Received: 6 December 2023 | Revised: 13 April 2024 | Accepted: 16 April 2024

DOI: 10.1111/jcap.12468

ORIGINAL ARTICLE

WILEY

Demographic, lifestyle, social, and psychological factors associated with worry-related sleep problems among school-going adolescents in Timor-Leste

Yong Kang Cheah PhD[1] | Chee Cheong Kee MSc[2] | Kuang Kuay Lim MSc[3] | Yoon Ling Cheong PhD[4]

[1]School of Economics, Finance and Banking, College of Business, Universiti Utara Malaysia, Sintok, Malaysia

[2]Sector for Biostatistics and Data Repository, National Institutes of Health, Ministry of Health Malaysia, Shah Alam, Malaysia

[3]Centre for Occupational Health Research, Institute for Public Health, Ministry of Health Malaysia, Shah Alam, Malaysia

[4]Special Research Centre, Institute for Medical Research, Ministry of Health Malaysia, Jalan Pahang, Malaysia

Correspondence
Yong Kang Cheah, PhD, School of Economics, Finance and Banking, College of Business, Universiti Utara Malaysia, 06010 Sintok, Malaysia.
Email: yong@uum.edu.my

Funding information
Universiti Utara Malaysia Research Generation University Grant, Grant/Award Number: 21359

Abstract

Objective: Adolescent sleep problems are a worldwide public health issue. The present study examines factors associated with worry-related sleep problems among school-going adolescents. The country of interest is Timor-Leste, a low-income country, where studies pertaining to adolescent sleep problems are lacking.

Design and Measures: Data were analysed from the Global School-Based Student Health Survey Timor-Leste (n = 3455). An ordered probit model was used to assess the effects of demographic, lifestyle, social, and psychological factors on different levels of worry-related sleep problems (i.e., no, mild and severe sleep problems).

Results: School-going adolescents were more likely to face mild or severe worry-related sleep problems if they were older, passive smokers, alcohol drinkers and moderately active. School-going adolescents who sometimes or always went hungry were more likely to experience worry-related sleep problems than those who did not. Involvement in physical fights, being bullied, and loneliness were positively associated with the probability of having modest or severe worry-related sleep problems.

Conclusion: Age, exposure to second-hand smoke, alcohol consumption, physical activity, going hungry, physical fights, being bullied and loneliness are the important determining factors of adolescent worry-related sleep problems. Policymakers should pay special attention to these factors when formulating intervention measures.

KEYWORDS
adolescents, going hungry, loneliness, sleep problems, worry

1 | INTRODUCTION

Worry shares a strong relationship with sleep problems because it may lead to various mental health issues, such as anxiety and depression (Danielsson et al., 2013; Danielsson et al., 2016). In an in-depth empirical study, worry was found to be negatively correlated with sleep quality (Yan et al., 2014). Worry-related sleep problems can cause serious adverse effects on health and academic performance in adolescents (Kansagra, 2020). Adolescents are more likely to experience a poor mood if they do not have adequate sleep. Studies show that self-harm and emotional regulation are highly correlated with worry-related sleep problems (Chen et al., 2012). The interrelationship between sleep problems and mood, in which the two affect each other and interact, is seen as a severe problem

 © 2024 Wiley Periodicals LLC.

(Lofthouse et al., 2009). There is also evidence that sleep problems are linked to obesity, which is a risk factor for various chronic diseases (Cappuccio et al., 2008). For instance, adolescents with insufficient sleep tend to gain more weight than those who have adequate sleep. Moreover, adolescents with sleep difficulties face an increased risk of cognitive impairment (Van Dongen et al., 2003).

In today's rapidly urbanizing society, adolescent sleep problems are no longer a rare issue. They have been treated as a serious public health concern that needs to be resolved urgently. The ongoing increase in the number of adolescents with sleep problems across the globe poses a challenge. For instance, Guo et al. (2014) surveyed 3186 students in Guangdong (China) and found that 39.6% of students had sleep problems. Hysing et al. (2022) found that 19.2% of adolescents in Western Norway ($n = 9077$) reported having sleep problems. Liang et al. (2021) reviewed cross-sectional studies related to adolescent sleep problems in China ($n = 430422$) and concluded that 26% of adolescents had encountered sleep inadequacy. Using the South Australian high school data ($n = 308$), Short et al. (2013) observed that 66% of adolescents suffered from sleep disorders. Lewien et al. (2021) conducted a cohort study in Germany and revealed that 20% of adolescents aged 10–17 years had sleep difficulties. Drawing from a sample of 451 adolescents in Iran, Shamsadini et al. (2022) found that 31.9% of adolescents had sleep disturbance.

In light of the global challenges faced by adolescents and public health administrators, there has been growing study that examines factors associated with sleep problems among adolescents in various countries. The common factors that have been found to be positively correlated with sleep problems include female gender, older age, going hungry, being bullied and loneliness (Glasbeek et al., 2022; Guo et al., 2014; Wang et al., 2020). However, studies conducted in Timor-Leste are nearly non-existent. To the best of our knowledge, the study by Wang et al. (2020) is the only study that focuses on Southeast Asian countries. A study that devotes its attention to Timor-Leste is of great importance as the country faces the issue of increasing prevalence of adolescent worry-related sleep problems (World Health Organization, 2017). Moreover, Timor-Leste is a low-income country where the low-socioeconomic population has poor access to health care (Guinness et al., 2018). Therefore, a better understanding of the risk factors for sleep problems within a large nationwide sample of adolescents in Timor-Leste may play an important role in assisting policymakers in formulating more effective intervention measures.

Several mental health-related policies have been implemented by the Timor-Leste government to improve mental health in the population, including adolescents (Ministry of Health, 2010). First, the government ensures that all urban and rural dwellers are able to access free mental health services and purchase highly subsidized psychotropic drugs. Second, the government frequently organizes a wide range of public mental health awareness programmes. Third, nongovernment organizations (NGOs) are encouraged to provide supplementary mental health services, including counseling and nonmedical measures.

