have the greatest risk of NMUPD relative to other age groups, [4, 6] and this finding may demonstrate youth's perception that prescription drugs are safer, easier to access, and less stigmatizing than illicit drugs. [7] Furthermore, McCabe's study found that individuals who initiated NMUPD at 18 years of age or younger were significantly more likely to develop substance use disorders than those who initiated later in life. [6] Clearly, NMUPD among juveniles is a large public health problem with negative consequences. [8]

Prior studies have illustrated many individual-level factors that are associated with NMUPD among high school students. The 2011 NSDUH showed that female students aged 12-17 years are slightly more likely than males (9.9% VS. 8.2%) to report NMUPD. [9] Furthermore, the monitoring the future (MTF) national survey demonstrated that age is associated with NMUPD, with older adolescents more likely to report NMUPD than younger adolescents. [10] Nakawaki's research found that adolescents from dual-parent households are at less risk for NMUPD than those from other types of family structures. [11] Notably, students whose parents and peers engage in nonmedical prescription drug use are at a higher risk of NMUPD, [12] and suicide behaviors are significantly associated with NMUPD among adolescents. [13]

High school is generally categorized into general high school (GHS) and vocational high school (VHS), and VHS students are typically characterized into heterogeneous educational levels, including a significant proportion with little or no educational attainment. [14, 15] In the highly academically stratified society, students who graduate

from VHS experience discrimination, including lower employment opportunities or significantly lower salary compared to those who graduate from GHS. [16] Prior studies have found that students in VHS have a greater risk of smoking or drinking behavior than those in GHS, even after controlling for individual-level factors, [17, 18] However, there was scarce study has been conducted to describe the prevalence and characteristics of NMUPD among GHS and VHS students separately or to examine the influence of individual-level factors and high school category on NMUPD simultaneously. Therefore, we conducted a cross-sectional study of GHS and VHS students in Southwest China to assess the lifetime prevalence and characteristics of NMUPD within a large sample of randomly selected GHS and VHS students and to explore the predictors of NMUPD in terms of individual-level factors and school category.

The following three hypotheses were formulated. First, consistent with the results of previous studies, [10, 19, 20] we hypothesized that NMUPD is a major international public health problem among adolescents, and Chinese high school students are no exception. Second, we expected differences in the demographics and prevalence of NMUPD between GHS and VHS students and that the current status of NMUPD in VHS is more serious than that in GHS. Third, consistent with previous findings, [4, 10, 20, 21] we hypothesized that most family-, school-, and psychosocial-related factors are related to NMUPD.

2. Methods

2.1 Study design and sample recruitment

A cross-sectional study of GHS and VHS students was conducted in 2012 in Chongqing, located in the southwest of China. This individual- and school-level study aimed to investigate the lifetime prevalence of NMUPD and to explore the predictors of NMUPD among GHS and VHS students. We used a multistage stratified random cluster sampling procedure to obtain a representative sample. In stage 1, geographic areas (or primary sampling units) were selected based on the 2009-2010 surveillance

data on the population of nonmedical prescription drug users in Chongqing. In stage 2, 29 GHS and 11 VHS within these primary units were selected (with probability of selection proportionate to school size). In stage 3, classes were randomly selected from each grade within the schools. All students of the participating classes were fully informed of the purpose of the survey and invited to participate voluntarily. Written consent letters were obtained from each participating student or one of the student's parents. A rigorously anonymous method of collection of self-report questionnaires was guaranteed. Research assistants administered the questionnaires in the classrooms without the presence of the teachers during a half hour of the students' regular class time. A total of 12,406 high school students were invited to participate, and 11,906 student questionnaires were completed and qualified for the survey, resulting in a response rate of 96.0%.

2.2 Measures

2.2.1 Dependent variable. The dependent variable was the lifetime NMUPD, which was assessed by the following question: 'Have you ever, even once, used the following medications when you were not sick or just for the intended purpose to experiment or to get high without a doctor's prescription?' The question was followed by a list of the following four categories of prescription-type drugs according to the NSDUH: prescription pain (e.g., Codeine, Percocet), prescription stimulant (Adderall, Dexedrine), and prescription sedatives and tranquilizers (Quaaludes, Valium, benzodiazepines). [4] The response categories were 'yes' and 'no'.

2.2.2 Independent variables. The individual-level independent variables included the students' sociodemographic characteristics, family and school-related factors, alcohol and cigarette use, and psychological-related factors. The sociodemographic variables were age, gender, grade, and pocket money (the students were asked how much pocket money, on average, they received per month from their parents. The responses were coded as 'less than 100 Yuan', '100-299 Yuan', or 'more than 300 Yuan'). Living arrangement was assessed by asking who lived in the student's primary home. Family

economic status was measured by asking the student's perception of his or her family's current economic status. Family relationships were assessed by asking the students how they judged the relationships between their family members. Academic stress was captured by a single item that asked for a personal appraisal of the student's academic stress relative to that of his/her classmates (responses were coded as 'below average', 'average', or 'above average'). Relationships with classmate or teacher were also assessed based on the students' self-ratings (responses were coded as 'poor', 'general', or 'good'). Whether the students' parents or friends engaged in NMUPD was assessed by asking participants the following question: 'Has your father, mother or friends used prescription drugs when they were not sick without a doctor's prescription during their lifetime?' Alcohol drinking was measured by a single item ('Have you used at least one drink previously and one or more drinks within the past 30 days?'). Cigarette smoking was assessed by asking the respondents the following question: 'Have you smoked at least one cigarette previously and used between 1 and 29 cigarettes within the past 30 days?' Psychosocial-related factors were assessed by two variables, feeling lonely and suicide behavior. Feeling lonely was assessed by asking the students the following question: 'During the past 12 months, how often did you feel lonely each week?' The response options for this question ranged from 1-never to 4-over 4 days. Suicide behavior was assessed by asking the students the following question: 'During the past 12 months, did you ever seriously consider attempting suicide?' The response options for this question were 1-never, 2-considered, 3-attempted. In regard to the school-level independent variable, the high school was categorized as GHS or VHS according to the official data that were provided by the city board of education.

2.3 Statistical analysis

Two investigators independently entered all of the data using EpiData software (version 3.1), and all statistical analyses were conducted using SAS (version 9.2). Descriptive analyses were conducted separately for GHS and VHS students to describe the different relationships in the demographic characteristics and lifetime prevalence of NMUPD. Subsequently, a stratified two-level logistic regression model (individuals at

level-1 nested within 29 general and 11 vocational high schools at level-2) was fitted to estimate variables that were independently predictive of NMUPD according to the odds ratios (ORs) and 95% confidence intervals (CIs). We entered all individual- and school-level variables as covariates into this regression model to select complete predictors of NMUPD. Statistical significance was evaluated at the <0.05 level using two-sided tests. The questionnaires were reasonably complete. The percentage of missing data was less than 2.0% for all relevant variables, and missing data were eliminated in the two-level analysis.

3. Results

3.1 Demographic characteristics of GHS and VHS students

The demographic information distributions are illustrated in **Table 1**. The final sample consisted of 11,906 high school students, with 8,095 (74.7%) general and 3,001 (25.3%) vocational high school students. The students ranged in age from 11 to 23 years old, and the mean age was 16.7 ($\pm$1.2) years. The proportion of males was 45.9% (45.7% of GHS and 46.5% of VHS students, $P>0.05$). In regard to family-related factors, a total of 54.4% of students lived with both biological parents (56.3% of GHS and 48.9% of VHS students, $P<0.001$), 37.8% of students (36.3% of GHS and 42.1% of VHS students, $P<0.001$) considered their family economic status to be below average, and 8.3% of students (8.2% of GHS and 8.9% of VHS students, $P<0.001$) had difficult family relationships. The proportion of students who had above average academic stress was 13.0% (10.1% of GHS and 21.6% of VHS students, $P<0.001$). A total of 2.9% of students (2.8% of GHS and 3.1% of VHS students, $P<0.001$) reported poor classmate relationships, and 6.2% (6.4% of GHS and 5.7% of VHS students, $P>0.05$) had poor relationships with teachers. The proportion of students who had parents who engaged in NMUPD was 3.4% (3.3% of GHS and 3.6% of VHS students, $P>0.05$), and 4.6% of students (4.5% of GHS and 4.8% of VHS students, $P>0.05$) reported having friends who engaged in NMUPD. A total of 13.8% of students (11.5% of GHS and 20.8% of VHS students, $P<0.001$) reported smoking, and 71.2% of students (72.0% of GHS

and 68.8% of VHS students, *P*<0.05) reported drinking during the past 30 days. In regard to psychological-related factors, 12.1% of students (12.1% of GHS and 12.2% of VHS students, *P*>0.05) felt lonely more than 4 days per week, and 1.2% of students (1.2% of GHS and 1.3% of VHS students, *P*<0.05) attempted suicide.

3.2 Prevalence and characteristics of NMUPD among GHS and VHS students

As shown in **Table 2**, we estimated the total prevalence and characteristics of NMUPD and the subgroup prevalence rates of NMUPD among GHS and VHS students. The total lifetime prevalence of NMUPD was 15.7%, and the VHS students had higher rates of lifetime exposure to nonmedical prescription drug use than the GHS students (20.7% in VHS and 14.1% in GHS). The prevalence of NMUPD was 17.2% among male students and 14.5% among female students, and male students had a higher prevalence of NMUPD than females both in GHS and VHS. The students in grade 12 (15.9% in total; 15.6% in GHS and 20.1% in VHS) demonstrated the highest prevalence of NMUPD compared to students in other grades. NMUPD was more prevalent among those who lived with others (16.6% in total; 14.6% in GHS and 19.9% in VHS), had monthly pocket money that was above 300 RMB (19.8% in total; 16.9% in GHS and 28.1% in VHS), reported above average family economic status (19.5% in total; 17.3% in GHS and 27.3% in VHS), had difficult family relationships (22.8% in total; 20.3% in GHS and 29.7% in VHS), reported below average academic stress (17.1% in total; 13.9% in GHS and 21.5% in VHS), had poor classmate relationships (24.4% in total; 22.4% in GHS and 29.8% in VHS), and had poor relationships with teachers (23.1% in total; 19.4% in GHS and 35.3% in VHS). Additionally, students who had parents or friends who engaged in NMUPD had a higher prevalence of NMUPD. The prevalence of NUMPD was higher among students who smoked than those who did not (22.6% in total; 20.8% in GHS and 25.6% in VHS) but was slightly lower among students who drank alcohol than those who did not (14.6% in total; 12.9% in GHS and 19.2% in VHS). The students who felt lonely more than 4 days per week had a higher prevalence than those who did not (19.6% in total; 17.9% in GHS and 24.9% in VHS), and those who attempted suicide had a much higher prevalence of NMUPD than those who did

not (41.5% in total; 41.3% in GHS and 42.1% in VHS).

3.3 Predictors of NMUPD based on a two-level logistic regression model

A two-level logistic regression model was used to initially examine the individual- and school-level predictors of NMUPD among high school students (see **Table 3**). The VHS students were more likely to be nonmedical prescription drugs users than the GHS students (AOR=1.55, 95% CI=1.37-1.76). Below average family economic status was negatively correlated with NMUPD (AOR=0.75, 95% CI=0.62-0.92). Students who had difficult family relationships (AOR= 1.38, 95% CI=1.16-1.65), below average academic stress (AOR=1.02, 95% CI=1.01-1.43), poor classmate relationships (AOR=1.36, 95% CI=1.01-1.81), and poor relationships with teachers (AOR=1.33, 95% CI=1.06-1.66) were at a higher risk for nonmedical prescription drug use. Students who had parents who engaged in NMUPD (AOR=2.45, 95% CI=1.95-3.09) and friends who engaged in NMUPD (AOR=1.64, 95% CI=1.32-2.03) were more likely to engage in nonmedical prescription drug use. Additionally, smoking (AOR=1.34, 95% CI=1.15-1.56), feeling lonely 1 to 4 days and more than 4 days per week, considering suicide (AOR=1.63, 95% CI=1.05-2.56), and attempting suicide (AOR=2.86, 95% CI=1.96-4.17) were risk predictors of NMUPD.

4. Discussion

The present study significantly contributes to the understanding of NMUPD among various high school students. The current results provided some evidence of significant demographic differences between GHS and VHS students, and these findings gave a plausible explanation for conducting a subgroup analysis of the prevalence and characteristics of NMUPD. We found that approximately 15.7% students reported nonmedical prescription drug use in their lifetime. The total prevalence rate of NMUPD was slightly lower than that revealed in the 2013 national youth risk behavior survey (YRBS), which consisted of students in grades 9-12 in all 50 states in the U.S. and the District of Columbia. This survey reported that 17.8% (15.9%-19.9%) of students had

taken prescription drugs without a doctor's prescription one or more times during their lifetime. [19] Additionally, the current study demonstrated that male students (17.2%) had a higher prevalence of NMUPD than females (14.5%) and that students in grade 12 had the highest prevalence of NMUPD compared to students in other grades (15.9%). This finding was consistent with the 2013 MTF, which reported that the proportion of 12th graders who used any prescription drugs was 15.0%. [10] Generally, nonmedical prescription drug use has been a major internal public health problem, and China is no exception.

Furthermore, consistent with our expectations, the current results demonstrated that VHS students (20.7%) had a much higher prevalence than GHS students (14.1%) and that VHS students consistently had a higher prevalence of NMUPD compared to GHS students across all demographic characteristics. Additionally, the final logistic regression model demonstrated that students who attended VHS had a higher risk for NMUPD compared to those who attended GHS (AOR=1.55, 95% CI=1.37-1.76). This result is consistent with previous findings that students who are unable to perform academically on the high school admittance test or are enduring household economic challenges typically enroll in VHS and that these students are more likely to be involved in substance use. [22] The current study was the first to examine the influence of different high school categories (GHS or VHS) on NMUPD, though Franke's research in German reported that pupils from vocational schools was at a higher prevalence of nonmedical use of prescription stimulants. [23] According to the findings, preventive and intervention programs should consider the school category, especially VHS, in developing measures to control the problem of NMUPD in school.

Regarding individual-level factors, the current study revealed that the risk of NMUPD increased for students who reported having pocket money that exceeded 100 RMB per month. The same results were found in Wang's study. [20] Additionally, we found that below average family economic status was negatively correlated with NMUPD. Hanson's research demonstrated that high socio-economic status teens were more likely to use substances than low socio-economic status teens. [24] We concluded that compared with students who reported above average family economic status,

students from lower-income families had less pocket money and, thus, less access to prescription drugs.

Previous national studies have shown relationships between students' gender, age, and grade in school and NMUPD. [9, 10] However, the results of the current study showed no significant association between gender, age, and grade in school and NMUPD. These conflicting results may be related to the source of the sample or the substance categories. For instance, Simoni-Wastila's research using 2003 NSDUH did not find the association between gender, age and stimulants or sedatives but showed a relationship between older age and pain relievers. [25] Wu's research using 2005 NSDUH showed that female gender and older age were significantly associated with nonmedical use of pain relievers. [26]

Parental factors have been associated with NMUPD in several studies. Prior studies have indicated that adolescents who reside in a two-parent household are significantly less likely to report any NMUPD. [27, 28] The results of the current study demonstrated that students who lived with one parent rather than two had a higher probability of NMUPD. Furthermore, Herman-Stahl's research reported that adolescents who had high family conflict were more likely than their counterparts to engage in nonmedical use of prescription stimulants. [29] The present study also found that difficult family relationships were associated with NMUPD, with an increased odds of 38% (AOR=1.38, 95% CI=1.16-1.65). Notably, the current research found that students who had parents who engaged in nonmedical drug use were at a higher risk for NMUPD, and a previous study also indicated that adolescents of parents who used substances were at an increased risk for substance use. [30] The present results emphasized the negative consequence that parental factors can have in terms of students' NMUPD and the importance of improving parental monitoring practices of both their own and their children's nonmedical drug use. Twombly's research suggested that it is necessary to improve parents' and adolescents' awareness of the risks of NMUPD. [31]

Additionally, frequent substance use is negatively related to school-related factors. [32] Many previous studies have demonstrated that nonmedical prescription drug use is significant among adolescents with poor academic performance [20, 33] and that stress

can have deleterious effects on health and academic performance. [34] The current study demonstrated that students who reported below average academic stress exhibited a slightly increased (2%) prevalence of nonmedical prescription drug use. Furthermore, we found that students who had poor relationships with classmates or teachers were more likely to engage in NMUPD. These findings are consistent with prior studies that have suggested that engagement and positive teacher-pupil relationships are strongly and negatively associated with all substance use. [35] Previous studies have indicated that students with friends who engage in nonmedical prescription drug use are at a higher risk of engaging in NMUPD. [21, 36] Peers may serve as role models, influence personal attitudes toward substance use, and/or provide access, encouragement, and social settings for substance use. [37] The present study also demonstrated that students who had friends who engaged in nonmedical prescription drug use were more likely to be involved in NMUPD. Therefore, prevention and effective interventions are needed to target school-related factors, especially the bidirectional influence between peers.

Additionally, consistent with previous studies that have reported that cigarette smoking increases the prevalence rate of NMUPD, [20, 38] the present study found that cigarette smokers were 1.34 (95% CI=1.15-1.56) times more likely to engage in NMUPD than nonsmokers. Although studies have reported a relationship between alcohol drinking and NMUPD, [22] we did not find this association in the current study. One reason for this finding may be related to the definition or extent of alcohol drinking. Nonetheless, interventions that target students who have initiated substance use may be effective in reducing use. [39]

Regarding psychology-related factors, many studies have indicated that mental health is closely related to substance use, [9, 37] and prescription drugs have been consistently associated with suicidal behavior. [13, 40] Consistent with these findings, the current study found that feeling lonely more than 4 days per week and considering or attempting suicide were positively correlated with NMUPD and that attempting suicide increased the odds of NMUPD by 186% (AOR=2.86, 95% CI=1.96-4.17). Therefore, students who report poor psychology-related factors should be a primary

focus, and proper interventions should be provided to them.

The present study has noteworthy strengths, including the analysis of survey data that were collected from a large-scale sample of GHS and VHS students. Furthermore, individual- and school-level factors were involved in a multilevel logistic regression model to select independent predictors of NMUPD simultaneously. An important contribution of this study is the differences that were found in NMUPD between GHS and VHS students. Despite these strengths, the results of the analyses are tempered by some methodological limitations that should be considered. First, the results cannot be generalized to all adolescents because this sample only included high school students and did not include individuals who had dropped out of school or were not present in school on the day of survey administration. Second, the data are subject to potential bias introduced by the administration of sensitive behaviors via self-report surveys in a school setting. Finally, the cross-sectional nature of the study presents several limitations; longitudinal studies with more diverse age groups of adolescents and measures of current use are needed to examine patterns of NMUPD.

In conclusion, NMUPD among Chinese adolescents is a significant public health problem that warrants the attention of policy makers, researchers, and practitioners. Effective interventions to prevent and control NMUPD among high school students are highly recommended and should consider the influence of both individual- and school-level factors. First, parents and schools should focus on the NMUPD among adolescents, particularly those who struggle in psychology-related or school-related relationships. Furthermore, educational campaigns that are directed at families and schools are needed to improve awareness of the serious consequences of NMUPD. Moreover, policies that aim to control the sale of prescription drugs to adolescents without a doctor's prescription are highly recommended. Finally, a well-established surveillance program to supervise and control nonmedical prescription drug use and to predict the trend and long-term negative outcomes of NMUPD among adolescents (similar to the YRBSS or MTF in the United States) is expected to be conducted in China.

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Table 1. Demographic characteristics of general and vocational high school students.

