

Assessment of mental health problems among adolescents in Sri Lanka: Findings from the cross-sectional Global School-based Health Survey

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CONFLICT OF INTEREST

The authors have no competing interests to declare.

DECLARATION

All authors have read and approved the final version of the manuscript. The corresponding author had full access to the data used in this study and takes complete responsibility for the integrity of the data and the accuracy of the data analysis. The funding sources and/or financial relationships (i.e. conflicts of interest), do not have any roles in study design; collection, analysis, and interpretation of data; writing of the report; and the decision to submit the report for publication.

TRANSPARENCY STATEMENT

The corresponding author affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

DATA SHARING AND DATA AVAILABILITY

The GSHS survey data are publicly available online on the WHO website. Data are anonymized to protect individual participant's identity. The data from Sri Lanka used in this study can also be accessed from the site. Web link: <https://www.who.int/ncds/surveillance/gshs/en/>.

Further details of the data policy and relevant procedures are documented in the following weblink: <https://www.cdc.gov/gshs/background/pdf/2005datapolicy.pdf>.

Abstract

Background and Aims: Mental health condition among adolescents is a leading cause of health-related disability in Sri Lanka. The study aims to estimate the prevalence and evaluate the associated risk factors in three major mental health domains - loneliness, anxiety and suicidal ideation - among Sri Lankan adolescents.

Methods: We conducted a secondary analysis of cross-sectional data of 3262 adolescents from the Global School-based Health Survey (GSHS) conducted by the WHO in 2016. We modeled the binary outcome variables using multivariable logistic regression models with exposures representing demography, food habits, personal hygiene, behavior, substance abuse, parental and social engagement of the respondents.

Results: We estimated the prevalence of loneliness, anxiety and suicidal ideation as 30.8% (95% CI: 29.3, 32.5), 20.2% (95% CI: 18.8, 21.6) and 3.7% (95% CI: 3.1, 4.4), respectively, and the overall prevalence as 40.3% (95% CI: 38.6, 42.0). Mental health problems were more prevalent among females than males. Engagement with parents and close friends, adequate nutritional intake and physically active lifestyles reduced the risk of common mental health problems. Exposure variables like food insecurity, truancy, second-hand smoking, physical fight, and being bullied increased adolescents' risk of reported psychological problems.

Conclusions: We conclude that the prevalence of mental health problems in the Sri Lankan adolescent population was higher than the global average. Results suggest that future policy decisions to mitigate mental health problems among Sri Lankan adolescents should incorporate an integrated approach involving the individual, family and community to promote positive home and school environments combined with an active and healthy lifestyle.

Keywords Mental health adolescents; Global School-based Student Health Survey; Anxiety; Loneliness; Suicidal ideation.

Abbreviations

WHO: World Health Organization

CDC: Centres for Disease Control and Prevention

GSHS: Global School-based Student Health Survey

LMIC: Lower Middle-Income Countries

OR: Odds Ratio

95% CI: 95% Confidence Interval

1. INTRODUCTION

Worldwide, 1.2 billion adolescents (between the ages of 10-19 years) represent 16 percent of the world population¹. Adolescence is an important physical, social, and cognitive transition period that translates to skills and opportunities influencing adult life². However, they are also exposed to uncertainties and risk factors, including non-communicable diseases and mental health. As a result, the United Nations 2030 global strategy on “Every woman and every child” prioritized adolescents and their mental health well-being³.

The World Health Organization (WHO) defined mental health as “*a state of well-being in which the individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his or her community*”⁴. Approximately 10-20% of adolescents worldwide suffer from mental health problems, a leading cause of health-related disability⁵. Mental health problems should be addressed urgently in lower-middle-income countries (LMIC) that represent approximately 90% of the world’s adolescent population¹. Practical implementations and scaling up of mental health services are still lagging in these countries due to the lack of policy decisions, limited commitment, and funding in health sectors^{5,6}.