The objective of the present study is to examine worry-related sleep problems and their determining factors among school-going adolescents in Timor-Leste. The present study intends to contribute to the literature in several manner. First, the present study extends the analysis of Wang et al. (2020) by including more explanatory variables in the regression, that is, exposure to second-hand smoke, alcohol drinking, going hungry and involvement in physical fights. The inclusion of more relevant variables could ensure that the results are credible and there are no omitted variable bias issues (Wooldridge, 2013). The present study hypothesizes that school-going adolescents who are exposed to passive smoking, consume alcohol, go hungry and participate in physical fights are more likely to experience worry-related sleep problems than others (Bartel et al., 2016; Guan et al., 2022; Kaur & Bhoday, 2017). The influences of passive smoking, alcohol consumption, hunger and physical fights on other worry-related mental health problems, such as loneliness, were evidenced in numerous studies (Amu et al., 2020; Peltzer & Pengpid, 2017; Pengpid & Peltzer, 2021). With the findings of the present study, a deeper understanding of which cohorts of the school-going adolescent population are more or less likely to experience worry-related sleep problems can be gained.

Second, a strong analytical approach is adopted to generate in-depth findings. Dissimilar to the study by Wang et al. (2020), which treated worry-related sleep problems as a binary variable (yes vs. no), the present study categorizes worry-related sleep problems into three levels, that is, no, mild and severe sleep problems, and uses an ordinal regression (ordered probit) to analyse factors affecting the probabilities of having different levels of worry-related sleep problems. This kind of analysis would be of great policy and research interests.

2 | METHODS

2.1 | Data

The present study is a cross-sectional, correlational study. Secondary data from the Global School-Based Student Health Survey (GSHS) Timor-Leste were used (World Health Organization, 2017). The GSHS Timor-Leste was jointly conducted by the Ministry of Health of Timor-Leste and the World Health Organization (WHO). The main objective of GSHS was to gather information on various health behaviors and protective factors among school-going adolescents. This information was used to support health policy planning. The survey period was from September to December 2015. Although the survey was conducted several years ago, it is the most recent and comprehensive nationwide adolescent health survey in Timor-Leste.

In terms of data collection, a two-stage cluster sampling approach was adopted. The population of interest was school-going adolescents in lower- and upper-secondary schools (13–17 years old). The education system in Timor-Leste can be categorized into five levels: (1) preprimary (≤6 years old); (2) primary (6–11 years old); (3) lower-secondary (12–14 years old); (4) upper-secondary (15–17 years old); and (5) tertiary (≥18 years old). In the first stage of sampling, the probability proportional to schools' enrollment size was used to select schools. A total of 38 schools were selected. In the

second stage, classes from each selected school were chosen using systematic equal probability sampling. All students in the selected classes were allowed to take part in the survey. A total of 4691 students were recruited, but only 3704 answered the questionnaires, which was equivalent to a response rate of 79%.

Piloted, structured questionnaires were distributed to respondents for self-administration. Students answered the printed hard-copy questionnaires during classroom periods. Their responses were recorded on the computer-scannable answer sheets. After completion, the answer sheets were scanned and saved in a database. Trained staff from the Ministry of Health took the responsibility to distribute and collect the questionnaires and answer sheets. The questionnaires were prepared in two languages, that is, the Tetum language and English. They consisted of a total of 70 questions related to demographics, lifestyle, drug abuse, sexual behavior, mental health, injuries, and personal hygiene. Several questions were of interest to the present study. Question 1, 2 and 3 sought demographic information on the students. Information on worry-related sleep problems was asked in Question 27. Question 33 and 36 sought to find out about smoking and exposure to second-hand smoke. Data on alcohol, use of illicit drugs and physical activity were derived from Question 41, 50 and 57. Information on going hungry, physical fights, bully, loneliness, and suicidal ideation was asked in Question 6, 19, 23, 26 and 28. Completed questionnaires were sent to the United States Centers for Disease Control and Prevention (CDC) for data screening and processing. Written consent was obtained from all the respondents. Those who did not give consent were not allowed to participate in the survey. Ethical approval was sought from the WHO's Ethical Committee as well as the Ministries of Education and Health in Timor-Leste.

2.2 | Dependent variable

The dependent variable used in the present study, worry-related sleep problems, was a categorical variable with ordinal outcomes. If the dependent variable was ordinal, its categories were ordered from low to high. Information on respondents' worry-related sleep problems was obtained from a question asked in the questionnaires: 'During the past 12 months, how often have you been so worried about something that you could not sleep at night?'. The respondents responded with 'never', 'rarely', 'sometimes', 'most of the time' or 'always'. To facilitate comparison, 'rarely' was combined with 'sometimes' to form 'mild sleep problems', while 'most of the time' was combined with 'always' to form 'severe sleep problems'. As such, the dependent variable had three ordered categories: no, mild and severe sleep problems.

2.3 | Independent variables

The independent variables were selected in light of the findings from previous studies as well as the availability of data (Guo et al., 2014; Lewien et al., 2021; Wang et al., 2020). They comprised demographic (gender, age), lifestyle (smoking, exposure to second-hand smoke, alcohol consumption, use of illicit drugs, physical activity), social (going hungry, involvement in physical fights, being bullied) and psychological variables (loneliness, suicidal ideation).

During the survey, the respondents were requested to report their age (in years) and genders (male vs. female). Age was categorized into four groups: 11–12, 13–14, 15–16 and 17–18 years. 'During the past 30 days, how many days did you smoke cigarettes?'. The respondents were categorized as smokers if they answered '≥1 day'. Similarly, the respondents who reported consuming alcohol (≥1 day) and using marijuana (≥1 time) in the past 30 days were categorized as alcohol drinkers and illicit drug users, respectively. The information on exposure to second-hand smoke came from the question: 'During the past 7 days, how many days have people smoked in your presence?'. The respondents who were exposed to second-hand smoke answered '≥1 day'. Respondents' physical activity levels were obtained from a question: 'During the past 7 days, how many days were you physically active for a total of at least 60 min per day?'. Respondents' responses were grouped into five categories: '0 day', '1–2 days', '3–4 days', '5–6 days' and '7 days'.