Variables	Total (n,%)	GHS (n,%)	VHS (n,%)	*P*
Total	11906 (100)	8905 (100)	3001 (100)	-
Gender				
Male	5465 (45.9)	4070 (45.7)	1395 (46.5)	0.458
Female	6441 (54.1)	4835 (54.3)	1606 (53.5)	
Age*	16.7 (1.2)	16.8 (1.1)	16.5 (1.3)	<0.001
Grade				
10	3942 (33.1)	2912 (32.7)	1030 (34.3)	0.064
11	3948 (33.2)	2934 (32.9)	1014 (33.8)	
12	4016 (33.7)	2895 (32.5)	1121(37.3)	
Living arrangement				
With both parents	6451 (54.4)	4994 (56.3)	1457 (48.9)	<0.001
With only father or mother	1899 (16.0)	1387 (15.6)	512 (17.2)	
With others	3501 (29.5)	2492 (28.1)	1009 (33.9)	
Missing data	55 (0.5)	-	-	
Pocket money (RMB)				
<100	5439 (45.7)	1361 (45.8)	4078 (46.1)	0.491
100-299	4388 (36.9)	1090 (36.7)	3298 (37.3)	
>300	1985 (16.7)	520 (17.5)	1465 (16.6)	
Missing data	94 (0.8)	-	-	
Family economic status				
Above average	851 (7.2)	664 (7.5)	187 (6.3)	<0.001
Average	6524 (55.1)	4987 (56.2)	1537 (51.6)	
Below average	4473 (37.8)	3218 (36.3)	1255 (42.1)	
Missing data	58 (0.5)	-	-	
Family relationships				
Good	8686 (73.1)	6589 (74.1)	2097 (70.1)	<0.001
Normal	2205 (18.6)	1576 (17.7)	629 (21.0)	
Difficult	991 (8.3)	725 (8.2)	266 (8.9)	
Missing data	24 (0.2)			
Academic stress				
Above average	1546 (13.0)	900 (10.1)	646 (21.6)	<0.001
Average	4979 (41.9)	3395 (38.2)	1584 (52.9)	
Below average	5355 (45.1)	4592 (51.7)	763 (25.5)	
Missing data	26 (0.2)	-	-	
Classmate relationships				
Good	6759 (56.9)	5201 (58.5)	1558 (52.1)	<0.001
Average	4771 (40.2)	3434 (38.6)	1337 (44.7)	
Poor	344 (2.9)	250 (2.8)	94 (3.1)	
Missing data	32 (0.3)			
Relationships with teachers				
Good	4608 (38.8)	3401 (38.3)	1207 (40.3)	0.076

Table 1. Demographic characteristics of general and vocational high school students (continued).

Average	6528 (55.0)	4913 (55.3)	1615 (54.0)	
Poor	741 (6.2)	571 (6.4)	170 (5.7)	
Missing data	29 (0.2)			
Parents engaged in NMUPD				
No	11501 (96.6)	8607 (96.7)	2894 (96.4)	0.567
Yes	405 (3.4)	298 (3.3)	107 (3.6)	
Friends engaged in NMUPD				
No	11363 (95.4)	8507 (95.5)	2856 (95.2)	0.411
Yes	543 (4.6)	398 (4.5)	145 (4.8)	
Cigarette smoking				
No	10297 (86.5)	7902 (88.7)	2395 (79.8)	<0.001
Yes	1609 (13.8)	1003 (11.5)	606 (20.8)	
Alcohol drinking				
No	3430 (28.8)	2494 (28.0)	936 (31.2)	0.001
Yes	8476 (71.2)	6411 (72.0)	2065 (68.8)	
Feel lonely				
Less than 1 day/week	5807 (49.5)	4376 (49.8)	1431 (48.6)	0.473
1 to 4 days/week	4495 (38.3)	3340 (38.0)	1155 (39.2)	
More than 4 days/week	1422 (12.1)	1064 (12.1)	358 (12.2)	
Missing data	182 (1.5)	-	-	
Suicide behavior				
Never	11276 (94.7)	8465 (96.2)	2811 (95.0)	0.008
Considered	344 (2.9)	233 (2.6)	111 (3.8)	
Attempted	142 (1.2)	104 (1.2)	38 (1.3)	
Missing data	144 (1.2)	-	-	

GHS= General high school; VHS= Vocational high school; NMUPD= Nonmedical use of prescription drugs.

*: Age data presented as the means (SD).

Table 2. Prevalence and characteristics of NMUPD among general and vocational high school students.

Variables	Total	GHS	VHS
	NMUPD (n,%)	NMUPD (n,%)	NMUPD (n,%)
NMUPD	1874 (15.7)	1254 (14.1)	620 (20.7)
Gender			
Male	942 (17.2)	631 (15.5)	311 (22.3)
Female	932 (14.5)	623 (12.9)	309 (19.2)
Age*	16.7 (1.2)	16.8 (1.1)	16.5 (1.3)
Grade			
10	624 (15.8)	366 (12.7)	195 (18.9)
11	612 (15.5)	435 (14.8)	200 (19.8)
12	639 (15.9)	453 (15.6)	225 (20.1)
Living arrangement			
With both parents	1001 (15.5)	709 (14.2)	292 (20.0)
With only father or mother	286 (15.1)	179 (12.9)	107 (20.9)
With others	581 (16.6)	363 (14.6)	218 (21.6)
Pocket money (RMB)			
<100	810 (14.9)	533 (13.1)	277 (20.4)
100-299	655 (14.9)	462 (14.0)	193 (17.7)
>300	394 (19.8)	248 (16.9)	146 (28.1)
Family economic status			
Above average	166 (19.5)	115 (17.3)	51 (27.3)
Average	967 (14.8)	673 (13.5)	294 (19.1)
Below average	744 (16.4)	461 (14.3)	272 (21.7)
Family relationships			
Good	1260 (14.5)	857 (13.0)	403 (19.2)
Normal	383 (17.4)	247 (15.7)	136 (21.6)
Difficult	226 (22.8)	147 (20.3)	79 (29.7)
Academic stress			
Above average	264 (17.1)	125 (13.9)	139 (21.5)
Average	728 (14.6)	420 (12.4)	308 (19.4)
Below average	879 (16.4)	706 (15.4)	173 (22.7)
Classmate relationships			
Good	1002 (14.8)	693 (13.3)	309 (19.8)
Average	782 (16.4)	502 (14.6)	280 (20.9)
Poor	84 (24.4)	56 (22.4)	28 (29.8)
Relationships with teachers			
Good	679 (14.7)	451 (13.3)	228 (18.9)
Average	1023 (15.7)	691 (14.1)	332 (20.6)
Poor	171 (23.1)	111 (19.4)	60 (35.3)
Parents engaged in NMUPD			

Table 2. Prevalence and characteristics of NMUPD among general and vocational high school students (continued).

No	1740 (15.1)	1159 (13.5)	581 (20.1)
Yes	134 (33.1)	95 (31.9)	39 (36.4)
Friends engaged in NMUPD			
No	1727 (15.2)	1158 (13.6)	569 (19.9)
Yes	147 (27.1)	96 (24.1)	51 (35.2)
Cigarette smoking			
No	1510 (14.7)	1045 (13.2)	465 (19.4)
Yes	364 (22.6)	209 (20.8)	155 (25.6)
Alcohol drinking			
No	1372 (16.2)	932 (14.5)	440 (21.3)
Yes	502 (14.6)	322 (12.9)	180 (19.2)
Feel lonely			
Less than 1 day/week	785 (13.5)	522 (11.9)	263 (18.4)
1 to 4 days/week	768 (17.1)	511 (15.3)	257 (22.3)
More than 4 days/week	279 (19.6)	190 (17.9)	89 (24.9)
Suicide behavior			
Never	1681 (14.9)	1121 (13.2)	560 (19.9)
Considered	95 (27.6)	62 (26.6)	33 (29.7)
Attempted	59 (41.5)	43 (41.3)	16 (42.1)

GHS= General high school; VHS= Vocational high school; NMUPD= Nonmedical use of prescription drugs.

*: Age data presented as the means (SD).

Table 3. Predictors of NMUPD based on a two-level logistic regression model.

Variables	AOR (95% CI)
School-level	
School category	
General high school	1.00 (reference)
Vocational high school	1.55 (1.37-1.76) #
Individual-level	
Gender	
Female	1.00
Male	1.09 (0.98-1.23)
Age	1. 02 (0.97-1.07)
Grade	
10	1.00
11	0.93 (0.67-1.31)
12	1.13 (0.80-1.59)
Living arrangement	
With both parents	1.00
With only father or mother	1.03 (1.02-1.16)
With others	0.92 (0.80-1.07)
Pocket money (RMB)	
<100	1.00
100-299	1.33 (1.16-1.56) #
>300	1.28 (1.11-1.49) #
Family economic status	
Above average	1.00
Average	0.77 (0.63-1.05)
Below average	0.75 (0.62-0.92) #
Family relationships	
Good	1.00
Normal	1.12 (0.98-1.28)
Difficult	1.38 (1.16-1.65) #
Academic stress	
Above average	1.00
Average	1.03 (0.87-1.22)
Below average	1.02 (1.01-1.43) #
Classmate relationships	
Good	1.00
Average	1.03 (0.92-1.17)
Poor	1.36 (1.01-1.81) #
Relationships with teachers	
Good	1.00
Average	1.08 (0.96-1.23)
Poor	1.33 (1.06-1.66)

Table 3. Predictors of NMUPD based on a two-level logistic regression model (continued).

Parents engaged in NMUPD	
No	1.00
Yes	2.45 (1.95-3.09) #
Friends engaged in NMUPD	
No	1.00
Yes	1.64 (1.32-2.03) #
Cigarette smoking	
No	1.00
Yes	1.34 (1.15-1.56) #
Alcohol drinking	
No	1.00
Yes	0.98 (0.87-1.11)
Feel lonely	
Less than 1 day/week	1.00
1 to 4 days/week	1.28 (1.09-1.50) #
More than 4 days/week	1.24 (1.10-1.39) #
Suicide behavior	
Never	1.00
Considered	1.63 (1.05-2.56) #
Attempted	2.86 (1.96-4.17) #

NMUPD= Nonmedical use of prescription drugs.

#: According to the two-level logistic regression model with adjustment for other variables, $P<0.05$.

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Nonmedical use of prescription pain relievers among high school students in China: A multilevel analysis

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1 **Nonmedical use of prescription pain relievers among high school**

2 **students in China: A multilevel analysis**

3

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1

1 **ABSTRACT**

2 **Objectives:** Given the differences between general high school (GHS) and vocational

3 high school (VHS) students, this study aimed to investigate the lifetime prevalence of

4 nonmedical use of prescription pain relievers (NMUPPR) among high school students

5 as well as the associations between NMUPPR and individual-level factors and school

6 category.

7

8 **Methods:** A cross-sectional study was conducted in GHS and VHS students in 2012

9 in Chongqing, and 11,906 students' questionnaires were completed and qualified for

10 the survey. Self-reported NMUPPR and information regarding individual-level

11 determinants and school category were collected. A multi-level multivariate logistic

12 regression model was fitted to explore independent predictors of NMUPPR.

13

14 **Results:** The total lifetime prevalence of NMUPPR was 11.3%, and NMUPPR was

15 more prevalent among VHS students (15.8%) compared with GHS students (9.8%).

16 Overall, the results indicated that VHS students were more likely to be involved in

17 NMUPPR (AOR=1.64, 95% CI=1.42-1.89). Regarding the individual-level predictors

18 of NMUPPR, below-average family economic status was negatively correlated with

19 NMUPPR (AOR=0.77, 95% CI= 0.60-0.98), and students with more pocket money

20 were more likely to be engaged in NMUPPR. Students who had difficult family

21 relationships, had poor relationships with teachers, had parents or friends who

22 engaged in nonmedical prescription drug use, and considered or attempted suicide

23 were more likely to be engaged in NMUPPR.

24

25 **Conclusions:** Nonmedical prescription pain reliever use among high school students

26 is a multi-determined phenomenon. The current findings indicate that VHS students

27 are an important subgroup of adolescents and highlight the need for additional

28 research and as well as targeted prevention and intervention programmes for

29 NMUPPR.

30

2

1 **Strengths and limitations of this study**

2 · There was scarce study has been conducted to describe the prevalence and

3 characteristics of nonmedical use of prescription pain relievers (NMUPPR)

4 among general high school and vocational high school students separately.

5 · Individual- and school-level factors were involved in a two-level multivariate

6 logistic regression model to select independent predictors of NMUPPR

7 simultaneously.

8 · Vocational high school students had a higher risk for NMUPPR compared to

9 general high school students.

10 · The study demonstrated that a student's family-, school-, and

11 psychosocial-related factors also influence the nonmedical use of prescription

12 pain relievers.

13 · Although the results cannot be generalized to all adolescents, there are sufficient

14 and representative samples in this study.

15

16

1   **INTRODUCTION**

2   Non-medical use of prescription drugs (including sedatives, tranquilizers, stimulants,

3   sedatives, and pain relievers) is defined as taking medications without a doctor's

4   prescription, for periods longer than prescribed, or for reasons other than the

5   medication's intended purpose (e.g., 'to experiment' or 'to get high').[1][2] During the

6   last two decades, the increase in nonmedical use of prescription drugs has been a topic

7   of great concern.[3] Prescription drugs were the second most popular drug among

8   adolescents in the United States according to the 2013 National Survey on Drug Use

9   and Health (NSDUH),[4] and pain relievers are currently the most abused types of

10   prescription drugs among teens, followed by stimulants, tranquilizers, and sedatives.[5]

11   Notably, according to the report of Monitoring the Future (MTF), 14% of nonmedical

12   prescription pain reliever users are dependent.[6] High school students, often described

13   as individuals between 10 and 24 years of age, which is roughly the period of

14   adolescence for much of the world, engage in priority health-risk behaviors, including

15   substance use.[7] Previous studies have reported that high school students have the

16   greatest risk of nonmedical prescription drug use relative to other age groups,[4][8] and

17   this finding may reflect youth's perception that prescription drugs are safer, easier to

18   access, and less stigmatizing than illicit drugs.[9] However, it is clear that nonmedical

19   prescription drug use among juveniles is a large public health problem with negative

20   consequences, such as depressive disorder, bipolar disorders and anxiety disorder.[10]

21   Nonmedical use of prescription pain relievers (NMUPPR) among adolescents in the

22   United States represents a growing public health problem,[11] and very few studies have

23   described the characteristics associated with NMUPPR among U.S. high school

24   students.[12] To our knowledge, no study has described NMUPPR among Chinese high

25   school students, and the recent increased interest in exploring the predictors

26   associated with NMUPPR in Chinese adolescents is warranted.

27   Prior studies have illustrated many individual-level factors that are associated with

28   NMUPPR among high school students. McCabe's study in the United States

29   suggested that male students were more likely than female students to report

30   NMUPPR in their lifetime (17.4% versus 15.7%),[1] while Boyd's study in a

4

1   Detroit-area public school district revealed that girls had a higher prevalence of

2   NMUPPR than boys (22% versus 10%), and students at higher grade levels were

3   more likely to report NMUPPR.[13] A study in six European countries indicated that

4   students whose parents and peers engaged in substance use were at a higher risk of

5   nonmedical prescription pain reliever use,[14] and a study among Mississippi youth

6   suggested that suicidal behaviors were significantly associated with nonmedical

7   prescription pain reliever use.[15]

8   High school is generally categorized into general high school (GHS) and vocational

9   high school (VHS), and VHS students are typically characterized into heterogeneous

10   educational levels, including a significant proportion with little or no educational

11   attainment.[16 17] In the highly academically stratified society, students who graduate

12   from VHS experience discrimination, including fewer employment opportunities or

13   significantly lower salaries compared to those who graduate from GHS.[18] Prior

14   studies in South Korea and the United States have found that students in VHS have a

15   greater risk for smoking or drinking behavior than those in GHS, even after

16   controlling for individual-level factors.[19 20] However, there was scarce study has been

17   conducted to describe the prevalence and characteristics of NMUPPR among GHS

18   and VHS students separately or to examine the influence of individual-level factors

19   and high school category on NMUPPR simultaneously. Therefore, we conducted a

20   cross-sectional study within a large sample of randomly selected GHS and VHS

21   students in southwest China to assess the lifetime prevalence and characteristics of

22   NMUPPR and to explore the independent predictors of NMUPPR in terms of

23   individual-level factors and school category.

24   The following three hypotheses were formulated. First, consistent with the results

25   of previous studies,[21 22] we hypothesized that NMUPPR is a major international public

26   health problem among adolescents, and Chinese high school students are no exception.

27   Second, we expected that differences in the demographics and prevalence of

28   NMUPPR between GHS and VHS students are significant and the current status of

29   NMUPPR in VHS students is more serious than that in GHS students. Third, in line

30   with previous findings,[21 23 24] we hypothesized that most family-, school-, and

5

1   psychosocial-related factors are related to NMUPPR.

2

3

4   **METHODS**

5   **Study design and participants**

6   A cross-sectional study among GHS and VHS students was conducted in 2012 in

7   Chongqing, located in southwest China. The sample size was calculated for a

8   prevalence of nonmedical prescription drug use among Chinese adolescents of

9   6.0%,[21] an α of 0.05, a sampling error of 0.005, an estimate of 3.8114 million high

10 school students in Chongqing. We used a multistage stratified cluster sampling

11 procedure to obtain a representative sample. With adjustment for the clustering design

12 effect and the non-response rate, the resulting calculated sample size was 9,014. In

13 stage 1, based on the surveillance data on the population of 'nonmedical prescription

14 drug users of cough syrup with codeine' during 2010-2011 from the Center for ADR

15 Monitoring of Chongqing, we divided the districts in Chongqing into three categories:

16 (1) high (districts accounting for more than 5% of this population): (2) middle

17 (districts accounting for 1-5% of this population); and (3) low (districts accounting for

18 less than 1% of this population). Then, we selected two representative districts (or

19 primary sampling units) from each category by simple randomization using SAS

20 software. In stage 2, high schools (or secondary sampling units) in each selected

21 district were divided into three categories based on teaching quality: key high school,

22 regular high school, and vocational high school. All high schools in the selected

23 districts were surveyed (including four key high schools, five regular high schools,

24 and four vocational high schools in each of the high and low districts as well as five

25 key high schools, six regular high schools, and three vocational high schools in the

26 middle districts). In total, 29 GHSs and 11 VHSs within these primary units were

27 selected. In stage 3, two classes (or minimum sampling units) were randomly selected

28 from each grade within the selected schools (see **Figure 1**). All available students in

29 the selected classes were invited to participate in our study. Of the 12,406 high school

30 students who were invited to participate, 11,906 students' questionnaires were

6

1   completed and qualified for the survey, resulting in a response rate of 96.0%.

2

Data collection

4   To protect the privacy of the students, a rigorously anonymous method for collection

5   of the self-report questionnaires was guaranteed, and the questionnaires were

6   administered by research assistants in the classrooms without the presence of the

7   teachers (to avoid any potential information bias) during thirty minutes of the

8   students' regular class time.

9

Ethics statement

11   The study received approval from the Sun Yat-sen University, School of Public Health

12   Institutional Review Board. All the participants were fully informed of the purpose of

13   the survey and were invited to participate voluntarily. Written consent letters were

14   obtained from each participating student who was at least 18 years of age. If the

15   student was under 18 years of age, a written consent letter was obtained from one of

16   the student's parents.