Sri Lanka, an LMIC with a population of 22 million, of which one-fifth are adolescents, has a reputed health infrastructure compared to its regional counterparts, but non-communicable diseases like mental health and malnutrition remain a challenge. Based on limited data available from outpatient child and adolescent mental health services⁷ and school-going children⁸, an increased prevalence of the mental health status among adolescents in Sri Lanka is a growing concern. However, the data on the prevalence of mental health conditions, particularly among adolescents in Sri Lanka, is still unknown⁹. The Sri Lankan health authorities have acknowledged the alarming nature of general mental health, including the higher suicide rates, increasing substance abuse, and psychosocial problems in children and adolescents¹⁰.

Mental well-being is a broad and complex topic. Some researchers specifically considered three major mental health domains - loneliness, anxiety, and suicidal ideation - to measure the psychological status of the adolescent in line with standard mental health directories^{11,12}. The World Health Organization (WHO) and Centres for Disease Control and Prevention (CDC), in collaboration with other United Nations agencies, developed and promoted the Global School-based Health Survey (GSHS). The GSHS data provide an excellent resource for understanding

adolescents' physical and mental well-being on multiple factors, including dietary habits, hygiene, behavioral, substance abuse, injuries, and protective factors. Given the multifaceted factors contributing to mental health problems, the present study aims to summarise the GSHS data and provide recommendations to support health professionals and policymakers in addressing the mental health issues among adolescents in Sri Lanka. We set out two objectives: first, to estimate the prevalence of mental health issues in the adolescent population in Sri Lanka, and second, to evaluate the factors associated with mental health issues in this population.

2. METHODS

2.1 Study design

This study is a secondary analysis of cross-sectional data from the Global School-based Health Survey (GSHS) conducted in Sri Lanka in 2016.

2.2 Data source

The GSHS is a school-based health survey completed through a self-administrated questionnaire by adolescents in grades 8-13. In collaboration with other United Nations agencies, the World Health Organization (WHO) and the Centres for Disease Control and Prevention (CDC) jointly developed the survey to measure the healthy behavior and protective factors among pupils attending school. The GSHS survey data are publicly available online on the WHO website (<https://www.who.int/ncds/surveillance/gshs/en/>).

2.3 Data collection procedure

The GSHS survey data were collected using a two-stage clustering method to select the representative of the study population. In the first stage, 40 schools were selected based on the probability proportional to the number of enrolments in grades 8-13 (Supplementary Figure S1). In the second stage, grades 8-13 classrooms were randomly chosen, and each student in the selected classroom was eligible to participate. To increase the likelihood of sampling and to reduce the bias of the non-responses to the survey, an appropriate weighting factor was used to validate the study¹³. The Ethics Review Committee of the Faculty of Medicine, the University of Colombo, approved the study. The questionnaire was prepared in three main languages (Sinhala, Tamil and English) widely spoken in Sri Lanka. All students provided their consent, and appropriate measures were taken regarding the confidentiality of participants and contamination of responses. All enrolled schools participated, and 89% of sampled students responded.

2.4 Study variables

Based on 58 questions measured in the Sri Lanka GSHS study, we constructed seven broad domains with relevant predictor variables: demography, food habits, personal hygiene, behavioral, substance abuse, parental, and social engagement. One question was used to identify the response variables loneliness (Q22), anxiety (Q23), and two questions (Q24 and Q25) to derive the variable suicidal ideation. Details of the predictor variables within each domain and data recoding strategies are presented in Supplementary Table S1.

2.5 Statistical analysis

We presented the descriptive statistics of all study variables using the total frequency and percentage. We estimated the prevalence of loneliness, anxiety, suicidal ideation and corresponding 95% confidence interval using the Wilson procedure with continuity correction. We fitted separate logistic regression models in a single (unadjusted) and multivariable (adjusted) framework to evaluate the association of different predictor variables. Predictor variables of the model included variables that correspond to demography, food habits, personal hygiene, behavioral, substance abuse, parental, and social engagement. The multivariable model selection between the competitive models was assessed using the Akaike information criterion (AIC) and the likelihood ratio test statistic. All statistical tests were two-sided with the type 1 error rate set at 5%. We obtained the estimates of odds ratio (OR) and corresponding 95% confidential interval from the final fitted models. All statistical analyses were conducted in the R software environment (version 3.6.0).