The survey asked the respondents about their food insecurity issues: 'During the past 30 days, how often did you go hungry because there was not enough food in your home?'. Respondents' answers were grouped into 'never', 'sometimes' and 'always'. In terms of physical fights and being bullied, the respondents were asked, 'During the past 12 months, how many times were you in physical fights?' and 'During the past 30 days, how many days were you bullied?'. The respondents answered '0', '1–3', '4–7' or '≥8 times' for the question related to physical fights. For the question regarding being bullied, the respondents answered '0', '1–5', '6–19' or '≥20 days'. The respondents reported their loneliness status when asked, 'During the past 12 months, how often have you felt lonely?'. The possible answers were 'never', 'sometimes' and 'always'. Information on respondents' suicidal ideation was obtained from a question: 'During the past 12 months, did you ever seriously consider attempting suicide?'.

2.4 | Statistical analyses

In the present study, several statistical analyses were performed. Firstly, the frequencies and proportions of respondents in the total sample, as well as the samples of no, mild and severe worry-related sleep problems were calculated. Secondly, the present study conducted Pearson's chi-squared tests of independence to assess whether demographic, lifestyle, social and psychological variables had associations with worry-related sleep problems. Lastly, since the dependent variable was a categorical variable with ordinal outcomes, the present study used ordered probit models to perform multivariate analysis. These models provided evidence of the independent relationships between the probabilities of experiencing different levels of worry-related sleep problems and demographic, lifestyle, social, and psychological variables. Marginal effects (MEs) were calculated and presented.

Additionally, two ordered probit models were estimated to identify the best model for the data. Model 1 regressed worry-related sleep problems on gender, age, use of illicit drugs, physical activity, being bullied, loneliness and suicidal ideation variables. Model 2 added smoking, exposure to second-hand smoke, alcohol drinking, going hungry and participation in physical fights variables. These two models were then compared according to their pseudo-R-squared, Akaike's information criterion (AIC) and Bayesian information criterion (BIC). Multicollinearity was diagnosed based on variance inflation factors (VIFs). Furthermore, to assess specification errors, the link test introduced by Pregibon (1980) was carried out. A significance level of $p < 0.05$ was selected for hypothesis testing. Stata statistical software was employed to perform the statistical analysis (StataCorp, 2019).

3 | RESULTS

Almost half of the respondents did not have worry-related sleep problems (48.4%), followed by those with mild (40.3%) and severe (11.4%) sleep problems. Large proportions of the respondents were females (53.8%) and 15–16 years old (34.4%). The majority of the respondents did not smoke (80.2%), drink (85.4%), consume illicit drugs (94.9%) but were exposed to second-hand smoke (78.2%). Nearly one-third of the respondents were physically inactive (29.8%). Only a small number of the respondents always went hungry (11.4%). More than half of the respondents did not engage in physical fights (70.9%) and were not bullied (74.4%). Only a small proportion of the respondents always felt lonely (13.5%) and had suicidal ideation (9.1%) (Table 1).

There were significant demographic, lifestyle, social, and psychological differences in the prevalence of worry-related sleep problems. In particular, severe and mild worry-related sleep problems were more prevalent among respondents who were males, 17–18 years old, smokers, passive smokers, alcohol drinkers, illicit drug users, physically active, going hungry, involved in physical fights, bullied, lonely, and having suicidal ideation compared to others. These results supported the use of an ordinal regression to examine the independent effects of demographic, lifestyle, social, and psychological variables on sleep problems (Table 2).

Model 2 was more appropriate and fitted the data better than Model 1 because it had a higher value of pseudo-R-squared as well as lower values of AIC and BIC. This implied that smoking, exposure to second-hand smoke, alcohol drinking, going hungry and participation in physical fights variables were relevant to the model. In addition, the prediction squared in Model 2 was insignificant, and its maximum VIF was less than 10, indicating that model specification errors and multicollinearity were not an issue (Wooldridge, 2013). As such, the results were interpreted based on Model 2 (Table 3).

Respondents aged 17–18 years were more likely to encounter mild (ME = 0.072) and severe (ME = 0.062) worry-related sleep problems than those aged 11–12 years. The probabilities of facing

TABLE 1 Summary statistics of variables ($n = 3455$).

Variables	Frequency	Percent
Dependent		
Sleep problems		
No	1671	48.36
Mild	1392	40.29
Severe	392	11.35
Independent		
Gender		
Male	1597	46.22
Female	1858	53.78
Age		
11–12	228	6.60
13–14	860	24.89
15–16	1188	34.38
17–18	1179	34.12
Smoking		
Yes	684	19.80
No	2771	80.20
Second-hand smoke		
Yes	2700	78.15
No	755	21.85
Alcohol		
Yes	505	14.62
No	2950	85.38
Illicit drugs		
Yes	178	5.15
No	3277	94.85
Physical activity		
0	1030	29.81
1–2	1702	49.26
3–4	284	8.22
5–6	120	3.47
7	319	9.23
Going hungry		
Never	1727	49.99
Sometimes	1334	38.61
Always	394	11.40
Physical fight		
0	2449	70.88
1–3	826	23.91
4–7	95	2.75

TABLE 1 (Continued)

Variables	Frequency	Percent
≥8	85	2.46
Bully		
0	2572	74.44
1–5	775	22.43
6–19	69	2.00
≥20	39	1.13
Loneliness		
Never	1390	40.23
Sometimes	1599	46.28
Always	466	13.49
Suicidal ideation		
Yes	315	9.12
No	3140	90.88

Source: GSHS 2015.

severe worry-related sleep problems were higher among respondents who were exposed to second-hand smoke (ME = 0.036), consumed alcohol (ME = 0.027), and participated in 3–4 days of physical activity (ME = 0.036) than others. Compared to 'never going hungry', 'sometimes going hungry' and 'always going hungry' were associated with 3.4% and 3.3% increases in the probabilities of having severe worry-related sleep problems. Respondents who engaged in ≥8 times of physical fights in the past 12 months were 10.3% more likely to experience severe worry-related sleep problems compared with those who did not. The probability of having severe worry-related sleep problems was positively associated with the frequency of being bullied. Specifically, the ME increased from 0.033 (1–5 days) to 0.148 (≥20 days). Respondents who sometimes (ME = 0.058) or always (ME = 0.129) felt lonely were more likely to face severe worry-related sleep problems than those without loneliness (Table 4).