17

Measures

19   **Dependent variable.** The dependent variable was the lifetime NMUPPR, which was

20   assessed by the following question: 'Have you ever, even once, used the following

21   medications when you were not sick or just for the intended purpose to experiment or

22   to get high without a doctor's prescription?' The question was followed by a list of the

23   following prescription pain relievers. The response categories were 'yes' and 'no'. In

24   this study, we only included four pain relievers: cough syrup with codeine, Percocet,

25   tramadol, and scattered analgesics (traditional Chinese medicine). The list of

26   medications was developed based on medicines reported to be widely used by

27   adolescent drug abusers in rehabilitation centers and a list provided by the Center for

28   ADR Monitoring of Chongqing.

29

30   **Independent variables.** The individual-level independent variables included the

7

students' sociodemographic characteristics, family- and school-related factors, alcohol and cigarette use, and psychosocial-related factors. The sociodemographic variables were age, gender, grade, and pocket money (the students were asked how much pocket money, on average, they received per month from their parents. The responses were coded as 'less than 100 RMB', '100-299 RMB', or 'more than 300 RMB'). Each student's living arrangement was assessed by asking who lived in the student's primary home. Family economic status was measured by asking about the student's perception of his or her family's current economic status. Family relationships were assessed by asking the students how they judged the relationships between their family members. Academic stress was captured by a single item that asked for a personal appraisal of the student's academic stress relative to that of his/her classmates (responses were coded as 'below average', 'average', or 'above average'). Relationships with classmates or teachers were also assessed based on the students' self-ratings (responses were coded as 'poor', 'average', or 'good'). Whether the students' parents or friends engaged in nonmedical prescription drug use was assessed by asking the participants the following question: 'Have your parents or friends used prescription drugs when they were not sick without a doctor's prescription during their lifetime?' Alcohol drinking was measured by a single item ('Have you used at least one drink previously and one or more drinks within the past 30 days?'). Cigarette smoking was assessed by asking the respondents the following question: 'Have you smoked at least one cigarette previously and used between 1 and 29 cigarettes within the past 30 days?' Psychosocial-related factors were assessed by two variables, feeling lonely and suicidal behavior. Feeling lonely was assessed by asking the students the following question: 'During the past 12 months, how often did you feel lonely each week?' The response options for this question ranged from 1-never to 4-over 4 days. Suicidal behavior was assessed by asking the students the following question: 'During the past 12 months, did you ever seriously consider attempting suicide?' The response options for this question were 1-never, 2-considered, or 3-attempted. In regard to the school-level independent variable, the high school was categorized as a GHS or VHS according to official data that were provided by the city

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1 board of education.

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3 **Sources of prescription pain relievers.** The sources of obtaining prescription pain

4 relievers for nonmedical use were assessed by asking students the following

5 multiple-choice question: 'Where did you get prescription pain relievers for

6 nonmedical use?' The response options for this question were 1-from peers, 2-from

7 family members, or 3-from others.

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9 **Motivations for NMUPPR.** The motivations for NMUPPR were assessed by asking

10 students the following multiple-choice question: 'Why did you nonmedically use

11 prescription pain relievers?' The response options for this question were 1-to

12 experiment, 2-to get high, 3-to relax or relieve tension, or 4-other.

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14 **Statistical analysis**

15 Two investigators independently entered all of the data using EpiData software

16 (version 3.1), and all statistical analyses were conducted using SAS (version 9.2).

17 Descriptive analyses were conducted separately in GHS and VHS students to describe

18 the different relationships among the demographic characteristics and the lifetime

19 prevalence of NMUPPR. Subsequently, a two-level multivariate logistic regression

20 model (individuals at level-1 nested within 29 general and 11 vocational high schools

21 at level-2) was fitted to estimate variables that were independently predictive of

22 NMUPPR according to the adjusted odds ratios (AORs) and 95% confidence intervals

23 (CIs). We entered all individual- and school-level variables as covariates into this

24 regression model (the generalized linear mixed effects model adopting the GLMMIX

25 procedure in SAS) to select the complete and independent predictors of NMUPPR.

26 Statistical significance was evaluated at the <0.05 level using two-sided tests. The

27 questionnaires were reasonably complete. The percentage of missing data was less

28 than 2.0% for all relevant variables, and missing data were eliminated in the

29 Chi-square tests, t-test, and two-level multivariate logistic regression analysis.

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2 **RESULTS**

3 **Demographic characteristics of GHS and VHS students**

4 The demographic information distributions are illustrated in **Table 1**. The final sample

5 consisted of 11,906 high school students, including 8,095 (74.7%) GHS and 3,001

6 (25.3%) VHS students. The students ranged in age from 11 to 23 years, and the mean

7 age was 16.7 (±1.2) years. The proportion of males was 45.9% (45.7% of GHS and

8 46.5% of VHS students, $p>0.05$). Regarding the individual-level factors, 37.8% of

9 students (36.3% of GHS and 42.1% of VHS students, $p<0.001$) considered their

10 family economic status to be below average. A total of 2.9% of the students (2.8% of

11 GHS and 3.1% of VHS students, $p<0.001$) reported poor classmate relationships, and

12 6.2% (6.4% of GHS and 5.7% of VHS students, $p>0.05$) had poor relationships with

13 teachers. A total of 13.8% of the students (11.5% of GHS and 20.8% of VHS students,

14 $p<0.001$) reported smoking, 71.2% of the students (72.0% of GHS and 68.8% of VHS

15 students, $p<0.05$) reported drinking during the past 30 days, and 1.2% of the students

16 (1.2% of GHS and 1.3% of VHS students, $p<0.05$) attempted suicide.

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18 **Prevalence and characteristics of NMUPPR among GHS and VHS students**

19 As shown in **Table 2**, we estimated the total prevalence and characteristics of

20 NMUPPR and the subgroup prevalence rates of NMUPPR among GHS and VHS

21 students. The total lifetime prevalence of NMUPPR was 11.3%, and the VHS students

22 had higher rates of lifetime exposure to nonmedical prescription pain reliever use than

23 the GHS students (15.8% in VHS and 9.8% in GHS students). The prevalence of

24 NMUPPR was 12.2% among male students and 10.5% among female students, and

25 male students had a higher prevalence of NMUPPR than females in both GHS and

26 VHS. NMUPPR was more prevalent among those who lived with others (12.2% in

27 total; 10.6% in GHS and 16.4% in VHS students), reported above average family

28 economic status (13.9% in total; 11.4% in GHS and 22.5% in VHS students), had

29 difficult family relationships (16.1% in total; 14.5% in GHS and 20.7% in VHS

30 students), had poor classmate relationships (18.3% in total; 17.6% in GHS and 20.2%

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in VHS students), and had poor relationships with teachers (18.9% in total; 15.8% in GHS and 29.4% in VHS students). Additionally, students who had parents or friends who engaged in nonmedical prescription drug use had a higher prevalence of NMUPPR. Students who attempted suicide had a much higher prevalence of NMUPPR than those who did not (35.2% in total; 34.6% in GHS and 36.8% in VHS students).

Classes, sources and motivations for NMUPPR among GHS and VHS students

Table 3 shows that the most common nonmedically used prescription pain reliever among high school students was scattered analgesics, at approximately 5.8% (4.9% in GHS and 8.4% in VHS students, $p<0.001$), followed by cough syrup with codeine (5.5% in total, 5.0% in GHS and 7.3% in VHS, $p<0.001$), Percocet (5.4% in total; 4.7% in GHS and 7.7% in VHS students, $p<0.001$), and tramadol (0.6% in total; 0.6% in GHS and 0.6% in VHS students, $p=0.871$). In this study, we also found that prescription pain relievers for nonmedical use among high school students were most commonly obtained from peers (6.3% in total, 5.9% in GHS and 7.5% in VHS students, $p<0.001$), followed by others (4.6% in total, 3.9% in GHS and 6.8% in VHS students, $p<0.001$) and family members (2.0% in total, 1.5% in GHS and 3.7% in VHS students, $p<0.001$). In addition, the most prevalent motivation for NMUPPR by high school students was 'to relax or relieve tension' (4.9% in total; 4.4% in GHS and 6.3% in VHS students, $p<0.001$), followed by 'to experiment' (2.6% in total, 2.3% in GHS and 3.5% in VHS students, $p=0.001$) and 'to get high' (2.5% in total, 2.2% in GHS and 3.4% in VHS students, $p<0.001$).

Predictors of NMUPPR based on a two-level multivariate logistic regression model

A two-level multivariate logistic regression model was used to initially examine the individual- and school-level independent predictors of NMUPPR among high school students (see **Table 4**). Compared with the GHS students, the VHS students were more likely to be users of nonmedical prescription pain relievers (AOR=1.64, 95%

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1 CI=1.42-1.89) after controlling for individual-level variables. Regarding the

2 individual-level predictors of NMUPPR, below-average family economic status was

3 negatively correlated with NMUPPR (AOR=0.77, 95% CI=0.60-0.98), and students

4 with more pocket money were more likely to be engaged in NMUPPR. Students who

5 had difficult family relationships (AOR= 1.26, 95% CI=1.02-1.54), average

6 relationships with teachers (AOR=1.50, 95% CI=1.20-1.89), and poor relationships

7 with teachers (AOR=1.57, 95% CI=1.23-2.01) were at a higher risk for nonmedical

8 prescription pain reliever use compared to the corresponding reference group.

9 Additionally, students having parents who engaged in nonmedical prescription drug

10 use (AOR=2.31, 95% CI=1.79-2.98) or having friends who engaged in nonmedical

11 prescription drug use (AOR=1.75, 95% CI=1.38-2.22) were more likely to be

12 involved in NMUPPR. Additionally, cigarette smoking (AOR=1.53, 95%

13 CI=1.29-1.82), considering suicide (AOR=3.47, 95% CI=2.34-5.15), and attempting

14 suicide (AOR=2.08, 95% CI=1.29-3.35) were independent risk predictors of

15 NMUPPR.

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18 **DISCUSSION**

19 To our knowledge, this is the first study to describe NMUPPR among Chinese high

20 school students and to explore potential predictors of NMUPPR in China. The present

21 study significantly contributes to the understanding of NMUPPR among various high

22 school students. The current results provide evidence of significant demographic

23 differences between GHS and VHS students, and these findings led us to conduct a

24 stratification analysis of the prevalence and characteristics of NMUPPR across school

25 type. We found that approximately 11.3% of the students reported nonmedical

26 prescription pain reliever use in their lifetime. The total prevalence rate of NMUPPR

27 was higher than that described in a previous report from the 2013 National Survey on

28 Drug Use and Health (NSDUH) in the United States which showed that 4.5 million

29 (1.7%) respondents aged 12 or older were nonmedical users of prescription pain

30 relievers,[4] and lower than that described in a study of a Detroit-area public school

1 district suggesting that approximately 16% of students had engaged in NMUPPR

2 during their lifetime.[13] A possible explanation for the variance in the prevalence could

3 be differences in the nature of the samples or the classes of pain relievers. In our

4 research, according to a list provided by the Center for ADR Monitoring of

5 Chongqing suggesting that pain relievers are widely used by adolescent drug abusers

6 in rehabilitation centers, we only included four specific classes of pain relievers. Our

7 results suggested the most common nonmedically used prescription pain reliever

8 among total high school students was scattered analgesics, at approximately 5.8%,

9 followed by cough syrup with codeine (5.5%). These results are consistent with the

10 study of Wang et al. in Guangdong.[21]

11 Furthermore, consistent with our expectations, the current results demonstrated that

12 VHS students (15.8%) had a much higher prevalence of NMUPPR than GHS students

13 (9.8%) and that VHS students consistently had a higher prevalence of NMUPPR

14 compared to GHS students regardless of their demographic characteristics.

15 Additionally, the final logistic regression model revealed that students who attended

16 VHS had a higher risk of NMUPPR compared to those who attended GHS

17 (AOR=1.64, 95% CI=1.42-1.89). This result is consistent with previous findings in

18 China and the United States showing that students who are unable to perform

19 academically on the high school admittance test or are enduring household economic

20 challenges typically enroll in VHS and that these students are more likely to be

21 involved in substance use.[25] The current study was the first to examine the influence

22 of different high school categories (GHS or VHS) on NMUPPR, although Franke

23 reported that German pupils from vocational schools was at a higher prevalence of

24 nonmedical use of prescription stimulants.[26] According to these findings, preventive

25 and intervention programmes should consider the school category, when developing

26 measures to control the problem of NMUPPR in schools, especially in VHSs. A prior

27 study in four German federal states demonstrated that school-based prevention

28 programmes are considered to be one of the most appropriate and suitable strategies

29 for preventing adolescent substance use.[27]

30 Regarding the individual-level factors, our study first showed that male students

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had a higher prevalence of NMUPPR than female students (12.2% versus 10.5%); however, after adjusting for other variables, there was no significant association between gender and NMUPPR. The findings on gender and NMUPPR have not been consistent in the previous literature, with some studies showing an association between NMUPPR and female gender,[24 28] others showing an association between NMUPPR and male gender,[29] and others showing no significant associations between gender and NMUPPR.[30] Additionally, consistent with a prior study in Sweden,[24] we did not find any association between NMUPPR and age. Prior studies in the United States have shown that there is a significant association between grade and NMUPPR,[31 32] while the results of our study showed no significant associations between school grade and NMUPPR. It is possible that this result might be related to the fact that the relationship between NMUPPR and grade is likely to vary depending on the substance.

The final logistic regression model also revealed that the risk of NMUPPR increased among students who reported receiving more than 100 RMB as pocket money per month, and the similar results were found in the study of Wang et al. in Guangdong.[21] It is possible that students with more pocket money have more access to prescription drugs. Additionally, we found that below-average family economic status was slightly negatively correlated with NMUPPR (AOR=0.77, 95% CI=0.60-0.98). Similarly, Hanson's research in the United States demonstrated that high socio-economic status teens were more likely to use substances than low socio-economic status teens.[33] It is possible that compared with students who reported above-average family economic status, students from lower-income families had less pocket money; thus, they had less access to prescription drugs. Parental factors have been associated with nonmedical prescription drug use in several studies. In the United States, Herman-Stahl's research reported that adolescents who had a high level of family conflict were more likely than their counterparts to engage in nonmedical use of prescription stimulants.[34] The present study also found that difficult family relationships were associated with nonmedical prescription pain reliever use, with an increased odds of 26% (AOR=1.26, 95% CI=1.02-1.54). Notably, the current study

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found that students having parents who engaged in nonmedical prescription drug use were at a higher risk for NMUPPR, and previous studies also indicated that adolescents having parents who used substances were at an increased risk for substance use.[23][35] The present results emphasized the negative consequence that parental factors can have in terms of students' NMUPPR and the importance of improving parental monitoring practices of both their own and their children's nonmedical drug use. Twombly's research in the United States suggested that it is necessary to improve parents' and adolescents' awareness of the risks of nonmedical use of any prescription drug.[36]

In addition, frequent substance use is negatively associated with school-related factors.[37] In this study, we found that students who had poor relationships with teachers were more likely to engage in NMUPPR. The finding is consistent with previous studies that have suggested that engagement and positive teacher-pupil relationships are strongly negatively associated with all substance use categories.[38] Previous studies have indicated that students with friends who engaged in nonmedical prescription drug use were at a higher risk of NMUPPR.[39][40] Peers may serve as role models, influence personal attitudes toward substance use, and/or provide access, encouragement, and social settings for substance use.[14] In this study, we found that students having friends who nonmedically used prescription drugs were more likely to be involved in NMUPPR, and the prescription pain relievers used nonmedically by high school students were most commonly obtained from peers. Similarly, McCabe's study in the United States suggested that the majority of students obtained prescription pain relievers for nonmedical use from peers.[1] Therefore, prevention and effective interventions are needed to target school-related factors, especially the bidirectional influence between peers. Students need to be educated about the potential dangers associated with providing abusable prescription pain medications to their peers.[13]

Consistent with previous studies in China and the United States showing that cigarette smoking increased the prevalence rate of NMUPPR,[21][41] the present study revealed that cigarette smokers were 1.53 (95% CI=1.29-1.82) times more likely to

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engage in NMUPPR than nonsmokers. Although a prior study in Sweden has reported

a relationship between alcohol drinking and nonmedical use of analgesics,[24] we did

not find this association in the current study. This discrepancy may be related to the

definition or extent of alcohol drinking. Nonetheless, interventions that target students

who have already initiated substance use may be effective in reducing use.[42]

Regarding the psycholosocial-related factors, many studies in European countries

and the United States have indicated that mental health is closely related to substance

use.[14 43] In the current study, we found that the most prevalent motivations for

prescription pain relievers nonmedically used by students was 'to relax or relieve

tension', and similar results has been reported in McCabe's study in the United

States.[44] Additionally, nonmedical prescription pain reliever use was reported to be

associated with suicidal behavior among Mississippi youth.[15] Consistent with these

findings, the current study found that considering or attempting suicide was positively

correlated with NMUPPR and that attempting suicide increased the odds of NMUPPR

by 186% (AOR=2.86, 95% CI=1.96-4.17). Therefore, students who report poor

psychosocial-related factors should be a primary focus, and proper interventions

should be provided for these individuals.

The present study has noteworthy strengths, including the analysis of survey data

that were collected from a large-scale sample of GHS and VHS students. Furthermore,

individual- and school-level factors were incorporated in a two-level multivariate

logistic regression model to select independent predictors of NMUPPR

simultaneously. Importantly, we observed the differences in NMUPPR between GHS

and VHS students. Despite these strengths, the results of our analyses are tempered by

some methodological limitations that should be considered. First, the results cannot be

generalized to all adolescents because this sample only included high school students

and did not include individuals who had dropped out of school or were not present in

school on the day of survey administration. Second, the data are subject to potential

bias introduced by the administration of sensitive behaviors via self-report surveys in

a school setting. Finally, the cross-sectional nature of the study presents several

limitations; thus, longitudinal studies that enroll adolescents in more diverse age

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groups and employ more diverse measures of current use are needed to examine the patterns of NMUPPR.

In conclusion, nonmedical prescription pain reliever use among Chinese high school students is a significant public health problem that warrants the attention of policy makers, researchers, and practitioners. Effective interventions to prevent and control NMUPPR among high school students are highly recommended and should consider the influence of both individual- and school-level factors. First, parents and schools should focus on NMUPPR among adolescents, particularly those who struggle in psychosocial-related or school-related relationships. Furthermore, educational campaigns that are directed at families and schools are needed to improve awareness of the serious consequences of NMUPPR. Moreover, policies that aim to control the sale of prescription pain relievers to adolescents without a doctor's prescription are highly recommended. Finally, a well-established surveillance program to supervise and control nonmedical prescription drug use and to predict the trends in and long-term negative outcomes of NMUPPR among adolescents (similar to MTF in the United States) is expected to be developed in China.

Contributorship statement

LG and CYL searched the literature, conceived the study, designed the study, analyzed the data, interpreted the results, and drafted the report. YX and JXD organized the study, collected the data and analyzed the data. YH, XG, PSL, HW, and JHZ collected the data, interpreted the results, and obtained funding.

Competing interests

The authors declare that no competing interests exist.

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6 **Data sharing statement**

7 No additional unpublished data are available.

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1   **Figure legend**

2   **Figure 1.** Flowchart of the sampling procedure

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Table 1. Demographic characteristics of GHS and VHS students.