3. RESULTS

3.1 Prevalence of mental health problems

A total of 3262 school-going adolescents in Grade 8 to 13 participated in the survey. Figure 1 presents the summary statistics of demography, behavioural, and psychosocial characteristics. The survey recorded that 40.3% (95% CI: 38.6, 42.0) of respondents experienced some form of mental health problem one year prior to the survey. Among them, 30.8% (95% CI: 29.3, 32.5) perceived loneliness, 20.2% (95% CI: 18.8, 21.6) experienced anxiety and 3.7% (95% CI: 3.1, 4.4) reported suicidal ideation.

3.2 Summary of predictor variables

The survey received slightly higher responses from females (55.7%, n=1805) than males (44.3%, n=1437). Most respondents (85.5%, n=2772) did not consume adequate fruit and vegetable, and more than 40% of adolescents consumed fast food (42.2%, n=1373), while 15.4% of households had identifiable food insecurity. Approximately half of the population practised good hand hygiene, and nearly 70% of adolescents had adequate oral hygiene. According to responses, approximately 80% of respondents received good parental and social support. Among the behavioral characteristics, 43.6% (n=1420) engaged in a physical fight, and 37.8% (n=1208) reported the experience of being bullied. More than 40% of respondents were exposed to second-hand smoking (41.8%, n=1356), and a smaller percentage of the respondents had psychoactive substance abuse like cigarette smoking (4.2%, n=137), alcohol (3.2%, n=103), and cannabis (2.4%, n=79).

FIGURE 1 here

FIGURE 1 Summary statistics of different categories of the response and predictor variables (frequency, percentage in parenthesis) measured on the Global School-based Health Survey (GSHS) data.

3.3 Factors associated with loneliness

The outcomes from the fitted logistic regression model of loneliness and its association with different predictor variables are presented in Supplementary Table S2 and summarised in Figure 2. The outcomes from the adjusted model showed that females, students in higher grades, and those who consumed inadequate amounts of fruits and vegetables or were hungry during the past 30 days had an increased likelihood of loneliness. Among behavioral, parental, and social engagement predictors, adolescents exposed to second-hand smoking, experienced reduced parental support, were involved in truancy, engaged in a physical fight, and were bullied suffered increased loneliness.

FIGURE 2 here

FIGURE 2 Estimates of the Odds Ratio (OR) and corresponding 95% confidence interval of categories of predictors (compared with the reference category) from the fitted multivariable logistic regression model of loneliness.

3.4 Factors associated with anxiety

Supplementary Table S3 and Figure 3 present the outcomes from the logistic regression model of anxiety. Like loneliness, the odds of anxiety were higher among female adolescents who studied in higher grades, consumed fast foods, took inadequate fruits and vegetables, or were hungry for 30 days. Similarly, adolescents who perceived reduced parental understanding, lack of close friends, second-hand smoking or engaged in a physical fight or being bullied had an increased level of anxiety. Interestingly, adolescents with increased peer support also had an increased anxiety level.

FIGURE 3 here

FIGURE 3 Estimates of the Odds Ratio (OR) and corresponding 95% confidence interval of categories of predictors (compared with the reference category) from the fitted multivariable logistic regression model of anxiety.

3.5 Factors associated with suicidal ideation

Supplementary Table S4 and Figure 4 present the outcomes from the logistic regression model of suicidal ideation. Increased parental and social engagement through perceived parental understanding, parental supervision, and close friends were associated with less reported suicidal ideation. Adolescents engaged in physical activity had decreased suicidal thoughts compared to those who were not physically active. The experience of bullying increased the odds of suicidal thoughts.

FIGURE 4 here

FIGURE 4 Estimates of the Odds Ratio (OR) and corresponding 95% confidence interval of categories of predictors (compared with the reference category) from the fitted multivariable logistic regression model of suicidal ideation.