4 | DISCUSSION

Using a nationally representative sample and a rigorous statistical method, the present study examined factors associated with different levels of worry-related sleep problems among school-going adolescents in Timor-Leste. The findings showed that large proportions of school-going adolescents experienced worry-related sleep problems (51.6%). This prevalence was higher than that reported in other countries, such as China, Iran, Germany, Australia, and the Netherlands (Fatima et al., 2016; Glasbeek et al., 2022; Guo et al., 2014; Lewien et al., 2021; Shamsadini et al., 2022). This indicated that adolescent worry-related sleep problems in Timor-Leste were more serious than those in middle- and high-income countries, thereby underscoring the urgent need for prevention efforts.

TABLE 2 Cross-tabulations of demographic, lifestyle, social, psychological variables and worry-related sleep problems (n = 3455).

	Sleep problems		
Variables	No	Mild	Severe
Gender			
Male	731	665	201
	(45.77)	(41.64)	(12.59)
Female	940	727	191
	(50.59)	(39.13)	(10.28)
$\chi^2(2)$	9.495		
p-value	0.009		
Age			
11–12	133	74	21
	(58.33)	(32.46)	(9.21)
13–14	486	320	54
	(56.51)	(37.21)	(6.28)
15–16	584	462	142
	(49.16)	(38.89)	(11.95)
17–18	468	536	175
	(39.69)	(45.46)	(14.84)
$\chi^2(6)$	82.343		
p-value	<0.001		
Smoking			
Yes	255	313	116
	(37.28)	(45.76)	(16.96)
No	1416	1079	276
	(51.10)	(38.94)	(9.96)
$\chi^2(2)$	51.683		
p-value	<0.001		
Second-hand smoke			
Yes	1200	1194	306
	(44.44)	(44.22)	(11.33)
No	471	198	86
	(62.38)	(26.23)	(11.39)
$\chi^2(2)$	86.695		
p-value	<0.001		
Alcohol			
Yes	183	235	87
	(36.24)	(46.53)	(17.23)
No	1488	1157	305
	(50.44)	(39.22)	(10.34)

(Continues)

TABLE 2 (Continued)

Variables	Sleep problems		
	No	Mild	Severe
$\chi^2(2)$	41.745		
p-value	<0.001		
Illicit drugs			
Yes	77	65	36
	(43.26)	(36.52)	(20.22)
No	1594	1327	356
	(48.64)	(40.49)	(10.86)
$\chi^2(2)$	14.714		
p-value	0.001		
Physical activity			
0	560	360	110
	(54.37)	(34.95)	(10.68)
1–2	796	718	188
	(46.77)	(42.19)	(11.05)
3–4	113	126	45
	(39.79)	(44.37)	(15.85)
5–6	60	48	12
	(50.00)	(40.00)	(10.00)
7	142	140	37
	(44.51)	(43.89)	(11.60)
$\chi^2(8)$	30.754		
p-value	<0.001		
Going hungry			
Never	970	583	174
	(56.17)	(33.76)	(10.08)
Sometimes	526	667	141
	(39.43)	(50.00)	(10.57)
Always	175	142	77
	(44.42)	(36.04)	(19.54)
$\chi^2(4)$	122.797		
p-value	<0.001		
Physical fight			
0	1252	970	227
	(51.12)	(39.61)	(9.27)
1–3	354	350	122
	(42.86)	(42.37)	(14.77)
4–7	39	35	21
	(41.05)	(36.84)	(22.11)
≥8	26	37	22
	(30.59)	(43.53)	(25.88)
$\chi^2(6)$	60.680		
p-value	<0.001		
Bully			
0	1350	973	249
	(52.49)	(37.83)	(9.68)
1–5	288	374	113
	(37.16)	(48.26)	(14.58)
6–19	23	31	15
	(33.33)	(44.93)	(21.74)
≥20	10	14	15
	(25.64)	(35.90)	(38.46)
$\chi^2(6)$	98.445		
p-value	<0.001		
Loneliness			
Never	853	432	105
	(61.37)	(31.08)	(7.55)
Sometimes	636	804	159
	(39.77)	(50.28)	(9.94)
Always	182	156	128
	(39.06)	(33.48)	(27.47)
$\chi^2(4)$	282.730		
p-value	<0.001		
Suicidal ideation			
Yes	137	128	50
	(43.49)	(40.63)	(15.87)
No	1534	1264	342
	(48.85)	(40.25)	(10.89)
$\chi^2(2)$	7.972		
p-value	0.019		

Note: The entries refer to observations. Row percentages in parentheses. *p*-values for Pearson's Chi-squared (χ^2) tests of independence. The significance level is $p < 0.05$.

Source: GSHS 2015.

Older age was a risk factor for worry-related sleep problems among school-going adolescents. To be specific, adolescents aged 17–18 years were more likely to experience moderate or profound

TABLE 3 Correlates of demographic, lifestyle, social and psychological variables to worry-related sleep problems (n = 3455).