Variables	Total, n (%)	GHS, n (%)	VHS, n (%)	p^{**}
Total	11906 (100)	8905 (100)	3001 (100)	-
Gender				
Male	5465 (45.9)	4070 (45.7)	1395 (46.5)	0.458
Female	6441 (54.1)	4835 (54.3)	1606 (53.5)	
Age (years)*	16.7 (1.2)	16.8 (1.1)	16.5 (1.3)	<0.001
Grade				
10	3942 (33.1)	2912 (32.7)	1030 (34.3)	0.064
11	3948 (33.2)	2934 (32.9)	1014 (33.8)	
12	4016 (33.7)	2895 (32.5)	1121(37.3)	
Living arrangement				
With both parents	6451 (54.4)	4994 (56.3)	1457 (48.9)	<0.001
With only father or mother	1899 (16.0)	1387 (15.6)	512 (17.2)	
With others	3501 (29.5)	2492 (28.1)	1009 (33.9)	
Missing data	55 (0.5)	-	-	
Pocket money (RMB)				
<100	5439 (45.7)	1361 (45.8)	4078 (46.1)	0.491
100-299	4388 (36.9)	1090 (36.7)	3298 (37.3)	
>300	1985 (16.7)	520 (17.5)	1465 (16.6)	
Missing data	94 (0.8)	-	-	
Family economic status				
Above average	851 (7.2)	664 (7.5)	187 (6.3)	<0.001
Average	6524 (55.1)	4987 (56.2)	1537 (51.6)	
Below average	4473 (37.8)	3218 (36.3)	1255 (42.1)	
Missing data	58 (0.5)	-	-	
Family relationships				
Good	8686 (73.1)	6589 (74.1)	2097 (70.1)	<0.001
Normal	2205 (18.6)	1576 (17.7)	629 (21.0)	
Difficult	991 (8.3)	725 (8.2)	266 (8.9)	
Missing data	24 (0.2)			
Academic stress				
Above average	1546 (13.0)	900 (10.1)	646 (21.6)	<0.001
Average	4979 (41.9)	3395 (38.2)	1584 (52.9)	
Below average	5355 (45.1)	4592 (51.7)	763 (25.5)	
Missing data	26 (0.2)	-	-	
Classmate relationships				
Good	6759 (56.9)	5201 (58.5)	1558 (52.1)	<0.001
Average	4771 (40.2)	3434 (38.6)	1337 (44.7)	
Poor	344 (2.9)	250 (2.8)	94 (3.1)	
Missing data	32 (0.3)			
Relationships with teachers				
Good	4608 (38.8)	3401 (38.3)	1207 (40.3)	0.076

23

Table 1. Demographic characteristics of GHS and VHS students (continued).

Average	6528 (55.0)	4913 (55.3)	1615 (54.0)	
Poor	741 (6.2)	571 (6.4)	170 (5.7)	
Missing data	29 (0.2)			
Parents engaged in NMUPD				
No	11501 (96.6)	8607 (96.7)	2894 (96.4)	0.567
Yes	405 (3.4)	298 (3.3)	107 (3.6)	
Friends engaged in NMUPD				
No	11363 (95.4)	8507 (95.5)	2856 (95.2)	0.411
Yes	543 (4.6)	398 (4.5)	145 (4.8)	
Cigarette smoking				
No	10297 (86.5)	7902 (88.7)	2395 (79.8)	<0.001
Yes	1609 (13.8)	1003 (11.5)	606 (20.8)	
Alcohol drinking				
No	3430 (28.8)	2494 (28.0)	936 (31.2)	0.001
Yes	8476 (71.2)	6411 (72.0)	2065 (68.8)	
Feel lonely				
Less than 1 day/week	5807 (49.5)	4376 (49.8)	1431 (48.6)	0.473
1 to 4 days/week	4495 (38.3)	3340 (38.0)	1155 (39.2)	
More than 4 days/week	1422 (12.1)	1064 (12.1)	358 (12.2)	
Missing data	182 (1.5)	-	-	
Suicide behavior				
Never	11276 (94.7)	8465 (96.2)	2811 (95.0)	0.008
Considered	344 (2.9)	233 (2.6)	111 (3.8)	
Attempted	142 (1.2)	104 (1.2)	38 (1.3)	
Missing data	144 (1.2)	-	-	

1 GHS= General high school; VHS= Vocational high school; NMUPD= Nonmedical use of

2 prescription drugs.

3 *: Age data are presented as the means (SD). SD= Standard deviation.

4 **: Chi-square tests were used to examine the differences between GHS and VHS students based

5 on the above-mentioned categorical variables, and a t-test was used to examine the age difference

6 between GHS and VHS students.

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Table 2. Prevalence and characteristics of NMUPPR among GHS and VHS students.

Variables	Total NMUPPR, n (%)	GHS NMUPPR, n (%)	VHS NMUPPR, n (%)
NMUPPR	1342 (11.3)	869 (9.8)	473 (15.8)
Gender			
Male	667 (12.2)	433 (10.6)	234 (16.8)
Female	675 (10.5)	436 (9.0)	239 (14.9)
Age (years)*	16.7 (1.3)	16.8 (1.1)	16.4 (1.5)
Grade			
10	454 (11.5)	266 (9.1)	188 (18.3)
11	452 (11.4)	325 (11.1)	127 (12.5)
12	436 (10.9)	278 (9.6)	158 (14.1)
Living arrangement			
With both parents	690 (10.7)	476 (9.5)	214 (14.7)
With only father or mother	219 (11.5)	128 (9.2)	91 (17.8)
With others	428 (12.2)	263 (10.6)	165 (16.4)
Pocket money (RMB)			
<100	600 (11.0)	378 (9.3)	222 (16.3)
100-299	454 (10.3)	313 (9.5)	141 (12.9)
>300	274 (13.8)	168 (11.5)	106 (20.4)
Family economic status			
Above average	118 (13.9)	76 (11.4)	42 (22.5)
Average	683 (10.5)	463 (9.3)	220 (14.3)
Below average	536 (12.0)	327 (10.2)	209 (16.7)
Family relationships			
Good	895 (10.3)	585 (8.9)	310 (14.8)
Normal	282 (12.8)	176 (11.2)	106 (16.9)
Difficult	160 (16.1)	105 (14.5)	55 (20.7)
Academic stress			
Above average	193 (12.5)	92 (10.2)	101 (15.6)
Average	522 (10.5)	286 (8.4)	236 (14.9)
Below average	625 (11.7)	489 (10.6)	136 (17.8)
Classmate relationships			
Good	720 (10.7)	487 (9.4)	233 (15.0)
Average	553 (11.6)	335 (9.8)	218 (16.3)
Poor	63 (18.3)	44 (17.6)	19 (20.2)
Relationships with teachers			
Good	483 (10.5)	304 (8.9)	179 (14.8)
Average	718 (11.0)	474 (9.6)	244 (15.1)
Poor	140 (18.9)	90 (15.8)	50 (29.4)
Parents engaged in NMUPD			

25

Table 2. Prevalence and characteristics of NMUPPR among GHS and VHS students. (continued).

No	1241 (10.8)	800 (9.3)	441 (15.2)
Yes	101 (24.9)	69 (23.2)	32 (29.9)
Friends engaged in NMUPD			
No	1227 (10.8)	795 (9.3)	432 (15.1)
Yes	115 (21.2)	74 (18.6)	41 (28.3)
Cigarette smoking			
No	1059 (10.3)	710 (9.0)	349 (14.6)
Yes	283 (17.6)	159 (15.9)	124 (20.5)
Alcohol drinking			
No	975 (11.5)	635 (9.9)	340 (16.5)
Yes	367 (10.7)	234 (9.4)	133 (14.2)
Feel lonely			
Less than 1 day/week	550 (9.5)	354 (8.1)	196 (13.7)
1 to 4 days/week	570 (12.7)	365 (10.9)	205 (17.7)
More than 4 days/week	193 (13.6)	128 (12.0)	65 (18.2)
Suicide behavior			
Never	1194 (10.6)	767 (9.1)	427 (15.2)
Considered	69 (20.1)	46 (19.7)	23 (20.7)
Attempted	50 (35.2)	36 (34.6)	14 (36.8)

1 NMUPPR= Nonmedical use of prescription pain relievers; GHS= General high school; VHS=

2 Vocational high school; NMUPD= Nonmedical use of prescription drugs.

3 *: Age data are presented as the means (SD). SD= Standard deviation.

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Table 3. Classes, sources, and motivations for NMUPPR among GHS and VHS students.

Variables	Total, n (%)	GHS, n (%)	VHS, n (%)	*p*-value*
Total	11906 (100)	8905 (100)	3001 (100)	
Class of pain relievers				
Scattered analgesics	685 (5.8)	434 (4.9)	251 (8.4)	<0.001
Codeine	661 (5.5)	443 (5.0)	218 (7.3)	<0.001
Percocet	647 (5.4)	416 (4.7)	231 (7.7)	<0.001
Tramadol	73 (0.6)	54 (0.6)	19 (0.6)	0.871
Source of pain relievers				
From peers	746 (6.3)	522 (5.9)	224 (7.5)	<0.001
From family members	241 (2.0)	130 (1.5)	111 (3.7)	<0.001
Others	551 (4.6)	348 (3.9)	203 (6.8)	<0.001
Motivation for NMUPPR				
To relax or relieve tension	580 (4.9)	391 (4.4)	189 (6.3)	<0.001
To experiment	310 (2.6)	206 (2.3)	104 (3.5)	0.001
To get high	294 (2.5)	192 (2.2)	102 (3.4)	<0.001
Other	482 (4.0)	315 (3.5)	167 (5.6)	<0.001

2   *: Chi-square tests were used to examine the differences between GHS and VHS students.

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Table 4. Predictors of NMUPPR based on a two-level multivariate logistic regression model.

Variables	AOR (95% CI)
School-level	
School category	
General high school	1.00 (reference)
Vocational high school	1.64 (1.42-1.89) #
Individual-level	
Gender	
Female	1.00
Male	0.98 (0.86-1.12)
Age (years)	0.99 (0.93-1.05)
Grade	
10	1.00
11	1.27 (1.09-1.46)
12	1.53 (0.99-2.37)
Living arrangement	
With both parents	1.00
With only father or mother	0.89 (0.78-1.03)
With others	0.97 (0.82-1.15)
Pocket money (RMB)	
<100	1.00
100-299	1.21 (1.02-1.43) #
>300	1.24 (1.04-1.47) #
Family economic status	
Above average	1.00
Average	1.03 (0.90-1.17)
Below average	0.77 (0.60-0.98) #
Family relationships	
Good	1.00
Normal	1.12 (0.89-1.41)
Difficult	1.26 (1.02-1.54) #
Academic stress	
Above average	1.00
Average	1.13 (0.97-1.33)
Below average	1.20 (0.98-1.46)
Classmate relationships	
Good	1.00
Average	1.25 (0.91-1.72)
Poor	1.24 (0.90-1.72)
Relationships with teachers	
Good	1.00
Average	1.50 (1.20-1.89) #
Poor	1.57 (1.23-2.01) #

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Table 4. Predictors of NMUPPR based on a two-level logistic regression model (continued).

Parents engaged in NMUPD	
No	1.00
Yes	2.31 (1.79-2.98) #
Friends engaged in NMUPD	
No	1.00
Yes	1.75 (1.38-2.22) #
Cigarette smoking	
No	1.00
Yes	1.53 (1.29-1.82) #
Alcohol drinking	
No	1.00
Yes	1.02 (0.89-1.17)
Feel lonely	
Less than 1 day/week	1.00
1 to 4 days/week	0.86 (0.71-1.04)
More than 4 days/week	1.06 (0.87-1.29)
Suicide behavior	
Never	1.00
Considered	3.47 (2.34-5.15) #
Attempted	2.08 (1.29-3.35) #

1 NMUPPR= Nonmedical use of prescription pain relievers.

2 #: According to the two-level multivariate logistic regression model with adjustment for other
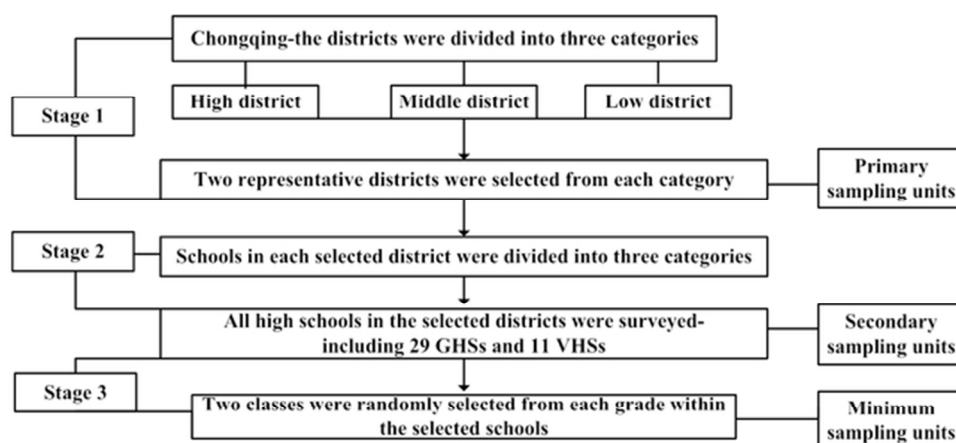
3 variables, $p<0.05$.

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Figure 1. Flowchart of the sampling procedure

56x29mm (300 x 300 DPI)

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4-5
Objectives	3	State specific objectives, including any prespecified hypotheses	5-6
Methods			
Study design	4	Present key elements of study design early in the paper	6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7-8
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	7-9
Bias	9	Describe any efforts to address potential sources of bias	7
Study size	10	Explain how the study size was arrived at	6-7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	-
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	9
		(*b*) Describe any methods used to examine subgroups and interactions	9
		(*c*) Explain how missing data were addressed	9
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	9
		(*e*) Describe any sensitivity analyses	-
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	6-7
		(b) Give reasons for non-participation at each stage	16
		(c) Consider use of a flow diagram	6
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	10
		(b) Indicate number of participants with missing data for each variable of interest	23-24
Outcome data	15*	Report numbers of outcome events or summary measures	10-11
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	11-12
		(*b*) Report category boundaries when continuous variables were categorized	-
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	-
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	10-11
Discussion			
Key results	18	Summarise key results with reference to study objectives	12-16
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	16-17
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	16
Generalisability	21	Discuss the generalisability (external validity) of the study results	16
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	18

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

Nonmedical use of prescription pain relievers among high school students in China: A multilevel analysis

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ABSTRACT~~bstract~~

Objectives: Given the differences between general high school (GHS) and vocational high school (VHS) students, this study aimed to investigate the lifetime prevalence of nonmedical use of prescription pain relievers~~drugs~~ (NMUPPR~~D~~) among high school students as~~and~~ well as the associations between NMUPPR~~D~~ and individual-level factors and school category.

Methods: A cross-sectional study was conducted in GHS and VHS students in 2012 in Chongqing, and 11,906 students' questionnaires were completed and qualified for the survey. Self-reported NMUPPR~~D~~ and information regarding individual-level determinants and school category were collected. A ~~stratified two~~multi-level multivariate logistic regression model was fitted to explore independent predictors of NMUPPR~~D~~.

Results: The total lifetime prevalence of NMUPPR~~D~~ was 11.3~~15.7~~%, and NMUPPR~~D~~ was more prevalent among VHS students (15.8~~20.7~~%) compared with GHS students (~~in VHS and~~ 9.8~~14.1~~%) ~~in GHS~~). Overall, the ~~The final~~ results indicated that VHS students were more likely to be involved in NMUPPR~~D~~ (AOR=1.64~~55~~, 95% CI=1.42-1.89~~1.37-1.76~~). Regarding the individual-level predictors of~~for~~ NMUPPR~~factors~~, below-average family economic status was negatively correlated with NMUPPR (AOR=0.77, 95% CI= 0.60-0.98), and students with more pocket money were more likely to be engaged in NMUPPR.~~:~~ Ss~~students who~~ had difficult family relationships, ~~had below average academic stress,~~ had poor relationships with ~~classmates or~~ teachers, had parents or friends who engaged in nonmedical prescription drug use~~NMUPD~~, ~~felt lonely more than 1 day,~~ and considered or attempted suicide were more likely to be engaged in NMUPPR~~D~~.

Conclusions: ~~NMUPD~~ Nonmedical prescription pain reliever use ~~use of prescription pain relievers use~~ among high school students is a multi-determined phenomenon. The current findings indicate~~d~~ that VHS students are an important

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1 subgroup of adolescents and highlighted the need for additional research and as well

2 as targeted prevention and intervention programmes for NMUPPR.

3

Strengths and limitations of this study

- There was scarce study has been conducted to describe the prevalence and characteristics of nonmedical use of prescription pain relievers (NMUPPR) among general high school and vocational high school students separately.
- Individual- and school-level factors were involved in a two-level multivariate logistic regression model to select independent predictors of NMUPPR simultaneously.
- Vocational high school students had a higher risk for NMUPPR compared to general high school students.
- The study demonstrated that a student's family-, school-, and psychosocial-related factors also influence the nonmedical use of prescription pain relievers.
- Although the results cannot be generalized to all adolescents, there are sufficient and representative samples in this study.

4

1   **INTRODUCTION**

2   Non-medical use of prescription drugs (including sedatives, tranquilizers, stimulants,
3   sedatives, and pain relievers) is defined as taking medications without a doctor's
4   prescription, for periods longer than prescribed, or for reasons other than the
5   medication's intended purpose (e.g., 'to experiment' or 'to get high').[1][2] During the
6   last two decades, the increase in nonmedical use of prescription drugs has been a topic
7   of great concern.[3] Prescription drugs were the second most popular drug among
8   adolescents ~~in the 2013 National Survey on Drug Use and Health (NSDUH)~~ in the
9   United States according to the 2013 National Survey on Drug Use and Health
10 (NSDUH),[4] and pain relievers are currently the most abused types of prescription
11 drugs among teens, followed by stimulants, tranquilizers, and sedatives.[5] Notably,
12 according to the report of Monitoring the Future (MTF), 14% of nonmedical
13 prescription pain reliever users are dependent.[6] High school students, often described
14 as individuals between 10 and 24 years of age, which is roughly the period of
15 adolescence for much of the world, engage in priority health-risk behaviors, including
16 substance use.[7] Previous studies have reported that high school students have the
17 greatest risk of nonmedical prescription drug use relative to other age groups,[4][8] and
18 this finding may reflect ~~demonstrate~~ youth's perception that prescription drugs are
19 safer, easier to access, and less stigmatizing than illicit drugs.[9] However, it is clear
20 that nonmedical prescription drug use among juveniles is a large public health
21 problem with negative consequences, such as depressive disorder, bipolar disorders
22 and anxiety disorder.[10] Nonmedical use of prescription pain relievers (NMUPPR)
23 among adolescents in the United States represents a growing public health problem,[11]
24 and very few studies have described the characteristics associated with NMUPPR
25 among U.S. high school students.[12] To our knowledge, no study has described
26 NMUPPR among Chinese high school students, and the recent increased interest in
27 exploring the predictors associated with NMUPPR in Chinese adolescents is
28 warranted.

29   Prior studies have illustrated many individual-level factors that are associated with
30 NMUPPR among high school students. McCabe's study in the United States

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suggested that male students were more likely than female students to report NMUPPR in their lifetime (17.4% versus 15.7%)[1] while Boyd's study in a Detroit-area public school district revealed that girls had a higher prevalence of NMUPPR than boys (22% versus 10%), and students at higher grade levels were more likely to report NMUPPR.[13] A study in six European countries indicated that students whose parents and peers engaged in substance use were at a higher risk of nonmedical prescription pain reliever use,[14] and a study among Mississippi youth suggested that suicidale behaviors were significantly associated with nonmedical prescription pain reliever use.[15]

High school is generally categorized into general high school (GHS) and vocational high school (VHS), and VHS students are typically characterized into heterogeneous educational levels, including a significant proportion with little or no educational attainment.[16 17] In the highly academically stratified society, students who graduate from VHS experience discrimination, including fewlower employment opportunities or significantly lower salariesy compared to those who graduate from GHS.[18] Prior studies in South Korea and the United States have found that students in VHS have a greater risk forof smoking or drinking behavior than those in GHS, even after controlling for individual-level factors.[19 20] However, there was scarce study has been conducted to describe the prevalence and characteristics of NMUPPR among GHS and VHS students separately or to examine the influence of individual-level factors and high school category on NMUPPR simultaneously. Therefore, we conducted a cross-sectional study within a large sample of randomly selected GHS and VHS students of GHS and VHS students in sSouthwest China to assess the lifetime prevalence and characteristics of NMUPPR and to explore the independent predictors of NMUPPR in terms of individual-level factors and school category.

The following three hypotheses were formulated. First, consistent with the results of previous studies,[21 22] we hypothesized that NMUPPR is a major international public health problem among adolescents, and Chinese high school students are no exception. Second, we expected that differences in the demographics and prevalence of NMUPPR between GHS and VHS students are significant and that the current status

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of NMUPPR in VHS students is more serious than that in GHS students. Third, in line consistent with previous findings,[21][23][24] we hypothesized that most family-, school-, and psychosocial-related factors are related to NMUPPR.

METHODS

Study design and participants

A cross-sectional study amongof GHS and VHS students was conducted in 2012among GHS and VHS students in 2012 in Chongqing, located in the southwest of China. This individual- and school-level study aimed to investigate the lifetime prevalence of NMUPPR and to explore the independent predictors forof NMUPPR among GHS and VHS students. The sample size was calculated for a prevalence of nonmedical prescription drug use among Chinese adolescents of 6.0%,[21] an α of 0.05, a sampling error of 0.005, an estimate of 3.8114 million high school students in Chongqing. We used a multistage stratified cluster sampling procedure to obtain a representative sample. With adjustment for the clustering design effect and the non-response rate, the resulting calculated sample size was 9,014. In stage 1, based on the surveillance data on the population of 'nonmedical prescription drug users of cough syrup with codeine' during 2010-2011 from the Center for ADR Monitoring of Chongqing, we divided the districts in Chongqing into three categories: (1) high (districts accounting for more than 5% of this population): (2) middle (districts accounting for 1-5% of this population); and (3) low (districts accounting for less than 1% of this population). Then, we selected two representative districts (or primary sampling units) from each category by simple randomization using SAS software. In stage 2, high schools (or secondary sampling units) in each selected district were divided into three categories based on teaching quality: key high school, regular high school, and vocational high school. All high schools in the selected districts were surveyed (including four key high schools, five regular high schools, and four vocational high schools in each of the high and low districts as well as five key high schools, six regular high schools, and three vocational high schools in the middle

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districts). In total, 29 GHSs and 11 VHSs within these primary units were selected. In stage 3, two classes (or minimum sampling units) were randomly selected from each grade within the selected schools (see **Figure 1**). All available students in the selected classes were invited to participate in our study. Of the 12,406 high school students who were invited to participate, 11,906 students' questionnaires were completed and qualified for the survey, resulting in a response rate of 96.0%.

Data collection

To protect the privacy of the students, a rigorously anonymous method for collection of the self-report questionnaires was guaranteed, and the questionnaires were administered by research assistants in the classrooms without the presence of the teachers (to avoid any potential information bias) during thirty minutes~~a half hour~~ of the students' regular class time.

Ethics statement

The study received approval from the Sun Yat-sen University, School of Public Health Institutional Review Board. All the participants were fully informed of the purpose of the survey and were invited to participate voluntarily. Written consent letters were obtained from each participating student who was at least 18 years of age. If the student was under 18 years of age, a written consent letter was obtained from one of the student's parents.

Measures

Dependent variable. The dependent variable was the lifetime NMUPPR, which was assessed by the following question: 'Have you ever, even once, used the following medications when you were not sick or just for the intended purpose to experiment or to get high without a doctor's prescription?' The question was followed by a list of the following prescription pain relievers. The response categories were 'yes' and 'no'. In this study, we only included four pain relievers: cough syrup with codeine, Percocet, tramadol, and scattered analgesics (traditional Chinese medicine). The list of

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medications was developed based on medicines reported to be widely used by adolescent drug abusers in rehabilitation centers and a list provided by the Center for ADR Monitoring of Chongqing.

Independent variables. The individual-level independent variables included the students' sociodemographic characteristics, family- and school-related factors, alcohol and cigarette use, and psychosocial-related psychological-related factors. The sociodemographic variables were age, gender, grade, and pocket money (the students were asked how much pocket money, on average, they received per month from their parents. The responses were coded as 'less than 100 RMBYuan', '100-299 RMBYuan', or 'more than 300 RMBYuan'). Each student's lLiving arrangement was assessed by asking who lived in the student's primary home. Family economic status was measured by asking about the student's perception of his or her family's current economic status. Family relationships were assessed by asking the students how they judged the relationships between their family members. Academic stress was captured by a single item that asked for a personal appraisal of the student's academic stress relative to that of his/her classmates (responses were coded as 'below average', 'average', or 'above average'). Relationships with classmates or teachers were also assessed based on the students' self-ratings (responses were coded as 'poor', 'averagegeneral', or 'good'). Whether the students' parents or friends engaged in nonmedical prescription drug use was assessed by asking the participants the following question: 'Haves your father, mothe parentsr or friends used prescription drugs when they were not sick without a doctor's prescription during their lifetime?' Alcohol drinking was measured by a single item ('Have you used at least one drink previously and one or more drinks within the past 30 days?'). Cigarette smoking was assessed by asking the respondents the following question: 'Have you smoked at least one cigarette previously and used between 1 and 29 cigarettes within the past 30 days?' Psychosocial-related factors were assessed by two variables, feeling lonely and suicidale behavior. Feeling lonely was assessed by asking the students the following question: 'During the past 12 months, how often did you feel lonely each week?' The

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response options for this question ranged from 1-never to 4-over 4 days. Suicidale behavior was assessed by asking the students the following question: 'During the past 12 months, did you ever seriously consider attempting suicide?' The response options for this question were 1-never, 2-considered, or 3-attempted. In regard to the school-level independent variable, the high school was categorized as a GHS or VHS according to the official data that were provided by the city board of education.

Sources of prescription pain relievers. The sources of obtaining prescription pain relievers for nonmedical use were assessed by asking students the following multiple-choice question: 'Where did you get prescription pain relievers for nonmedical use?' The response options for this question were 1-from peers, 2-from family members, or 3-from others.

Motivations for NMUPPR. The motivations for NMUPPR were assessed by asking students the following multiple-choice question: 'Why did you nonmedically use prescription pain relievers?' The response options for this question were 1-to experiment, 2-to get high, 3-to relax or relieve tension, or 4-other.

Statistical analysis

Two investigators independently entered all of the data using EpiData software (version 3.1), and all statistical analyses were conducted using SAS (version 9.2). Descriptive analyses were conducted separately for in GHS and VHS students to describe the different relationships among in the demographic characteristics and the lifetime prevalence of NMUPPR. Subsequently, a stratified two-level multivariate logistic regression model (individuals at level-1 nested within 29 general and 11 vocational high schools at level-2) was fitted to estimate variables that were independently predictive of NMUPPR according to the adjusted odds ratios (AORs) and 95% confidence intervals (CIs). We entered all individual- and school-level variables as covariates into this regression model (the generalized linear mixed effects model adopting the GLMMIX procedure in SAS) to select the complete and

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independent predictors of for NMUPPR. Statistical significance was evaluated at the <0.05 level using two-sided tests. The questionnaires were reasonably complete. The percentage of missing data was less than 2.0% for all relevant variables, and missing data were eliminated in the Chi-square tests, tT-test, and two-level multivariate logistic regression analysis.

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RESULTS

Demographic characteristics of GHS and VHS students

The demographic information distributions are illustrated in **Table 1**. The final sample consisted of 11,906 high school students, including 8,095 (74.7%) GHS and 3,001 (25.3%) VHS students. The students ranged in age from 11 to 23 years, and the mean age was 16.7 (±1.2) years. The proportion of males was 45.9% (45.7% of GHS and 46.5% of VHS students, $p>0.05$). Regarding the individual-level factors, 54.4% of students lived with both biological parents (56.3% of GHS and 48.9% of VHS students, $P<0.001$), 37.8% of students (36.3% of GHS and 42.1% of VHS students, $pP<0.001$) considered their family economic status to be below average, and 8.3% of students (8.2% of GHS and 8.9% of VHS students, $P<0.001$) had difficult family relationships. The proportion of students who had above average academic stress was 13.0% (10.1% of GHS and 21.6% of VHS students, $P<0.001$). A total of 2.9% of the students (2.8% of GHS and 3.1% of VHS students, $pP<0.001$) reported poor classmate relationships, and 6.2% (6.4% of GHS and 5.7% of VHS students, $pP>0.05$) had poor relationships with teachers. The proportion of students who had parents who engaged in NMUPD was 3.4% (3.3% of GHS and 3.6% of VHS students, $P>0.05$), and 4.6% of students (4.5% of GHS and 4.8% of VHS students, $P>0.05$) reported having friends who engaged in NMUPD. A total of 13.8% of the students (11.5% of GHS and 20.8% of VHS students, $pP<0.001$) reported smoking, and 71.2% of the students (72.0% of GHS and 68.8% of VHS students, $pP<0.05$) reported drinking during the past 30 days. In regard to psychological related factors, 12.1% of students (12.1% of GHS and 12.2% of VHS students, $P>0.05$) felt lonely more than 4 days per

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1 ~~week~~, and 1.2% of the students (1.2% of GHS and 1.3% of VHS students, p~~P~~<0.05)

2 attempted suicide.

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4 **Prevalence and characteristics of NMUPPR among GHS and VHS students**

5 As shown in **Table 2**, we estimated the total prevalence and characteristics of

6 NMUPPR and the subgroup prevalence rates of NMUPPR among GHS and VHS

7 students. The total lifetime prevalence of NMUPPR was 11.3%, and the VHS students

8 had higher rates of lifetime exposure to nonmedical prescription pain reliever use than

9 the GHS students (15.8% in VHS and 9.8% in GHS students). The prevalence of

10 NMUPPR was 12.2% among male students and 10.5% among female students, and

11 male students had a higher prevalence of NMUPPR than females in both GHS and

12 VHS. ~~The students in grade 12 (15.9% in total; 15.6% in GHS and 20.1% in VHS)~~

13 ~~demonstrated the highest prevalence of NMUPD compared to students in other grades.~~

14 NMUPPR~~D~~ was more prevalent among those who lived with others (12.2~~6.6~~% in

15 total; 10~~4~~.6% in GHS and 16.4~~9.9~~% in VHS students)~~, had monthly pocket money~~

16 ~~that was above 300 RMB (19.8% in total; 16.9% in GHS and 28.1% in VHS)~~,

17 reported above average family economic status (13.9~~9.5~~% in total; 11.4~~7.3~~% in GHS

18 and 22.5~~7.3~~% in VHS students), had difficult family relationships (22.1~~6.18~~% in total;

19 14.5~~20.3~~% in GHS and 20~~9~~.7% in VHS students)~~, reported below average academic~~

20 ~~stress (17.1% in total; 13.9% in GHS and 21.5% in VHS),~~ had poor classmate

21 relationships (24.4~~18.3~~% in total; 17.6~~22.4~~% in GHS and 20.2~~9.8~~% in VHS students),

22 and had poor relationships with teachers (18.9~~23.1~~% in total; 15.8~~9.4~~% in GHS and

23 29.4~~35.3~~% in VHS students). Additionally, students who had parents or friends who

24 engaged in nonmedical prescription drug use ~~NMUPD~~ had a higher prevalence of

25 NMUPPR~~D~~. ~~The prevalence of NUMPD was higher among students who smoked~~

26 ~~than those who did not (22.6% in total; 20.8% in GHS and 25.6% in VHS) but was~~

27 ~~slightly lower among students who drank alcohol than those who did not (14.6% in~~

28 ~~total; 12.9% in GHS and 19.2% in VHS). The students who felt lonely more than 4~~

29 ~~days per week had a higher prevalence than those who did not (19.6% in total; 17.9%~~

30 ~~in GHS and 24.9% in VHS), and~~ Students~~those~~ who attempted suicide had a much

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higher prevalence of NMUPPRD than those who did not (35.241.5% in total; 34.641.3% in GHS and 36.842.1% in VHS students).

Classes, sources and motivations for NMUPPR among GHS and VHS students

Table 3 shows that the most common nonmedically used prescription pain reliever among high school students was scattered analgesics, at approximately 5.8% (4.9% in GHS and 8.4% in VHS students, $p<0.001$), followed by cough syrup with codeine (5.5% in total, 5.0% in GHS and 7.3% in VHS, $p<0.001$), Percocet (5.4% in total; 4.7% in GHS and 7.7% in VHS students, $p<0.001$), and tramadol (0.6% in total; 0.6% in GHS and 0.6% in VHS students, $p=0.871$). In this study, we also found that prescription pain relievers for nonmedical use among high school students were most commonly obtained from peers (6.3% in total, 5.9% in GHS and 7.5% in VHS students, $p<0.001$), followed by others (4.6% in total, 3.9% in GHS and 6.8% in VHS students, $p<0.001$) and family members (2.0% in total, 1.5% in GHS and 3.7% in VHS students, $p<0.001$). In addition, the most prevalent motivation for NMUPPR by high school students was 'to relax or relieve tension' (4.9% in total; 4.4% in GHS and 6.3% in VHS students, $p<0.001$), followed by 'to experiment' (2.6% in total, 2.3% in GHS and 3.5% in VHS students, $p=0.001$) and 'to get high' (2.5% in total, 2.2% in GHS and 3.4% in VHS students, $p<0.001$).

Predictors of NMUPPR based on a two-level multivariate logistic regression model

A two-level multivariate logistic regression model was used to initially examine the individual- and school-level independent predictors of NMUPPR among high school students (see **Table 4**). Compared with the GHS students, tThe VHS students were more likely to be users of nonmedical prescription pain relievers (AOR=1.64, 95% CI=1.42-1.89) after controlling for individual-level variables. Regarding to the individual-level predictors of NMUPPR, below-average family economic status was negatively correlated with NMUPPR (AOR=0.77, 95% CI=0.60-0.98), and students with more pocket money were more likely to be engaged in NMUPPR. ; Sstudents

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who had difficult family relationships (AOR= 1.26, 95% CI=1.02-1.54), average relationships with teachers (AOR=1.50, 95% CI=1.20-1.89), and poor relationships with teachers (AOR=1.57, 95% CI=1.23-2.01) were at a higher risk for nonmedical prescription pain reliever use compared to the corresponding reference group. Additionally, ;students having parents who engaged in nonmedical prescription drug use (AOR=2.31, 95% CI=1.79-2.98) or having friends who engaged in nonmedical prescription drug use (AOR=1.75, 95% CI=1.38-2.22) were more likely to be involved in NMUPPR. Additionally, cigarette smoking (AOR=1.53, 95% CI=1.29-1.82), considering suicide (AOR=3.47, 95% CI=2.34-5.15), and attempting suicide (AOR=2.08, 95% CI=1.29-3.35) were independent risk predictors of NMUPPR.

DISCUSSION

To our knowledge, this is the first study to describe NMUPPR among Chinese high school students and to explore potential predictors of NMUPPR in China. The present study significantly contributes to the understanding of NMUPPR among various high school students. The current results provided some evidence of significant demographic differences between GHS and VHS students, and these findings led us to gave a plausible explanation for conducting a subgroup stratification analysis of the prevalence and characteristics of NMUPPR across school type. We found that approximately 11.3% of the students reported nonmedical prescription pain reliever use in their lifetime. The total prevalence rate of NMUPPR was higher than that described in a previous report from the 2013 National Survey on Drug Use and Health (NSDUH) in the United States which showed that 4.5 million (1.7%) respondents aged 12 or older were nonmedical users of prescription pain relievers,[4] and lower than that described in a study of a Detroit-area public school district suggesting that approximately 16% of students had engaged in NMUPPR during their lifetime.[13] A possible explanation for the variance in the prevalence could be differences in the nature of the samples or the classes of pain relievers. In our research, according to a

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list provided by the Center for ADR Monitoring of Chongqing suggesting that pain relievers are widely used by adolescent drug abusers in rehabilitation centers, we only included four specific classes of pain relievers. Our results suggested the most common nonmedically used prescription pain reliever among total high school students was scattered analgesics, at approximately 5.8%, followed by cough syrup with codeine (5.5%). These results are consistent with the study of Wang et al. in Guangdong.[21] Generally, nonmedical prescription pain reliever use has been a major internal public health problem, and China is no exception.

Furthermore, consistent with our expectations, the current results demonstrated that VHS students (15.8%) had a much higher prevalence of NMUPPR than GHS students (9.8%) and that VHS students consistently had a higher prevalence of NMUPPR compared to GHS students regardless of their across all demographic characteristics. Additionally, the final logistic regression model revealed demonstrated that students who attended VHS had a higher risk of for NMUPPR compared to those who attended GHS (AOR=1.64, 95% CI=1.42-1.89). This result is consistent with previous findings in China and the United States showing that students who are unable to perform academically on the high school admittance test or are enduring household economic challenges typically enroll in VHS and that these students are more likely to be involved in substance use.[25] The current study was the first to examine the influence of different high school categories (GHS or VHS) on NMUPPR, although Franke research in German reported that German pupils from vocational schools was at a higher prevalence of nonmedical use of prescription stimulants.[26] According to these findings, preventive and intervention programmes should consider the school category, especially VHS, when in developing measures to control the problem of NMUPPR in schools, especially in VHSs. A prior study in four German federal states has demonstrated that school-based prevention programmes are considered to be one of the most appropriate and suitable strategies for to preventing adolescent substance use.[27]

Regarding the individual-level factors, our study first showed that male students had a higher prevalence of NMUPPR than female students (12.2% versus 10.5%);

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however, after adjusting for other variables, there was no significant association between gender and NMUPPR. The findings on gender and NMUPPR have not been consistent in the previous literature, with some studies showing an association between NMUPPR and female gender,[24 28] others showing an association between NMUPPR and male gender,[29] and others showing no significant associations between gender and NMUPPR.[30] Additionally, consistent with a prior study in Sweden,[24] we did not find any association between NMUPPR and age. Prior studies in the United States have shown that there is a significant association between grade and NMUPPR,[31 32] while the results of our study showed no significant associations between school grade and NMUPPR. It is possible that this result might be related to the fact that the relationship between NMUPPR and grade is likely to vary depending on the substance.

The final logistic regression model also revealed that the risk of NMUPPR increased among students who reported receiving more than 100 RMB as pocket money per month, and the similar results were found in the study of Wang et al. in Guangdong.[21] It is possible that students with more pocket money have more access to prescription drugs. Additionally, we found that below-average family economic status was slightly negatively correlated with NMUPPR (AOR=0.77, 95% CI=0.60-0.98). Similarly, Hanson's research in the United States demonstrated that high socio-economic status teens were more likely to use substances than low socio-economic status teens.[33] It is possible that compared with students who reported above-average family economic status, students from lower-income families had less pocket money; thus, they had less access to prescription drugs.