Variables	Model 1	Model 2
Gender		
Male	0.043	−0.015
	(0.041)	(0.044)
Female	Ref.	Ref.
Age		
11–12	Ref.	Ref.
13–14	−0.032	−0.032
	(0.091)	(0.091)
15–16	0.172	0.158
	(0.088)	(0.089)
17–18	0.370*	0.340*
	(0.089)	(0.090)
Smoking		
Yes	–	0.091
		(0.057)
No	–	Ref.
Second-hand smoke		
Yes	–	0.228*
		(0.055)
No	–	Ref.
Alcohol		
Yes	–	0.146*
		(0.059)
No	–	Ref.
Illicit drugs		
Yes	0.096	0.006
	(0.099)	(0.101)
No	Ref.	Ref.
Physical activity		
0	Ref.	Ref.
1–2	0.097*	0.068
	(0.047)	(0.048)
3–4	0.231*	0.190*
	(0.078)	(0.079)
5–6	−0.032	−0.074
	(0.113)	(0.114)
7	0.100	0.061
	(0.075)	(0.076)
Going hungry		
Never	–	Ref.
Sometimes	–	0.191*
		(0.043)
Always	–	0.179*
		(0.071)
Physical fight		
0	–	Ref.
1–3	–	0.140*
		(0.050)
4–7	–	0.175
		(0.132)
≥8	–	0.463*
		(0.138)
Bully		
0	Ref.	Ref.
1–5	0.293*	0.183*
	(0.046)	(0.049)
6–19	0.514*	0.410*
	(0.144)	(0.148)
≥20	0.791*	0.613*
	(0.220)	(0.217)
Loneliness		
Never	Ref.	Ref.
Sometimes	0.386*	0.331*
	(0.044)	(0.044)
Always	0.621*	0.583*
	(0.070)	(0.071)
Suicidal ideation		
Yes	0.074	0.063
	(0.070)	(0.071)
No	Ref.	Ref.
Pseudo R-squared	0.048	0.060
AIC	6379.817	6317.807
BIC	6484.326	6471.496
Wald test	295.340	360.690
p-value	<0.001	<0.001
Prediction squared	−0.079	−0.083

(Continues)

TABLE 3 (Continued)

Variables	Model 1	Model 2
p-value	0.506	0.361
Maximum VIF	4.160	4.230

Note: Robust standard errors in parentheses. The significance level is $p < 0.05$.

Source: GSHS 2015.

*$p < 0.05$.

worry-related sleep problems when compared to those aged 11–12 years. This finding is in agreement with the evidence of previous studies that the odds of having sleep problems were higher among older adolescents (Bartel et al., 2016; Glasbeek et al., 2022; Guo et al., 2014; Zhou et al., 2020). Several plausible explanations were provided by prior studies. First, older school-going adolescents tended to encounter heavier academic burdens than their younger peers, thus resulting in worry-related sleep disturbance (Zhou et al., 2020). Second, older school-going adolescents were more likely to have negative emotional states at bedtime compared with younger school-going adolescents and consequently faced more serious sleep deprivation (Glasbeek et al., 2022). The findings of the present study highlight the need to focus on reducing sleep problems in upper-secondary school students. Teachers are suggested to take extra responsibilities to monitor students' mental health and provide assistance when necessary.

In the present study, although smoking was not associated with sleep problems, school-going adolescents who were exposed to second-hand smoke were more likely to face alarming worry-related sleep problems compared with those without exposure to second-hand smoke. Similar findings were evidenced by Guan et al. (2022), who claimed passive smoking to be associated with an increase in the odds of suffering from sleep deprivation. This is perhaps because nicotine is a stimulant that increases brain alertness, leading to sleep difficulties (Guan et al., 2022; Patten et al., 2000). However, the adverse effect of nicotine on sleep may become negligible for smokers who smoke frequently, and this could be a reason why there was no significant relationship between smoking and sleep problems. A more in-depth understanding of the nicotine-sleep deprivation mechanism can be supplemented by a clinical study. Considering the present study's findings, the Ministry of Health of Timor-Leste is suggested to integrate second-hand smoking reduction with the intervention targeting sleep problem prevention in school-going adolescents, especially in light of the fact that second-hand smoking is highly prevalent in Timor-Leste.

The effects of alcohol consumption and illicit drug use on worry-related sleep problems are important but have not been examined thoroughly in previous studies. As pointed out by Kaur and Bhoday (2017), who discussed factors affecting adolescent sleep problems, alcohol and drug use had negative impacts on sleep problems. In the present study, only alcohol drinking was associated

TABLE 4 Marginal effects from ordered probit regression ($n = 3455$).

	Sleep problems		
Variables	No	Mild	Severe
Gender			
Male	0.006	−0.003	−0.003
	(0.018)	(0.010)	(0.008)
Female	Ref.	Ref.	Ref.
Age			
11–12	Ref.	Ref.	Ref.
13–14	0.013	−0.007	−0.005
	(0.036)	(0.021)	(0.015)
15–16	−0.063	0.035	0.028
	(0.035)	(0.019)	(0.016)
17–18	−0.134*	0.072*	0.062*
	(0.035)	(0.018)	(0.018)
Smoking			
Yes	−0.036	0.020	0.016
	(0.023)	(0.012)	(0.011)
No	Ref.	Ref.	Ref.
Second-hand smoke			
Yes	−0.091*	0.055*	0.036*
	(0.023)	(0.014)	(0.008)
No	Ref.	Ref.	Ref.
Alcohol			
Yes	−0.058*	0.031*	0.027*
	(0.023)	(0.012)	(0.012)
No	Ref.	Ref.	Ref.
Illicit drugs			
Yes	−0.002	0.001	0.001
	(0.040)	(0.023)	(0.017)
No	Ref.	Ref.	Ref.
Physical activity			
0	Ref.	Ref.	Ref.
1–2	−0.027	0.015	0.012
	(0.019)	(0.011)	(0.008)
3–4	−0.075*	0.039*	0.036*
	(0.031)	(0.014)	(0.016)
5–6	0.030	−0.018	−0.012
	(0.045)	(0.028)	(0.018)
7	−0.024	0.014	0.011
	(0.030)	(0.016)	(0.014)

TABLE 4 (Continued)

	Sleep problems		
Variables	**No**	**Mild**	**Severe**
Going hungry			
Never	Ref.	Ref.	Ref.
Sometimes	−0.076*	0.042*	0.034*
	(0.017)	(0.009)	(0.008)
Always	−0.071*	0.038*	0.033*
	(0.028)	(0.014)	(0.015)
Physical fight			
0	Ref.	Ref.	Ref.
1–3	−0.056*	0.031*	0.025*
	(0.020)	(0.010)	(0.009)
4–7	−0.069	0.036	0.033
	(0.051)	(0.024)	(0.028)
≥8	−0.177*	0.074*	0.103*
	(0.049)	(0.012)	(0.038)
Bully			
0	Ref.	Ref.	Ref.
1–5	−0.073*	0.039*	0.033*
	(0.019)	(0.010)	(0.009)
6–19	−0.158*	0.069*	0.089*
	(0.054)	(0.015)	(0.039)
≥20	−0.227*	0.080*	0.148*
	(0.070)	(0.006)	(0.068)
Loneliness			
Never	Ref.	Ref.	Ref.
Sometimes	−0.131*	0.074*	0.058*
	(0.017)	(0.010)	(0.008)
Always	−0.222*	0.093*	0.129*
	(0.025)	(0.007)	(0.020)
Suicidal ideation			
Yes	−0.025	0.014	0.011
	(0.028)	(0.015)	(0.013)
No	Ref.	Ref.	Ref.

Note: Robust standard errors in parentheses. The significance level is $p < 0.05$.

Source: GSHS 2015.

*$p < 0.05$.

with worry-related sleep problems. Particularly, the likelihood of having severe or mild worry-related sleep problems was higher among school-going adolescents who indulged in alcohol drinking compared to those without drinking habits. The reason for this finding could be that alcohol use can lead to insomnia and sleep disturbance (Chakravorty et al., 2016). For instance, Kenney et al. (2014), using data from a survey of university students, found high levels of alcohol intake to be associated with poor sleep quality. Popovici and French (2013) further concluded that binge drinking could result in various sleep problems in the adolescent population. The present study's findings lead us to suggest a complete ban on alcohol drinking among adolescents in Timor-Leste. It seems to be important for public health administrators to take the initiative to reduce the availability of alcoholic beverages in the market and impose age restrictions. Underage consumers should not be allowed by law to purchase and consume alcohol.

The odds of having modest or serious worry-related sleep problems were higher among moderately active school-going adolescents, that is, those who participated in 3–4 days of physical activity per week, when compared to inactive school-going adolescents. However, not all the levels of physical activity were correlated with sleep problems. Our results contradict the findings of previous studies. Wang et al. (2020) found that highly physically active adolescents in Brunei had a decreased likelihood of developing sleep problems compared with those who were inactive. The findings of Bartel et al. (2016) also showed that frequent participation in physical activity could improve sleep quality among adolescents in Australia. Why being moderately active was positively associated with worry-related sleep problems in Timor-Leste school-going adolescents is ambiguous, but the environment and social factors may be the explanations. This topic can be explored thoroughly in future qualitative research.

Going hungry was found to be correlated with worry-related sleep problems. More specifically, school-going adolescents who sometimes or always went hungry because of inadequate food at home had a higher tendency to experience serious worry-related sleep problems when compared to their peers who did not face food insecurity. This finding is consistent with past studies' evidence. Drawing from the data of the Global School-based Students Health Survey across the globe, Wang (2021) found that adolescents who faced food insecurity problems were more likely to suffer from sleep disturbance than those who did not. The author claimed that food insecurity was closely linked to poor housing state and insecurity of housing, thereby leading to sleep problems. If the information on respondents' socioeconomic status was available, the association between worry-related sleep problems and housing conditions can be explored in detail. In terms of policy implication, intervention strategies directed toward reducing sleep problems could be more tailored to school-going adolescents who face food insecurity. Suggested policies include providing free food to adolescents with poor socioeconomic status.

The relationship between being bullied and worry-related sleep problems was significant and noteworthy. In particular, school-going adolescents who were often bullied at school had a higher probability of suffering from moderate or serious worry-related sleep problems when compared to non-bully-victims. This finding is consistent with the evidence drawn by Wang et al. (2020). As pointed out by the

authors, adolescents who had the experience of being bullied were worried about future victimization than those who did not and consequently had a poorer sleep quality. The present study included involvement in physical fights variable in the analyses in addition to bully victimization, and found that school-going adolescents who often engaged in physical fights were more likely to suffer from worry-related sleep problems than those who did not. A plausible reason is that physical fights may cause mental health disorders (Chen & Wei, 2011; He et al., 2022). An important implication of the present study's finding is that school authorities should make a concerted effort to strengthen the school rules and regulations so that there are no bullying and physical fights in schools. Moreover, students who are bully or physical fight victims should be advised and encouraged to seek immediate assistance from teachers.

The correlation between loneliness and sleep problems was observed in several studies. Wang et al. (2020) found that loneliness was positively associated with worry-related sleep problems. Similarly, Guo et al. (2014) found that loneliness could increase the odds of sleep disturbance. While the mechanisms for the correlation between loneliness and worry-related sleep problems are not very clear and may need a more in-depth investigation, a plausible explanation was provided by Wang et al. (2020). The authors discussed the possibility that adolescents with feelings of loneliness did not receive adequate social support and thus tended to experience sleep problems. Similar to these findings, the present study found that school-going adolescents who sometimes or always felt lonely were more likely to encounter distressful worry-related sleep problems when compared to their non-lonely counterparts. Therefore, school teachers could be taught that loneliness may coexist with worry-related sleep disturbance. It is essential for school teachers to pay special attention to students who have the symptoms of loneliness and provide timely assistance and support if the goal of reducing the prevalence of adolescent worry-related sleep problems in schools is to be achieved.

Gender was found to be a factor associated with sleep problems in past studies (Camhi, 2000; Fatima et al., 2016; Lewien et al., 2021; Patten et al., 2000). Using data from a population-based cohort study in Germany, Lewien et al. (2021) found that female adolescents faced more serious sleep difficulties than males because of pubertal and hormonal variations in gender. In an Australian study, Fatima et al. (2016) also suggested that females had more sleep problems compared with males. Surprisingly, however, the present study found no association between gender and sleep problems. This may be because the present study only considered sleep problems caused by worry.

Several limitations of the present study are noteworthy. Because the questionnaires were self-administrated by the respondents, there is a possibility that the respondents reported wrong information. Since school-going adolescents are prohibited from using illicit drugs and smoking, social desirability bias may occur. Although the cross-sectional data set used in this study has a large sample size and consists of important information, it does not establish causalities. Furthermore, owing to data limitations, the present study only focused on worry-related sleep problems and did not examine a wide range of sleep problems. Also, the findings related to sleep problems were not easy to compare because many dissimilar measures and definitions were used. Moreover, adolescents who were not in school were excluded from the present study. Lastly, since the data were not collected recently, the latest scenario in Timor-Leste may not be reflected. To obtain a better understanding of the causal effects of demographic, lifestyle, social and psychological factors on worry-related sleep problems, an in-depth longitudinal study has to be conducted. Investigating the comprehensive policy implications of this research topic can also be a direction for a future study.