Parental factors have been associated with nonmedical prescription drug use in several studies. ~~Herman Stahl's research~~ In the United States, Herman-Stahl's research reported that adolescents who had a high level of family conflict were more likely than their counterparts to engage in nonmedical use of prescription stimulants.[34] The present study also found that difficult family relationships were associated with nonmedical prescription pain reliever use, with an increased odds of 26% (AOR=1.26, 95% CI=1.02-1.54). Notably, the current study ~~research~~ found that students having

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parents who engaged in nonmedical prescription drug use were at a higher risk for NMUPPR, and previous studies also indicated that adolescents havingof parents who used substances were at an increased risk for substance use.[23 35] The present results emphasized the negative consequence that parental factors can have in terms of students' NMUPPR and the importance of improving parental monitoring practices of both their own and their children's nonmedical drug use. Twombly's research in the United States suggested that it is necessary to improve parents' and adolescents' awareness of the risks of nonmedical use of any prescription drug.[36]

In additionAdditionally, frequent substance use is negatively related to associated with school-related factors.[37] In this study, we found that students who had poor relationships with teachers were more likely to engage in NMUPPR. The finding is consistent with previousior studies that have suggested that engagement and positive teacher-pupil relationships are strongly and negatively associated with all substance use categories.[38] PAdditionally, previous studies have indicated that students with friends who engaged in nonmedical prescription drug use were are at a higher risk of engaging in NMUPPR.[39 40] Peers may serve as role models, influence personal attitudes toward substance use, and/or provide access, encouragement, and social settings for substance use.[14] In this study, we found The present study demonstrated that students having who had friends who nonmedically used prescription drugs were more likely to be involved in NMUPPR, and the prescription pain relievers used nonmedically by high school students were most commonly obtained from peers. Similarly, McCabe's study in the United States suggested that the majority of students obtained prescription pain relievers for nonmedical use from peers.[1] Therefore, prevention and effective interventions are needed to target school-related factors, especially the bidirectional influence between peers. Students need to be educated about the potential dangers associated with providing abusable prescription pain medications to their peers.[13]

Additionally, Cconsistent with previous studies in China and the United States showing that have reported that cigarette smoking increaseds the prevalence rate of NMUPPR,[21 41] the present study revealed found that cigarette smokers were 1.53

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1 (95% CI=1.29-1.82) times more likely to engage in NMUPPR than nonsmokers.

2 Although a prior study in Sweden has reported a relationship between alcohol

3 drinking and nonmedical use of analgesics,[24] we did not find this association in the

4 current study. TOne reason for this discrepancy finding may be related to the

5 definition or extent of alcohol drinking. Nonetheless, interventions that target students

6 who have already initiated substance use may be effective in reducing use.[42]

7 Regarding the psycholosocialgy-related factors, many studies in European

8 countries and the United States have indicated that mental health is closely related to

9 substance use.[14 43] In the current study, we found that the most prevalent motivations

10 for prescription pain relievers nonmedically used by students was 'to relax or relieve

11 tension', and similar results has been reported in McCabe's study in the United

12 States.[44] Additionally, nonmedical prescription pain reliever use was reported to be

13 associated with suicidal behavior among Mississippi youth.[15] Consistent with these

14 findings, the current study found that considering or attempting suicide wasere

15 positively correlated with NMUPPR and that attempting suicide increased the odds of

16 NMUPPR by 186% (AOR=2.86, 95% CI=1.96-4.17). Therefore, students who report

17 poor psychosocial-related factors should be a primary focus, and proper interventions

18 should be provided– for these individualsto them.

19 The present study has noteworthy strengths, including the analysis of survey data

20 that were collected from a large-scale sample of GHS and VHS students. Furthermore,

21 individual- and school-level factors were incorporatedvolved in a two-multilevel

22 multivariate logistic regression model to select independent predictors of NMUPPRD

23 simultaneously. Importantly, we observed An important contribution of this study is

24 the the differences that were found in NMUPPRD between GHS and VHS students.

25 Despite these strengths, the results of our the analyses are tempered by some

26 methodological limitations that should be considered. First, the results cannot be

27 generalized to all adolescents because this sample only included high school students

28 and did not include individuals who had dropped out of school or were not present in

29 school on the day of survey administration. Second, the data are subject to potential

30 bias introduced by the administration of sensitive behaviors via self-report surveys in

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a school setting. Finally, the cross-sectional nature of the study presents several limitations; thus, longitudinal studies ~~with~~ that enroll adolescents in more diverse age groups ~~of adolescents~~ and employ more diverse measures of current use are needed to examine the patterns of NMUP~~PRD~~.

In conclusion, nonmedical prescription pain reliever use ~~NMUPD~~ among Chinese ~~adolescents~~ high school students is a significant public health problem that warrants the attention of policy makers, researchers, and practitioners. Effective interventions to prevent and control NMUP~~PRD~~ among high school students are highly recommended and should consider the influence of both individual- and school-level factors. First, parents and schools should focus on ~~the~~ NMUP~~PRD~~ among adolescents, particularly those who struggle in psychosocial-related or school-related relationships. Furthermore, educational campaigns that are directed at families and schools are needed to improve awareness of the serious consequences of NMUP~~PRD~~. Moreover, policies that aim to control the sale of prescription pain relievers ~~drugs~~ to adolescents without a doctor's prescription are highly recommended. Finally, a well-established surveillance program to supervise and control nonmedical prescription drug use and to predict the trends in and long-term negative outcomes of NMUP~~PRD~~ among adolescents (similar to MTF in the United States) is expected to be develope~~conduct~~ed in China.

Contributorship statement

LG and CYL searched the literature, conceived the study, designed the study, analyzed the data, interpreted the results, and drafted the report. YX and JXD organized the study, collected the data and analyzed the data. YH, XG, PSL, HW, and JHZ collected the data, interpreted the results, and obtained funding.

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1 **Competing interests**

2 The authors declare that no competing interests exist.

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6 funders had no role in study design, data collection and analysis, decision to publish,

7 or preparation of the manuscript.

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9 **Data sharing statement**

10 No additional unpublished data are available.

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1   **Figure legend**

2   **Figure 1.** Flowchart of the sampling procedure

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Table 1. Demographic characteristics of GHS and VHS students.

Variables	Total, n (%)	GHS, n (%)	VHS, n (%)	P**
Total	11906 (100)	8905 (100)	3001 (100)	-
Gender				
Male	5465 (45.9)	4070 (45.7)	1395 (46.5)	0.458
Female	6441 (54.1)	4835 (54.3)	1606 (53.5)	
Age (years)*	16.7 (1.2)	16.8 (1.1)	16.5 (1.3)	<0.001
Grade				
10	3942 (33.1)	2912 (32.7)	1030 (34.3)	0.064
11	3948 (33.2)	2934 (32.9)	1014 (33.8)	
12	4016 (33.7)	2895 (32.5)	1121(37.3)	
Living arrangement				
With both parents	6451 (54.4)	4994 (56.3)	1457 (48.9)	<0.001
With only father or mother	1899 (16.0)	1387 (15.6)	512 (17.2)	
With others	3501 (29.5)	2492 (28.1)	1009 (33.9)	
Missing data	55 (0.5)	-	-	
Pocket money (RMB)				
<100	5439 (45.7)	1361 (45.8)	4078 (46.1)	0.491
100-299	4388 (36.9)	1090 (36.7)	3298 (37.3)	
>300	1985 (16.7)	520 (17.5)	1465 (16.6)	
Missing data	94 (0.8)	-	-	
Family economic status				
Above average	851 (7.2)	664 (7.5)	187 (6.3)	<0.001
Average	6524 (55.1)	4987 (56.2)	1537 (51.6)	
Below average	4473 (37.8)	3218 (36.3)	1255 (42.1)	
Missing data	58 (0.5)	-	-	
Family relationships				
Good	8686 (73.1)	6589 (74.1)	2097 (70.1)	<0.001
Normal	2205 (18.6)	1576 (17.7)	629 (21.0)	
Difficult	991 (8.3)	725 (8.2)	266 (8.9)	
Missing data	24 (0.2)			
Academic stress				
Above average	1546 (13.0)	900 (10.1)	646 (21.6)	<0.001
Average	4979 (41.9)	3395 (38.2)	1584 (52.9)	
Below average	5355 (45.1)	4592 (51.7)	763 (25.5)	
Missing data	26 (0.2)	-	-	
Classmate relationships				
Good	6759 (56.9)	5201 (58.5)	1558 (52.1)	<0.001
Average	4771 (40.2)	3434 (38.6)	1337 (44.7)	
Poor	344 (2.9)	250 (2.8)	94 (3.1)	
Missing data	32 (0.3)			
Relationships with teachers				
Good	4608 (38.8)	3401 (38.3)	1207 (40.3)	0.076

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Table 1. Demographic characteristics of GHS and VHS students (continued).

Average	6528 (55.0)	4913 (55.3)	1615 (54.0)	
Poor	741 (6.2)	571 (6.4)	170 (5.7)	
Missing data	29 (0.2)			
Parents engaged in NMUPD				
No	11501 (96.6)	8607 (96.7)	2894 (96.4)	0.567
Yes	405 (3.4)	298 (3.3)	107 (3.6)	
Friends engaged in NMUPD				
No	11363 (95.4)	8507 (95.5)	2856 (95.2)	0.411
Yes	543 (4.6)	398 (4.5)	145 (4.8)	
Cigarette smoking				
No	10297 (86.5)	7902 (88.7)	2395 (79.8)	<0.001
Yes	1609 (13.8)	1003 (11.5)	606 (20.8)	
Alcohol drinking				
No	3430 (28.8)	2494 (28.0)	936 (31.2)	0.001
Yes	8476 (71.2)	6411 (72.0)	2065 (68.8)	
Feel lonely				
Less than 1 day/week	5807 (49.5)	4376 (49.8)	1431 (48.6)	0.473
1 to 4 days/week	4495 (38.3)	3340 (38.0)	1155 (39.2)	
More than 4 days/week	1422 (12.1)	1064 (12.1)	358 (12.2)	
Missing data	182 (1.5)	-	-	
Suicide behavior				
Never	11276 (94.7)	8465 (96.2)	2811 (95.0)	0.008
Considered	344 (2.9)	233 (2.6)	111 (3.8)	
Attempted	142 (1.2)	104 (1.2)	38 (1.3)	
Missing data	144 (1.2)	-	-	

1 GHS= General high school; VHS= Vocational high school; NMUPD= Nonmedical use of
2 prescription drugs.
3 *: Age data are presented as the means (SD). SD= Standard deviation.
4 **: Chi-square tests were used to examine the differences between GHS and VHS students based
5 on the above-mentioned categorical variables, and a t-test was used to examine the age difference
6 between GHS and VHS students.

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Table 2. Prevalence and characteristics of NMUPPR among GHS and VHS students.

Variables	Total NMUP, n (%)	GHS NMUP, n (%)	VHS NMUP, n (%)
NMUPPRD	1342 (11.3)	869 (9.8)	473 (15.8)
Gender			
Male	667 (12.2)	433 (10.6)	234 (16.8)
Female	675 (10.5)	436 (9.0)	239 (14.9)
Age (years)*	16.7 (1.3)	16.8 (1.1)	16.4 (1.5)
Grade			
10	454 (11.5)	266 (9.1)	188 (18.3)
11	452 (11.4)	325 (11.1)	127 (12.5)
12	436 (10.9)	278 (9.6)	158 (14.1)
Living arrangement			
With both parents	690 (10.7)	476 (9.5)	214 (14.7)
With only father or mother	219 (11.5)	128 (9.2)	91 (17.8)
With others	428 (12.2)	263 (10.6)	165 (16.4)
Pocket money (RMB)			
<100	600 (11.0)	378 (9.3)	222 (16.3)
100-299	454 (10.3)	313 (9.5)	141 (12.9)
>300	274 (13.8)	168 (11.5)	106 (20.4)
Family economic status			
Above average	118 (13.9)	76 (11.4)	42 (22.5)
Average	683 (10.5)	463 (9.3)	220 (14.3)
Below average	536 (12.0)	327 (10.2)	209 (16.7)
Family relationships			
Good	895 (10.3)	585 (8.9)	310 (14.8)
Normal	282 (12.8)	176 (11.2)	106 (16.9)
Difficult	160 (16.1)	105 (14.5)	55 (20.7)
Academic stress			
Above average	193 (12.5)	92 (10.2)	101 (15.6)
Average	522 (10.5)	286 (8.4)	236 (14.9)
Below average	625 (11.7)	489 (10.6)	136 (17.8)
Classmate relationships			
Good	720 (10.7)	487 (9.4)	233 (15.0)
Average	553 (11.6)	335 (9.8)	218 (16.3)
Poor	63 (18.3)	44 (17.6)	19 (20.2)
Relationships with teachers			
Good	483 (10.5)	304 (8.9)	179 (14.8)
Average	718 (11.0)	474 (9.6)	244 (15.1)
Poor	140 (18.9)	90 (15.8)	50 (29.4)
Parents engaged in NMUPD			

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Table 2. Prevalence and characteristics of NMUPPR among GHS and VHS students. (continued).

No	1241 (10.8)	800 (9.3)	441 (15.2)
Yes	101 (24.9)	69 (23.2)	32 (29.9)
Friends engaged in NMUPD			
No	1227 (10.8)	795 (9.3)	432 (15.1)
Yes	115 (21.2)	74 (18.6)	41 (28.3)
Cigarette smoking			
No	1059 (10.3)	710 (9.0)	349 (14.6)
Yes	283 (17.6)	159 (15.9)	124 (20.5)
Alcohol drinking			
No	975 (11.5)	635 (9.9)	340 (16.5)
Yes	367 (10.7)	234 (9.4)	133 (14.2)
Feel lonely			
Less than 1 day/week	550 (9.5)	354 (8.1)	196 (13.7)
1 to 4 days/week	570 (12.7)	365 (10.9)	205 (17.7)
More than 4 days/week	193 (13.6)	128 (12.0)	65 (18.2)
Suicide behavior			
Never	1194 (10.6)	767 (9.1)	427 (15.2)
Considered	69 (20.1)	46 (19.7)	23 (20.7)
Attempted	50 (35.2)	36 (34.6)	14 (36.8)

1 NMUPPR= Nonmedical use of prescription pain relievers; GHS= General high school; VHS=

2 Vocational high school; NMUPD= Nonmedical use of prescription drugs.

3 *: Age data are presented as the means (SD). SD= Standard deviation.

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Table 3. Classes, sources, and motivations for NMUPPR among GHS and VHS students.

Variables	Total, n (%)	GHS, n (%)	VHS, n (%)	*p*-value*
Total	11906 (100)	8905 (100)	3001 (100)	
Class of pain relievers				
Scattered analgesics	685 (5.8)	434 (4.9)	251 (8.4)	<0.001
Codeine	661 (5.5)	443 (5.0)	218 (7.3)	<0.001
Percocet	647 (5.4)	416 (4.7)	231 (7.7)	<0.001
Tramadol	73 (0.6)	54 (0.6)	19 (0.6)	0.871
Source of pain relievers				
From peers	746 (6.3)	522 (5.9)	224 (7.5)	<0.001
From family members	241 (2.0)	130 (1.5)	111 (3.7)	<0.001
Others	551 (4.6)	348 (3.9)	203 (6.8)	<0.001
Motivation for NMUPPR				
To relax or relieve tension	580 (4.9)	391 (4.4)	189 (6.3)	<0.001
To experiment	310 (2.6)	206 (2.3)	104 (3.5)	0.001
To get high	294 (2.5)	192 (2.2)	102 (3.4)	<0.001
Other	482 (4.0)	315 (3.5)	167 (5.6)	<0.001

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2 *: Chi-square tests were used to examine the differences between GHS and VHS students.

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Table 4. Predictors of NMUPPR based on a two-level multivariate logistic regression model.

Variables	AOR (95% CI)
School-level	
School category	
General high school	1.00 (reference)
Vocational high school	1.64 (1.42-1.89) #
Individual-level	
Gender	
Female	1.00
Male	0.98 (0.86-1.12)
Age (years)	0.99 (0.93-1.05)
Grade	
10	1.00
11	1.27 (1.09-1.46)
12	1.53 (0.99-2.37)
Living arrangement	
With both parents	1.00
With only father or mother	0.89 (0.78-1.03)
With others	0.97 (0.82-1.15)
Pocket money (RMB)	
<100	1.00
100-299	1.21 (1.02-1.43) #
>300	1.24 (1.04-1.47) #
Family economic status	
Above average	1.00
Average	1.03 (0.90-1.17)
Below average	0.77 (0.60-0.98) #
Family relationships	
Good	1.00
Normal	1.12 (0.89-1.41)
Difficult	1.26 (1.02-1.54) #
Academic stress	
Above average	1.00
Average	1.13 (0.97-1.33)
Below average	1.20 (0.98-1.46)
Classmate relationships	
Good	1.00
Average	1.25 (0.91-1.72)
Poor	1.24 (0.90-1.72)
Relationships with teachers	
Good	1.00
Average	1.50 (1.20-1.89) #
Poor	1.57 (1.23-2.01) #

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Table 4. Predictors of NMUP~~PRD~~ based on a two-level logistic regression model (continued).

Parents engaged in NMUPD	
No	1.00
Yes	2.31 (1.79-2.98) #
Friends engaged in NMUPD	
No	1.00
Yes	1.75 (1.38-2.22) #
Cigarette smoking	
No	1.00
Yes	1.53 (1.29-1.82) #
Alcohol drinking	
No	1.00
Yes	1.02 (0.89-1.17)
Feel lonely	
Less than 1 day/week	1.00
1 to 4 days/week	0.86 (0.71-1.04)
More than 4 days/week	1.06 (0.87-1.29)
Suicide behavior	
Never	1.00
Considered	3.47 (2.34-5.15) #
Attempted	2.08 (1.29-3.35) #

1 NMUP~~PRD~~= Nonmedical use of prescription pain relievers.~~drugs~~.

2 #: According to the two-level multivariate logistic regression model with adjustment for other

3 variables, $p<0.05$.

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Nonmedical use of prescription pain relievers among high school students in China: A multilevel analysis

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Manuscripts

1   # **Nonmedical use of prescription pain relievers among high school**

2   # **students in China: A multilevel analysis**

3

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1 **ABSTRACT**

2 **Objectives:** Given the differences between general high school (GHS) and vocational

3 high school (VHS) students, this study aimed to investigate the lifetime prevalence of

4 nonmedical use of prescription pain relievers (NMUPPR) among high school students

5 as well as the associations between NMUPPR and individual-level factors and school

6 category.

7

8 **Methods:** A cross-sectional study was conducted in GHS and VHS students in 2012

9 in Chongqing, and 11,906 students' questionnaires were completed and qualified for

10 the survey. Self-reported NMUPPR and information regarding individual-level

11 determinants and school category were collected. A multi-level multivariate logistic

12 regression model was fitted to explore independent predictors of NMUPPR.

13

14 **Results:** The total lifetime prevalence of NMUPPR was 11.3%, and NMUPPR was

15 more prevalent among VHS students (15.8%) compared with GHS students (9.8%).

16 Overall, the results indicated that VHS students were more likely to be involved in

17 NMUPPR (AOR=1.64, 95% CI=1.42-1.89). Regarding the individual-level predictors

18 of NMUPPR, below-average family economic status was negatively correlated with

19 NMUPPR (AOR=0.77, 95% CI= 0.60-0.98), and students with more pocket money

20 were more likely to be engaged in NMUPPR. Students who had difficult family

21 relationships, had poor relationships with teachers, had parents or friends who

22 engaged in nonmedical prescription drug use, and considered or attempted suicide

23 were more likely to be engaged in NMUPPR.

24

25 **Conclusions:** Nonmedical prescription pain reliever use among high school students

26 is a multi-determined phenomenon. The current findings indicate that VHS students

27 are an important subgroup of adolescents and highlight the need for additional

28 research and as well as targeted prevention and intervention programmes for

29 NMUPPR.

30

2

1 **Strengths and limitations of this study**

2 · There was scarce study has been conducted to describe the prevalence and

3 characteristics of nonmedical use of prescription pain relievers (NMUPPR)

4 among general high school and vocational high school students separately.