Despite the limitations, the present study has numerous strengths. One of them is the novelty of the population. The country of interest, Timor-Leste, is a low-income country, where the prevalence of adolescent sleep problems is high and empirical studies are lacking. In addition, the present study provides empirical findings from large, nationally representative data, which play an important role in supporting policy decision-making in Timor-Leste, especially in light of the fact that low-income countries are not capable of spending a large amount of money on healthcare. Moreover, the present study is among a few in-depth studies that shed light on the influences of demographic, lifestyle, social and psychological factors on sleep problems among school-going adolescents. Lastly, empirical evidence of factors associated with different levels of sleep problems is provided, which serves as essential information for public health planning.

5 | CONCLUSION

The present study adds to the literature on factors associated with adolescent sleep problems. Demographic, lifestyle, social and psychological factors play an important role in affecting worry-related sleep problems among school-going adolescents in Timor-Leste. In particular, school-going adolescents with mild or severe worry-related sleep problems are more likely to be older, be exposed to second-hand smoke, drink alcohol, be moderately active, go hungry, be involved in physical fights, be bullied, and feel lonely. Therefore, a nationwide policy aimed at resolving sleep issues is suggested to pay special attention to school-going adolescents with different demographic, lifestyle, social and psychological profiles.

AUTHOR CONTRIBUTIONS

Conceptualization: Yong Kang Cheah. *Methodology*: Yong Kang Cheah, Chee Cheong Kee, Kuang Kuay Lim. *Validation*: Yong Kang Cheah, Yoon Ling Cheong. *Formal analysis*: Yong Kang Cheah. *Investigation*: Yong Kang Cheah. *Writing–original draft*: Yong Kang Cheah, Chee Cheong Kee, Kuang Kuay Lim, Yoon Ling Cheong. *Writing–review & editing*: Yong Kang Cheah, Chee Cheong Kee, Kuang Kuay Lim, Yoon Ling Cheong.

ACKNOWLEDGMENTS

The authors thank Kim-Leng Goh for his feedback and comments. This paper uses data from the Global School-Based Student Health Survey (GSHS). GSHS is supported by the World Health Organization

and the US Centers for Disease Control and Prevention. Research support from the Universiti Utara Malaysia Research Generation University Grant (SO Code: 21359) is acknowledged.

CONFLICT OF INTEREST STATEMENT

The authors have no competing interests to declare.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are openly available in World Health Organization at https://extranet.who.int/ncdsmicrodata/index.php/catalog/659, reference number TLS_2015_GSHS_v01.

ETHICS STATEMENT

Ethical approval was sought from the WHO's Ethical Committee and Ministries of Education and Health in Timor-Leste.

ORCID

Yong Kang Cheah https://orcid.org/0000-0002-6793-7055

REFERENCES

Amu, H., Seidu, A. A., Agbemavi, W., Ahinkorah, B. O., Ameyaw, E. K., Amoah, A., Dadzie, L. K., & Kissah-Korsah, K. (2020). Loneliness and its associated risk factors among in-school adolescents in Tanzania: Cross-sectional analyses of the Global School-Based Health Survey Data. *Psychological Studies*, *65*, 536–542.

Bartel, K., Williamson, P., van Maanen, A., Cassoff, J., Meijer, A. M., Oort, F., Knäuper, B., Gruber, R., & Gradisar, M. (2016). Protective and risk factors associated with adolescent sleep: Findings from Australia, Canada, and the Netherlands. *Sleep Medicine*, *26*, 97–103.

Camhi, S. (2000). Factors affecting sleep disturbances in children and adolescents. *Sleep Medicine*, *1*, 117–123.

Cappuccio, F. P., Taggart, F. M., Kandala, N. B., Currie, A., Peile, E., Stranges, S., & Miller, M. A. (2008). Meta-analysis of short sleep duration and obesity in children and adults. *Sleep*, *31*(5), 619–626.

Chakravorty, S., Chaudhary, N. S., & Brower, K. J. (2016). Alcohol dependence and its relationship with insomnia and other sleep disorders. *Alcoholism: Clinical and Experimental Research*, *40*(11), 2271–2282.

Chen, J. K., & Wei, H. S. (2011). The impact of school violence on self-esteem and depression among Taiwanese junior high school students. *Social Indicators Research*, *100*, 479–498.

Chen, M. C., Burley, H. W., & Gotlib, I. H. (2012). Reduced sleep quality in healthy girls at risk for depression. *Journal of Sleep Research*, *21*(1), 68–72.

Danielsson, N. S., Norell-Clarke, A., & Hagquist, C. (2016). Associations between adolescent sleep disturbance and different worry themes: Findings from a repeated cross-sectional study from 1988 to 2011. *Sleep Health*, *2*, 194–197.

Danielsson, N. S., Harvey, A. G., MacDonald, S., Jansson-Fröjmark, M., & Linton, S. J. (2013). Sleep disturbance and depressive symptoms in adolescence: The role of catastrophic worry. *Journal of Youth and Adolescence*, *42*, 1223–1233.

Fatima, Y., Doi, S. A. R., O'Callaghan, M., Williams, G., Najman, J. M., & Mamun, A. A. (2016). Parent and adolescent reports in assessing adolescent sleep problems: Results from a large population study. *Acta Paediatrica*, *105*(9), e433–e439.

Glasbeek, M. P., Inhulsen, M. B. M. R., Busch, V., & van Stralen, M. M. (2022). Sleep reduction in adolescents: Socio-demographic factors and the mediating role of sleep hygiene practices. *Sleep Epidemiology*, *2*:100024.

Guan, Q., Huan, F., Wang, Y., Wang, L., Shen, L., Xiong, J., Guo, W., & Jing, Z. (2022). The relationship between secondhand smoking exposure and mental health among never-smoking adolescents in school: data from the Global School-based Student Health Survey. *Journal of Affective Disorders*, *311*, 486–493.