5 · Individual- and school-level factors were involved in a two-level multivariate

6 logistic regression model to select independent predictors of NMUPPR

7 simultaneously.

8 · Vocational high school students had a higher risk for NMUPPR compared to

9 general high school students.

10 · The study demonstrated that a student's family-, school-, and

11 psychosocial-related factors also influence the nonmedical use of prescription

12 pain relievers.

13 · Although the results cannot be generalized to all adolescents, there are sufficient

14 and representative samples in this study.

15

16

1 **INTRODUCTION**

2 Non-medical use of prescription drugs (including sedatives, tranquilizers, stimulants,

3 sedatives, and pain relievers) is defined as taking medications without a doctor's

4 prescription, for periods longer than prescribed, or for reasons other than the

5 medication's intended purpose (e.g., 'to experiment' or 'to get high').[1][2] During the

6 last two decades, the increase in nonmedical use of prescription drugs has been a topic

7 of great concern.[3] Prescription drugs were the second most popular drug among

8 adolescents in the United States according to the 2013 National Survey on Drug Use

9 and Health (NSDUH),[4] and pain relievers are currently the most abused types of

10 prescription drugs among teens, followed by stimulants, tranquilizers, and sedatives.[5]

11 Notably, according to the report of Monitoring the Future (MTF), 14% of nonmedical

12 prescription pain reliever users are dependent.[6] High school students, often described

13 as individuals between 10 and 24 years of age, which is roughly the period of

14 adolescence for much of the world, engage in priority health-risk behaviors, including

15 substance use.[7] Previous studies have reported that high school students have the

16 greatest risk of nonmedical prescription drug use relative to other age groups,[4][8] and

17 this finding may reflect youth's perception that prescription drugs are safer, easier to

18 access, and less stigmatizing than illicit drugs.[9] However, it is clear that nonmedical

19 prescription drug use among juveniles is a large public health problem with negative

20 consequences, such as depressive disorder, bipolar disorders and anxiety disorder.[10]

21 Nonmedical use of prescription pain relievers (NMUPPR) among adolescents in the

22 United States represents a growing public health problem,[11] and very few studies have

23 described the characteristics associated with NMUPPR among U.S. high school

24 students.[12] To our knowledge, no study has described NMUPPR among Chinese high

25 school students, and the recent increased interest in exploring the predictors

26 associated with NMUPPR in Chinese adolescents is warranted.

27 Prior studies have illustrated many individual-level factors that are associated with

28 NMUPPR among high school students. McCabe's study in the United States

29 suggested that male students were more likely than female students to report

30 NMUPPR in their lifetime (17.4% versus 15.7%),[1] while Boyd's study in a

4

Detroit-area public school district revealed that girls had a higher prevalence of NMUPPR than boys (22% versus 10%), and students at higher grade levels were more likely to report NMUPPR.[13] A study in six European countries indicated that students whose parents and peers engaged in substance use were at a higher risk of nonmedical prescription pain reliever use,[14] and a study among Mississippi youth suggested that suicidal behaviors were significantly associated with nonmedical prescription pain reliever use.[15]

High school is generally categorized into general high school (GHS) and vocational high school (VHS), and VHS students are typically characterized into heterogeneous educational levels, including a significant proportion with little or no educational attainment.[16 17] In the highly academically stratified society, students who graduate from VHS experience discrimination, including fewer employment opportunities or significantly lower salaries compared to those who graduate from GHS.[18] Prior studies in South Korea and the United States have found that students in VHS have a greater risk for smoking or drinking behavior than those in GHS, even after controlling for individual-level factors.[19 20] However, there was scarce study has been conducted to describe the prevalence and characteristics of NMUPPR among GHS and VHS students separately or to examine the influence of individual-level factors and high school category on NMUPPR simultaneously. Therefore, we conducted a cross-sectional study within a large sample of randomly selected GHS and VHS students in southwest China to assess the lifetime prevalence and characteristics of NMUPPR and to explore the independent predictors of NMUPPR in terms of individual-level factors and school category.

The following three hypotheses were formulated. First, consistent with the results of previous studies,[21 22] we hypothesized that NMUPPR is a major international public health problem among adolescents, and Chinese high school students are no exception. Second, we expected that differences in the demographics and prevalence of NMUPPR between GHS and VHS students are significant and the current status of NMUPPR in VHS students is more serious than that in GHS students. Third, in line with previous findings,[21 23 24] we hypothesized that most family-, school-, and

5

1 psychosocial-related factors are related to NMUPPR.

2

3

4 **METHODS**

5 **Study design and participants**

6 A cross-sectional study among GHS and VHS students was conducted in 2012 in

7 Chongqing, located in southwest China. The sample size was calculated for a

8 prevalence of nonmedical prescription drug use among Chinese adolescents of

9 6.0%,[21] an α of 0.05, a sampling error of 0.005, an estimate of 3.8114 million high

10 school students in Chongqing. We used a multistage stratified cluster sampling

11 procedure to obtain a representative sample. With adjustment for the clustering design

12 effect and the non-response rate, the resulting calculated sample size was 9,014. In

13 stage 1, based on the surveillance data on the population of 'nonmedical prescription

14 drug users of cough syrup with codeine' during 2010-2011 from the Center for ADR

15 Monitoring of Chongqing, we divided the districts in Chongqing into three categories:

16 (1) high (districts accounting for more than 5% of this population): (2) middle

17 (districts accounting for 1-5% of this population); and (3) low (districts accounting for

18 less than 1% of this population). Then, we selected two representative districts (or

19 primary sampling units) from each category by simple randomization using SAS

20 software. In stage 2, high schools (or secondary sampling units) in each selected

21 district were divided into three categories based on teaching quality: key high school,

22 regular high school, and vocational high school. All high schools in the selected

23 districts were surveyed (including four key high schools, five regular high schools,

24 and four vocational high schools in each of the high and low districts as well as five

25 key high schools, six regular high schools, and three vocational high schools in the

26 middle districts). In total, 29 GHSs and 11 VHSs within these primary units were

27 selected. In stage 3, two classes (or minimum sampling units) were randomly selected

28 from each grade within the selected schools (see **Figure 1**). All available students in

29 the selected classes were invited to participate in our study. Of the 12,406 high school

30 students who were invited to participate, 11,906 students' questionnaires were

6

1 completed and qualified for the survey, resulting in a response rate of 96.0%.

2

3 **Data collection**

4 To protect the privacy of the students, a rigorously anonymous method for collection

5 of the self-report questionnaires was guaranteed, and the questionnaires were

6 administered by research assistants in the classrooms without the presence of the

7 teachers (to avoid any potential information bias) during thirty minutes of the

8 students' regular class time.

9

10 **Ethics statement**

11 The study received approval from the Sun Yat-sen University, School of Public Health

12 Institutional Review Board. All the participants were fully informed of the purpose of

13 the survey and were invited to participate voluntarily. Written consent letters were

14 obtained from each participating student who was at least 18 years of age. If the

15 student was under 18 years of age, a written consent letter was obtained from one of

16 the student's parents.

17

18 **Measures**

19 **Dependent variable.** The dependent variable was the lifetime NMUPPR, which was

20 assessed by the following question: 'Have you ever, even once, used the following

21 medications when you were not sick or just for the intended purpose to experiment or

22 to get high without a doctor's prescription?' The question was followed by a list of the

23 following prescription pain relievers. The response categories were 'yes' and 'no'. In

24 this study, we only included four pain relievers: cough syrup with codeine, Percocet,

25 tramadol, and scattered analgesics (commonly used traditional Chinese medicine,

26 such as Ephedra Herb and Aconitum carmichaeli Debx, not only having the function

27 of relieving pain, but also having complex compositions which can make people

28 addicted when reaching a high dose).[25] The list of medications was developed based

29 on medicines reported to be widely used by adolescent drug abusers in rehabilitation

30 centers and a list provided by the Center for ADR Monitoring of Chongqing.

7

Independent variables. The individual-level independent variables included the students' sociodemographic characteristics, family- and school-related factors, alcohol and cigarette use, and psychosocial-related factors. The sociodemographic variables were age, gender, grade, and pocket money (the students were asked how much pocket money, on average, they received per month from their parents. The responses were coded as 'less than 100 RMB', '100-299 RMB', or 'more than 300 RMB'). Each student's living arrangement was assessed by asking who lived in the student's primary home. Family economic status was measured by asking about the student's perception of his or her family's current economic status. Family relationships were assessed by asking the students how they judged the relationships between their family members. Academic stress was captured by a single item that asked for a personal appraisal of the student's academic stress relative to that of his/her classmates (responses were coded as 'below average', 'average', or 'above average'). Relationships with classmates or teachers were also assessed based on the students' self-ratings (responses were coded as 'poor', 'average', or 'good'). Whether the students' parents or friends engaged in nonmedical prescription drug use was assessed by asking the participants the following question: 'Have your parents or friends used prescription drugs when they were not sick without a doctor's prescription during their lifetime?' Alcohol drinking was measured by a single item ('Have you used at least one drink previously and one or more drinks within the past 30 days?'). Cigarette smoking was assessed by asking the respondents the following question: 'Have you smoked at least one cigarette previously and used between 1 and 29 cigarettes within the past 30 days?' Psychosocial-related factors were assessed by two variables, feeling lonely and suicidal behavior. Feeling lonely was assessed by asking the students the following question: 'During the past 12 months, how often did you feel lonely each week?' The response options for this question ranged from 1-never to 4-over 4 days. Suicidal behavior was assessed by asking the students the following question: 'During the past 12 months, did you ever seriously consider attempting suicide?' The response options for this question were 1-never, 2-considered, or

8

3-attempted. In regard to the school-level independent variable, the high school was categorized as a GHS or VHS according to official data that were provided by the city board of education.

Sources of prescription pain relievers. The sources of obtaining prescription pain relievers for nonmedical use were assessed by asking students the following multiple-choice question: 'Where did you get prescription pain relievers for nonmedical use?' The response options for this question were 1-from peers, 2-from family members, or 3-from others.

Motivations for NMUPPR. The motivations for NMUPPR were assessed by asking students the following multiple-choice question: 'Why did you nonmedically use prescription pain relievers?' The response options for this question were 1-to experiment, 2-to get high, 3-to relax or relieve tension, or 4-other.

Statistical analysis

Two investigators independently entered all of the data using EpiData software (version 3.1), and all statistical analyses were conducted using SAS (version 9.2). Descriptive analyses were conducted separately in GHS and VHS students to describe the different relationships among the demographic characteristics and the lifetime prevalence of NMUPPR. Subsequently, a two-level multivariate logistic regression model (individuals at level-1 nested within 29 general and 11 vocational high schools at level-2) was fitted to estimate variables that were independently predictive of NMUPPR according to the adjusted odds ratios (AORs) and 95% confidence intervals (CIs). We entered all individual- and school-level variables as covariates into this regression model (the generalized linear mixed effects model adopting the GLMMIX procedure in SAS) to select the complete and independent predictors of NMUPPR. Statistical significance was evaluated at the <0.05 level using two-sided tests. The questionnaires were reasonably complete. The percentage of missing data was less than 2.0% for all relevant variables, and missing data were eliminated in the

9

1 Chi-square tests, t-test, and two-level multivariate logistic regression analysis.

2

3

4 **RESULTS**

5 **Demographic characteristics of GHS and VHS students**

6 The demographic information distributions are illustrated in **Table 1**. The final sample

7 consisted of 11,906 high school students, including 8,095 (74.7%) GHS and 3,001

8 (25.3%) VHS students. The students ranged in age from 11 to 23 years, and the mean

9 age was 16.7 (±1.2) years. The proportion of males was 45.9%. Regarding the

10 individual-level factors, 37.8% of students considered their family economic status to

11 be below average. A total of 2.9% of the students reported poor classmate

12 relationships, and 6.2% had poor relationships with teachers. A total of 13.8% of the

13 students reported smoking, 71.2% of the students reported drinking during the past 30

14 days, and 1.2% of the students attempted suicide.

15

16 **Prevalence and characteristics of NMUPPR among GHS and VHS students**

17 As shown in **Table 2**, we estimated the total prevalence and characteristics of

18 NMUPPR and the subgroup prevalence rates of NMUPPR among GHS and VHS

19 students. The total lifetime prevalence of NMUPPR was 11.3%, and the VHS students

20 had higher rates of lifetime exposure to nonmedical prescription pain reliever use than

21 the GHS students (15.8% in VHS and 9.8% in GHS students). The prevalence of

22 NMUPPR was 12.2% among male students and 10.5% among female students, and

23 male students had a higher prevalence of NMUPPR than females in both GHS and

24 VHS. NMUPPR was more prevalent among those who lived with others, reported

25 above average family economic status, had difficult family relationships, had poor

26 classmate relationships, and had poor relationships with teachers. Additionally,

27 students who had parents or friends who engaged in nonmedical prescription drug use

28 had a higher prevalence of NMUPPR. Students who attempted suicide had a much

29 higher prevalence of NMUPPR than those who did not.

30

10

Classes, sources and motivations for NMUPPR among GHS and VHS students

Table 3 shows that the most common nonmedically used prescription pain reliever among high school students was scattered analgesics, at approximately 5.8%, followed by cough syrup with codeine, Percocet, and tramadol. In this study, we also found that prescription pain relievers for nonmedical use among high school students were most commonly obtained from peers, followed by others and family members. In addition, the most prevalent motivation for NMUPPR by high school students was 'to relax or relieve tension', followed by 'to experiment' and 'to get high'.

Predictors of NMUPPR based on a two-level multivariate logistic regression model

A two-level multivariate logistic regression model was used to initially examine the individual- and school-level independent predictors of NMUPPR among high school students (see **Table 4**). Compared with the GHS students, the VHS students were more likely to be users of nonmedical prescription pain relievers (AOR=1.64, 95% CI=1.42-1.89) after controlling for individual-level variables. Regarding the individual-level predictors of NMUPPR, below-average family economic status was negatively correlated with NMUPPR (AOR=0.77, 95% CI=0.60-0.98), and students with more pocket money were more likely to be engaged in NMUPPR. Students who had difficult family relationships (AOR= 1.26, 95% CI=1.02-1.54), average relationships with teachers (AOR=1.50, 95% CI=1.20-1.89), and poor relationships with teachers (AOR=1.57, 95% CI=1.23-2.01) were at a higher risk for nonmedical prescription pain reliever use compared to the corresponding reference group. Additionally, students having parents who engaged in nonmedical prescription drug use (AOR=2.31, 95% CI=1.79-2.98) or having friends who engaged in nonmedical prescription drug use (AOR=1.75, 95% CI=1.38-2.22) were more likely to be involved in NMUPPR. Additionally, cigarette smoking (AOR=1.53, 95% CI=1.29-1.82), considering suicide (AOR=3.47, 95% CI=2.34-5.15), and attempting suicide (AOR=2.08, 95% CI=1.29-3.35) were independent risk predictors of NMUPPR.

11

DISCUSSION

To our knowledge, this is the first study to describe NMUPPR among Chinese high school students and to explore potential predictors of NMUPPR in China. The present study significantly contributes to the understanding of NMUPPR among various high school students. The current results provide evidence of significant demographic differences between GHS and VHS students, and these findings led us to conduct a stratification analysis of the prevalence and characteristics of NMUPPR across school type. We found that approximately 11.3% of the students reported nonmedical prescription pain reliever use in their lifetime. The total prevalence rate of NMUPPR was higher than that described in a previous report from the 2013 National Survey on Drug Use and Health (NSDUH) in the United States which showed that 4.5 million (1.7%) respondents aged 12 or older were nonmedical users of prescription pain relievers,[4] and lower than that described in a study of a Detroit-area public school district suggesting that approximately 16% of students had engaged in NMUPPR during their lifetime.[13] A possible explanation for the variance in the prevalence could be differences in the nature of the samples or the classes of pain relievers. In our research, according to a list provided by the Center for ADR Monitoring of Chongqing suggesting that pain relievers are widely used by adolescent drug abusers in rehabilitation centers, we only included four specific classes of pain relievers. Our results suggested the most common nonmedically used prescription pain reliever among total high school students was scattered analgesics, at approximately 5.8%, followed by cough syrup with codeine (5.5%). These results are consistent with the study of Wang et al. in Guangdong.[21]

Furthermore, consistent with our expectations, the current results demonstrated that VHS students (15.8%) had a much higher prevalence of NMUPPR than GHS students (9.8%) and that VHS students consistently had a higher prevalence of NMUPPR compared to GHS students regardless of their demographic characteristics. Additionally, the final logistic regression model revealed that students who attended

12

1   VHS had a higher risk of NMUPPR compared to those who attended GHS

2   (AOR=1.64, 95% CI=1.42-1.89). This result is consistent with previous findings in

3   China and the United States showing that students who are unable to perform

4   academically on the high school admittance test or are enduring household economic

5   challenges typically enroll in VHS and that these students are more likely to be

6   involved in substance use.[26] The current study was the first to examine the influence

7   of different high school categories (GHS or VHS) on NMUPPR, although Franke

8   reported that German pupils from vocational schools was at a higher prevalence of

9   nonmedical use of prescription stimulants.[27] According to these findings, preventive

10 and intervention programmes should consider the school category, when developing

11 measures to control the problem of NMUPPR in schools, especially in VHSs. A prior

12 study in four German federal states demonstrated that school-based prevention

13 programmes are considered to be one of the most appropriate and suitable strategies

14 for preventing adolescent substance use.[28]

15 Regarding the individual-level factors, our study first showed that male students

16 had a higher prevalence of NMUPPR than female students (12.2% versus 10.5%);

17 however, after adjusting for other variables, there was no significant association

18 between gender and NMUPPR. The findings on gender and NMUPPR have not been

19 consistent in the previous literature, with some studies showing an association

20 between NMUPPR and female gender,[24 29] others showing an association between

21 NMUPPR and male gender,[30] and others showing no significant associations between

22 gender and NMUPPR.[31] Additionally, consistent with a prior study in Sweden,[24] we

23 did not find any association between NMUPPR and age. Prior studies in the United

24 States have shown that there is a significant association between grade and

25 NMUPPR,[32 33] while the results of our study showed no significant associations

26 between school grade and NMUPPR. It is possible that this result might be related to

27 the fact that the relationship between NMUPPR and grade is likely to vary depending

28 on the substance.