Guinness, L., Paul, R. C., Martins, J. S., Asante, A., Price, J. A., Hayen, A., Jan, S., Soares, A., & Wiseman, V. (2018). Determinants of health care utilisation: The case of Timor-Leste. *International Health*, *10*(6), 412–420.

Guo, L., Deng, J., He, Y., Deng, X., Huang, J., Huang, G., Gao, X., & Lu, C. (2014). Prevalence and correlates of sleep disturbance and depressive symptoms among Chinese adolescents: a cross-sectional survey study. *BMJ Open*, *4*:e005517.

He, Y., Chen, S. S., Xie, G. D., Chen, L. R., Zhang, T. T., Yuan, M. Y., Li, Y. H., Chang, J. J., & Su, P. Y. (2022). Bidirectional associations among school bullying, depressive symptoms and sleep problems in adolescents: a cross-lagged longitudinal approach. *Journal of Affective Disorders*, *298*, 590–598.

Hysing, M., Heradstveit, O., Harvey, A. G., Nilsen, S. A., Bøe, T., & Sivertsen, B. (2022). Sleep problems among adolescents within child and adolescent mental health services. An epidemiological study with registry linkage. *European Child & Adolescent Psychiatry*, *31*, 121–131.

Kansagra, S. (2020). Sleep disorders in adolescents. *Pediatrics*, *145*(S2), S204–S209.

Kaur, H., & Bhoday, H. S. (2017). Changing adolescent sleep patterns: Factors affecting them and the related problems. *The Journal of the Association of Physicians of India*, *65*, 73–77.

Kenney, S. R., Paves, A. P., Grimaldi, E. M., & LaBrie, J. W. (2014). Sleep quality and alcohol risk in college students: Examining the moderating effects of drinking motives. *Journal of American College Health*, *62*(5), 301–308.

Lewien, C., Genuneit, J., Meigen, C., Kiess, W., & Poulain, T. (2021). Sleep-related difficulties in healthy children and adolescents. *BMC Pediatrics*, *21*, 82.

Liang, M., Guo, L., Huo, J., & Zhou, G. (2021). Prevalence of sleep disturbances in Chinese adolescents: A systematic review and meta-analysis. *PLoS One*, *16*(3), e0247333.

Lofthouse, N., Gilchrist, R., & Splaingard, M. (2009). Mood-related sleep problems in children and adolescents. *Child and Adolescent Psychiatric Clinics of North America*, *18*(4), 893–916.

Ministry of Health. (2010), *National Mental Health Strategy 2011-2015*. Department of Mental Health.

Patten, C. A., Choi, W. S., Gillin, J. C., & Pierce, J. P. (2000). Depressive symptoms and cigarette smoking predict development and persistence of sleep problems in US adolescents. *Pediatrics*, *106*(2), e23.

Peltzer, K., & Pengpid, S. (2017). Loneliness and health risk behaviors among ASEAN adolescents. *Iranian Journal of Psychiatry and Behavioral Sciences*, *11*(3), e7691.

Pengpid, S., & Peltzer, K. (2021). Prevalence and associated factors of loneliness among a national sample of in-school adolescents in Morocco. *Journal of Psychology in Africa*, *31*(3), 303–309.

Popovici, I., & French, M. T. (2013). Binge drinking and sleep problems among young adults. *Drug and Alcohol Dependence*, *132*, 207–215.

Pregibon, D. (1980). Goodness of link tests for generalized linear models. *Journal of the Royal Statistical Society*, *29*(1), 15–23.

Shamsadini, A., Amizadeh, M., Motamed, S., & Rajabi, F. (2022). Epidemiology of sleep disorders among adolescents in Kerman, Iran, in 2019. *Social Work in Public Health*, *37*, 775–780. https://doi.org/10.1080/19371918.2022.2089310

StataCorp. (2019). *Stata statistical software: Release 16.0*. Stata Corporation.

Short, M. A., Gradisar, M., Gill, J., & Camfferman, D. (2013). Identifying adolescent sleep problems. *PLoS One*, *8*(9), e75301.

Van Dongen, H. P. A., Maislin, G., Mullington, J. M., & Dinges, D. F. (2003). The cumulative cost of additional wakefulness: Dose-response effects

on neurobehavioral functions and sleep physiology from chronic sleep restriction and total sleep deprivation. *Sleep*, *26*(2), 117–126.

Wang, Q. (2021). Food insecurity and sleep disturbance among 223561 adolescents: a multi-country analysis of cross-sectional surveys. *Public Health*, *9*:693544.

World Health Organization. (2017). *Global School-based Student Health Survey Results: 2015 – Timor-Leste*. World Health Organization.

Wang, Q., Liu, Y., & Mati, K. (2020). Bully victimization is a correlate of sleep loss over worry (SLOW) among adolescents in four South-East Asian countries. *Sleep Medicine*, *69*, 179–188.

Wooldridge, J. (2013). *Introductory econometrics: a modern approach*, *5th ed*. South-Western Cengage Learning.

Yan, Y., Lin, R., Tang, X., He, F., Cai, W., & Su, Y. (2014). The relationship between worry tendency and sleep quality in Chinese adolescents and young adults: The mediating role of state – trait anxiety. *Journal of health psychology*, *19*(6), 778–788.

Zhou, S. J., Wang, L. L., Yang, R., Yang, X. J., Zhang, L. G., Guo, Z. C., Chen, J. C., Wang, J. Q., & Chen, J. X. (2020). Sleep problems among Chinese adolescents and young adults during the coronavirus-2019 pandemic. *Sleep Medicine*, *74*, 39–47.

How to cite this article: Cheah, Y. K., Kee, C. C., Lim, K. K., & Cheong, Y. L. (2024). Demographic, lifestyle, social, and psychological factors associated with worry-related sleep problems among school-going adolescents in Timor-Leste. *Journal of Child and Adolescent Psychiatric Nursing*, *37*, e12468. https://doi.org/10.1111/jcap.12468