29 The final logistic regression model also revealed that the risk of NMUPPR

30 increased among students who reported receiving more than 100 RMB as pocket

13

1 money per month, and the similar results were found in the study of Wang et al. in

2 Guangdong.[21] It is possible that students with more pocket money have more access

3 to prescription drugs. Additionally, we found that below-average family economic

4 status was slightly negatively correlated with NMUPPR (AOR=0.77, 95%

5 CI=0.60-0.98). Similarly, Hanson's research in the United States demonstrated that

6 high socio-economic status teens were more likely to use substances than low

7 socio-economic status teens.[34] It is possible that compared with students who reported

8 above-average family economic status, students from lower-income families had less

9 pocket money; thus, they had less access to prescription drugs. Parental factors have

10 been associated with nonmedical prescription drug use in several studies. In the

11 United States, Herman-Stahl's research reported that adolescents who had a high level

12 of family conflict were more likely than their counterparts to engage in nonmedical

13 use of prescription stimulants.[35] The present study also found that difficult family

14 relationships were associated with nonmedical prescription pain reliever use, with an

15 increased odds of 26% (AOR=1.26, 95% CI=1.02-1.54). Notably, the current study

16 found that students having parents who engaged in nonmedical prescription drug use

17 were at a higher risk for NMUPPR, and previous studies also indicated that

18 adolescents having parents who used substances were at an increased risk for

19 substance use.[23 36] The present results emphasized the negative consequence that

20 parental factors can have in terms of students' NMUPPR and the importance of

21 improving parental monitoring practices of both their own and their children's

22 nonmedical drug use. Twombly's research in the United States suggested that it is

23 necessary to improve parents' and adolescents' awareness of the risks of nonmedical

24 use of any prescription drug.[37]

25 In addition, frequent substance use is negatively associated with school-related

26 factors.[38] In this study, we found that students who had poor relationships with

27 teachers were more likely to engage in NMUPPR. The finding is consistent with

28 previous studies that have suggested that engagement and positive teacher-pupil

29 relationships are strongly negatively associated with all substance use categories.[39]

30 Previous studies have indicated that students with friends who engaged in nonmedical

14

prescription drug use were at a higher risk of NMUPPR.[40] [41] Peers may serve as role models, influence personal attitudes toward substance use, and/or provide access, encouragement, and social settings for substance use.[14] In this study, we found that students having friends who nonmedically used prescription drugs were more likely to be involved in NMUPPR, and the prescription pain relievers used nonmedically by high school students were most commonly obtained from peers. Similarly, McCabe's study in the United States suggested that the majority of students obtained prescription pain relievers for nonmedical use from peers.[1] Therefore, prevention and effective interventions are needed to target school-related factors, especially the bidirectional influence between peers. Students need to be educated about the potential dangers associated with providing abusable prescription pain medications to their peers.[13]

Consistent with previous studies in China and the United States showing that cigarette smoking increased the prevalence rate of NMUPPR,[21] [42] the present study revealed that cigarette smokers were 1.53 (95% CI=1.29-1.82) times more likely to engage in NMUPPR than nonsmokers. Although a prior study in Sweden has reported a relationship between alcohol drinking and nonmedical use of analgesics,[24] we did not find this association in the current study. This discrepancy may be related to the definition or extent of alcohol drinking. Nonetheless, interventions that target students who have already initiated substance use may be effective in reducing use.[43]

Regarding the psycholosocial-related factors, many studies in European countries and the United States have indicated that mental health is closely related to substance use.[14] [44] In the current study, we found that the most prevalent motivations for prescription pain relievers nonmedically used by students was 'to relax or relieve tension', and similar results has been reported in McCabe's study in the United States.[45] Additionally, nonmedical prescription pain reliever use was reported to be associated with suicidal behavior among Mississippi youth.[15] Consistent with these findings, the current study found that considering or attempting suicide was positively correlated with NMUPPR and that attempting suicide increased the odds of NMUPPR by 186% (AOR=2.86, 95% CI=1.96-4.17). Therefore, students who report poor

15

1   psychosocial-related factors should be a primary focus, and proper interventions

2   should be provided for these individuals.

3   The present study has noteworthy strengths, including the analysis of survey data

4   that were collected from a large-scale sample of GHS and VHS students. Furthermore,

5   individual- and school-level factors were incorporated in a two-level multivariate

6   logistic regression model to select independent predictors of NMUPPR

7   simultaneously. Importantly, we observed the differences in NMUPPR between GHS

8   and VHS students. Despite these strengths, the results of our analyses are tempered by

9   some methodological limitations that should be considered. First, the results cannot be

10 generalized to all adolescents because this sample only included high school students

11 and did not include individuals who had dropped out of school or were not present in

12 school on the day of survey administration. Second, the data are subject to potential

13 bias introduced by the administration of sensitive behaviors via self-report surveys in

14 a school setting. Finally, the cross-sectional nature of the study presents several

15 limitations; thus, longitudinal studies that enroll adolescents in more diverse age

16 groups and employ more diverse measures of current use are needed to examine the

17 patterns of NMUPPR.

18   In conclusion, nonmedical prescription pain reliever use among Chinese high

19 school students is a significant public health problem that warrants the attention of

20 policy makers, researchers, and practitioners. Effective interventions to prevent and

21 control NMUPPR among high school students are highly recommended and should

22 consider the influence of both individual- and school-level factors. First, parents and

23 schools should focus on NMUPPR among adolescents, particularly those who

24 struggle in psychosocial-related or school-related relationships. Furthermore,

25 educational campaigns that are directed at families and schools are needed to improve

26 awareness of the serious consequences of NMUPPR. Moreover, policies that aim to

27 control the sale of prescription pain relievers to adolescents without a doctor's

28 prescription are highly recommended. Finally, a well-established surveillance

29 program to supervise and control nonmedical prescription drug use and to predict the

30 trends in and long-term negative outcomes of NMUPPR among adolescents (similar

16

to MTF in the United States) is expected to be developed in China.

Contributorship statement

LG and CYL searched the literature, conceived the study, designed the study, analyzed the data, interpreted the results, and drafted the report. YX and JXD organized the study, collected the data and analyzed the data. YH, XG, PSL, HW, and JHZ collected the data, interpreted the results, and obtained funding.

Competing interests

The authors declare that no competing interests exist.

Data sharing statement

No additional unpublished data are available.

17

1 **Figure legend**

2 **Figure 1.** Flowchart of the sampling procedure

3

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1

Table 1. Demographic characteristics of GHS and VHS students.

Variables	Total, n (%)	GHS, n (%)	VHS, n (%)	p**
Total	11906 (100)	8905 (100)	3001 (100)	-
Gender				
Male	5465 (45.9)	4070 (45.7)	1395 (46.5)	0.458
Female	6441 (54.1)	4835 (54.3)	1606 (53.5)	
Age (years)*	16.7 (1.2)	16.8 (1.1)	16.5 (1.3)	<0.001
Grade				
10	3942 (33.1)	2912 (32.7)	1030 (34.3)	0.064
11	3948 (33.2)	2934 (32.9)	1014 (33.8)	
12	4016 (33.7)	2895 (32.5)	1121(37.3)	
Living arrangement				
With both parents	6451 (54.4)	4994 (56.3)	1457 (48.9)	<0.001
With only father or mother	1899 (16.0)	1387 (15.6)	512 (17.2)	
With others	3501 (29.5)	2492 (28.1)	1009 (33.9)	
Missing data	55 (0.5)	-	-	
Pocket money (RMB)				
<100	5439 (45.7)	1361 (45.8)	4078 (46.1)	0.491
100-299	4388 (36.9)	1090 (36.7)	3298 (37.3)	
>300	1985 (16.7)	520 (17.5)	1465 (16.6)	
Missing data	94 (0.8)	-	-	
Family economic status				
Above average	851 (7.2)	664 (7.5)	187 (6.3)	<0.001
Average	6524 (55.1)	4987 (56.2)	1537 (51.6)	
Below average	4473 (37.8)	3218 (36.3)	1255 (42.1)	
Missing data	58 (0.5)	-	-	
Family relationships				
Good	8686 (73.1)	6589 (74.1)	2097 (70.1)	<0.001
Normal	2205 (18.6)	1576 (17.7)	629 (21.0)	
Difficult	991 (8.3)	725 (8.2)	266 (8.9)	
Missing data	24 (0.2)			
Academic stress				
Above average	1546 (13.0)	900 (10.1)	646 (21.6)	<0.001
Average	4979 (41.9)	3395 (38.2)	1584 (52.9)	
Below average	5355 (45.1)	4592 (51.7)	763 (25.5)	
Missing data	26 (0.2)	-	-	
Classmate relationships				
Good	6759 (56.9)	5201 (58.5)	1558 (52.1)	<0.001
Average	4771 (40.2)	3434 (38.6)	1337 (44.7)	
Poor	344 (2.9)	250 (2.8)	94 (3.1)	
Missing data	32 (0.3)			
Relationships with teachers				
Good	4608 (38.8)	3401 (38.3)	1207 (40.3)	0.076

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Table 1. Demographic characteristics of GHS and VHS students (continued).

Average	6528 (55.0)	4913 (55.3)	1615 (54.0)	
Poor	741 (6.2)	571 (6.4)	170 (5.7)	
Missing data	29 (0.2)			
Parents engaged in NMUPD				
No	11501 (96.6)	8607 (96.7)	2894 (96.4)	0.567
Yes	405 (3.4)	298 (3.3)	107 (3.6)	
Friends engaged in NMUPD				
No	11363 (95.4)	8507 (95.5)	2856 (95.2)	0.411
Yes	543 (4.6)	398 (4.5)	145 (4.8)	
Cigarette smoking				
No	10297 (86.5)	7902 (88.7)	2395 (79.8)	<0.001
Yes	1609 (13.8)	1003 (11.5)	606 (20.8)	
Alcohol drinking				
No	3430 (28.8)	2494 (28.0)	936 (31.2)	0.001
Yes	8476 (71.2)	6411 (72.0)	2065 (68.8)	
Feel lonely				
Less than 1 day/week	5807 (49.5)	4376 (49.8)	1431 (48.6)	0.473
1 to 4 days/week	4495 (38.3)	3340 (38.0)	1155 (39.2)	
More than 4 days/week	1422 (12.1)	1064 (12.1)	358 (12.2)	
Missing data	182 (1.5)	-	-	
Suicide behavior				
Never	11276 (94.7)	8465 (96.2)	2811 (95.0)	0.008
Considered	344 (2.9)	233 (2.6)	111 (3.8)	
Attempted	142 (1.2)	104 (1.2)	38 (1.3)	
Missing data	144 (1.2)	-	-	

1 GHS= General high school; VHS= Vocational high school; NMUPD= Nonmedical use of

2 prescription drugs.

3 *: Age data are presented as the means (SD). SD= Standard deviation.

4 **: Chi-square tests were used to examine the differences between GHS and VHS students based

5 on the above-mentioned categorical variables, and a t-test was used to examine the age difference

6 between GHS and VHS students.

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Table 2. Prevalence and characteristics of NMUPPR among GHS and VHS students.

Variables	Total NMUPPR, n (%)	GHS NMUPPR, n (%)	VHS NMUPPR, n (%)
NMUPPR	1342 (11.3)	869 (9.8)	473 (15.8)
Gender			
Male	667 (12.2)	433 (10.6)	234 (16.8)
Female	675 (10.5)	436 (9.0)	239 (14.9)
Age (years)*	16.7 (1.3)	16.8 (1.1)	16.4 (1.5)
Grade			
10	454 (11.5)	266 (9.1)	188 (18.3)
11	452 (11.4)	325 (11.1)	127 (12.5)
12	436 (10.9)	278 (9.6)	158 (14.1)
Living arrangement			
With both parents	690 (10.7)	476 (9.5)	214 (14.7)
With only father or mother	219 (11.5)	128 (9.2)	91 (17.8)
With others	428 (12.2)	263 (10.6)	165 (16.4)
Pocket money (RMB)			
<100	600 (11.0)	378 (9.3)	222 (16.3)
100-299	454 (10.3)	313 (9.5)	141 (12.9)
>300	274 (13.8)	168 (11.5)	106 (20.4)
Family economic status			
Above average	118 (13.9)	76 (11.4)	42 (22.5)
Average	683 (10.5)	463 (9.3)	220 (14.3)
Below average	536 (12.0)	327 (10.2)	209 (16.7)
Family relationships			
Good	895 (10.3)	585 (8.9)	310 (14.8)
Normal	282 (12.8)	176 (11.2)	106 (16.9)
Difficult	160 (16.1)	105 (14.5)	55 (20.7)
Academic stress			
Above average	193 (12.5)	92 (10.2)	101 (15.6)
Average	522 (10.5)	286 (8.4)	236 (14.9)
Below average	625 (11.7)	489 (10.6)	136 (17.8)
Classmate relationships			
Good	720 (10.7)	487 (9.4)	233 (15.0)
Average	553 (11.6)	335 (9.8)	218 (16.3)
Poor	63 (18.3)	44 (17.6)	19 (20.2)
Relationships with teachers			
Good	483 (10.5)	304 (8.9)	179 (14.8)
Average	718 (11.0)	474 (9.6)	244 (15.1)
Poor	140 (18.9)	90 (15.8)	50 (29.4)
Parents engaged in NMUPD			

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Table 2. Prevalence and characteristics of NMUPPR among GHS and VHS students. (continued).

No	1241 (10.8)	800 (9.3)	441 (15.2)
Yes	101 (24.9)	69 (23.2)	32 (29.9)
Friends engaged in NMUPD			
No	1227 (10.8)	795 (9.3)	432 (15.1)
Yes	115 (21.2)	74 (18.6)	41 (28.3)
Cigarette smoking			
No	1059 (10.3)	710 (9.0)	349 (14.6)
Yes	283 (17.6)	159 (15.9)	124 (20.5)
Alcohol drinking			
No	975 (11.5)	635 (9.9)	340 (16.5)
Yes	367 (10.7)	234 (9.4)	133 (14.2)
Feel lonely			
Less than 1 day/week	550 (9.5)	354 (8.1)	196 (13.7)
1 to 4 days/week	570 (12.7)	365 (10.9)	205 (17.7)
More than 4 days/week	193 (13.6)	128 (12.0)	65 (18.2)
Suicide behavior			
Never	1194 (10.6)	767 (9.1)	427 (15.2)
Considered	69 (20.1)	46 (19.7)	23 (20.7)
Attempted	50 (35.2)	36 (34.6)	14 (36.8)

1 NMUPPR= Nonmedical use of prescription pain relievers; GHS= General high school; VHS= Vocational high school; NMUPD= Nonmedical use of prescription drugs.

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3 *: Age data are presented as the means (SD). SD= Standard deviation.

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Table 3. Classes, sources, and motivations for NMUPPR among GHS and VHS students.

Variables	Total, n (%)	GHS, n (%)	VHS, n (%)	*p*-value*
Total	11906 (100)	8905 (100)	3001 (100)	
Class of pain relievers				
Scattered analgesics	685 (5.8)	434 (4.9)	251 (8.4)	<0.001
Codeine	661 (5.5)	443 (5.0)	218 (7.3)	<0.001
Percocet	647 (5.4)	416 (4.7)	231 (7.7)	<0.001
Tramadol	73 (0.6)	54 (0.6)	19 (0.6)	0.871
Source of pain relievers				
From peers	746 (6.3)	522 (5.9)	224 (7.5)	<0.001
From family members	241 (2.0)	130 (1.5)	111 (3.7)	<0.001
Others	551 (4.6)	348 (3.9)	203 (6.8)	<0.001
Motivation for NMUPPR				
To relax or relieve tension	580 (4.9)	391 (4.4)	189 (6.3)	<0.001
To experiment	310 (2.6)	206 (2.3)	104 (3.5)	0.001
To get high	294 (2.5)	192 (2.2)	102 (3.4)	<0.001
Other	482 (4.0)	315 (3.5)	167 (5.6)	<0.001

2 *: Chi-square tests were used to examine the differences between GHS and VHS students.

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Table 4. Predictors of NMUPPR based on a two-level multivariate logistic regression model.

Variables	AOR (95% CI)
School-level	
School category	
General high school	1.00 (reference)
Vocational high school	1.64 (1.42-1.89) #
Individual-level	
Gender	
Female	1.00
Male	0.98 (0.86-1.12)
Age (years)	0.99 (0.93-1.05)
Grade	
10	1.00
11	1.27 (1.09-1.46)
12	1.53 (0.99-2.37)
Living arrangement	
With both parents	1.00
With only father or mother	0.89 (0.78-1.03)
With others	0.97 (0.82-1.15)
Pocket money (RMB)	
<100	1.00
100-299	1.21 (1.02-1.43) #
>300	1.24 (1.04-1.47) #
Family economic status	
Above average	1.00
Average	1.03 (0.90-1.17)
Below average	0.77 (0.60-0.98) #
Family relationships	
Good	1.00
Normal	1.12 (0.89-1.41)
Difficult	1.26 (1.02-1.54) #
Academic stress	
Above average	1.00
Average	1.13 (0.97-1.33)
Below average	1.20 (0.98-1.46)
Classmate relationships	
Good	1.00
Average	1.25 (0.91-1.72)
Poor	1.24 (0.90-1.72)
Relationships with teachers	
Good	1.00
Average	1.50 (1.20-1.89) #
Poor	1.57 (1.23-2.01) #

Table 4. Predictors of NMUPPR based on a two-level logistic regression model (continued).

Parents engaged in NMUPD	
No	1.00
Yes	2.31 (1.79-2.98) #
Friends engaged in NMUPD	
No	1.00
Yes	1.75 (1.38-2.22) #
Cigarette smoking	
No	1.00
Yes	1.53 (1.29-1.82) #
Alcohol drinking	
No	1.00
Yes	1.02 (0.89-1.17)
Feel lonely	
Less than 1 day/week	1.00
1 to 4 days/week	0.86 (0.71-1.04)
More than 4 days/week	1.06 (0.87-1.29)
Suicide behavior	
Never	1.00
Considered	3.47 (2.34-5.15) #
Attempted	2.08 (1.29-3.35) #

1 NMUPPR= Nonmedical use of prescription pain relievers.

2 #: According to the two-level multivariate logistic regression model with adjustment for other
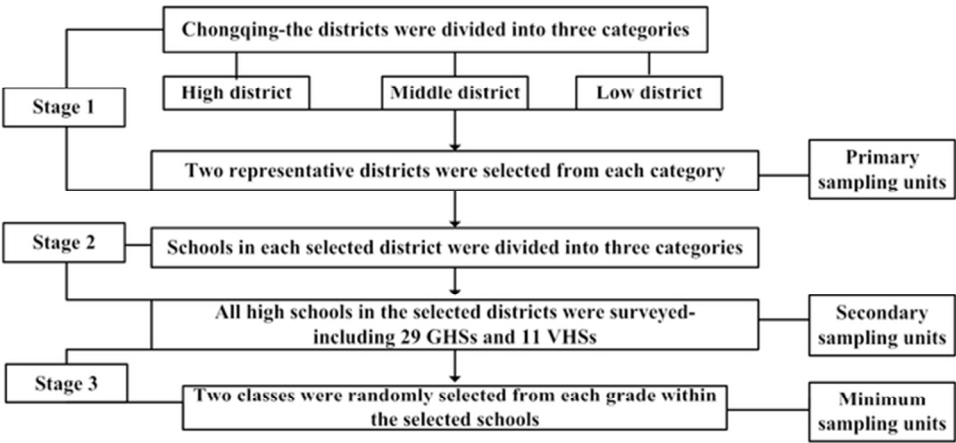
3 variables, $p<0.05$.

Figure 1. Flowchart of the sampling procedure

56x29mm (300 x 300 DPI)

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4-5
Objectives	3	State specific objectives, including any prespecified hypotheses	5-6
Methods			
Study design	4	Present key elements of study design early in the paper	6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7-8
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	7-9
Bias	9	Describe any efforts to address potential sources of bias	7
Study size	10	Explain how the study size was arrived at	6-7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	-
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	9
		(*b*) Describe any methods used to examine subgroups and interactions	9
		(*c*) Explain how missing data were addressed	9
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	9
		(*e*) Describe any sensitivity analyses	-
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	6-7
		(b) Give reasons for non-participation at each stage	16
		(c) Consider use of a flow diagram	6
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	10
		(b) Indicate number of participants with missing data for each variable of interest	23-24
Outcome data	15*	Report numbers of outcome events or summary measures	10-11
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	11-12
		(*b*) Report category boundaries when continuous variables were categorized	-
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	-
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	10-11
Discussion			
Key results	18	Summarise key results with reference to study objectives	12-16
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	16-17
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	16
Generalisability	21	Discuss the generalisability (external validity) of the study results	16
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	18

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.