4. DISCUSSION

Using one of the largest survey data on the adolescent population in Sri Lanka, the present study assessed the prevalence of mental health problems among school students between grades 8 to 13 and evaluated the factors associated with their psychological health. The prevalence estimates of loneliness, anxiety and suicidal ideation were 30.8%, 20.2% and 3.7%, respectively, while the overall prevalence (%) was 40.3 (95% CI: 38.6, 42.0). We observed increased engagement with parents and close friends, adequate nutritional intake and physically active lifestyles reduced the likelihood of mental health problems. On the other hand, food insecurity, truancy, exposure to second-hand smoking, physical fight, and being bullied increased the odds of mental health problems among Sri Lankan adolescents.

The overall prevalence (40.3%) of mental health problems among adolescents in Sri Lanka is higher than the reported global average estimate of prevalence of 10-20% in the adolescent and children population⁵. In a recent school survey, conducted in four lower- and middle-income countries, including Sri Lanka, the reported prevalence of loneliness among the local participants was 9%, anxiety at 5.5%, and suicidal ideation at 7.9%¹⁴. The items in the questionnaire used in this survey were derived and modified from various sources, including GSHS. We also observed that mental health problems were more prevalent among female pupils confirming that girls are affected more than boys and seek more help for mental health problems¹⁵. Many factors contribute to women's mental health and well-being, such as violence, socio-economic disadvantage, inequalities, social status, and unremitting caring responsibilities¹⁶. As observed in the current study, an increased likelihood of loneliness and anxiety among upper-grade students has been reported earlier¹⁷; this could be due to the critical phase of grade 12-13 students who prepare for various competitive examinations and university admissions. A study assessing a similar age group of upper-grade students in Sri Lanka revealed higher mental health problems with 28% anxiety and 36% reported depression, and significantly more symptoms in female pupils¹⁷.

A large percentage (85%, n=2772) of adolescents had lower nutritional supplements, particularly inadequate consumption of fruits and vegetables. The WHO and World Food Program recommend a daily dietary intake of at least 400-500g per day, about two servings of fruit and three servings of vegetables¹⁸. Nutritional problems are common worldwide; less than thirty percent of adolescents meet the WHO nutrition requirement¹⁹. The relationship between consuming fruits and vegetables and mental health remains unclear, but studies confirmed the

positive association between subjective mental health well-being and adequate intake of fruits and vegetables²⁰. This study also found that adolescents who experienced hunger were more likely to experience loneliness and anxiety. It is suggested that the lower social-economic status of the family may lead to food insecurity and hunger, which may negatively impact physical and mental well-being including substance abuse, anxiety and behavioral problems²¹.

The study demonstrates that moderate or intensive physical activity had a beneficial effect on alleviating mental health problems, especially with suicidal ideation. Many cross-sectional studies confirmed the positive impact of physical activity on mental health. Several plausible mechanisms are proposed to explain such association: physical activity acts as an emotional buffer against stressful events²², increases self-esteem²³, and distracts from negative thoughts²⁴; and possibly regular exercise increases the release of the neurotransmitters such as dopamine, norepinephrine, and serotonin, involved in mood regulation²⁵.

The positive influence of parental engagement, as observed in this study, is consistent with the previous studies²⁶; parental understanding reduces the odds of experiences of loneliness, anxiety, and suicidal ideation. A similar study in Sri Lanka has found that a large percentage of children experience psychological and physical violence at home and school, with a lifetime prevalence of 46% corporal punishment by parents and 80.4% during a school term²⁷. This probably signifies that many parents in Sri Lanka are involved with children but need better strategies and support to deal with the behavioral problems of the children.

This study found that bullied adolescents were more vulnerable as they suffered severe mental health problems, including suicidal ideation. Bullying is the most common form of social evil faced by adolescents, particularly in school surroundings²⁸. On the other hand, access to close friends and good school attendance contributed positively and reduced the odds of feeling lonely and anxious. Enhanced parental involvement, good dietary habits and increased physical activity are recognized to improve mental health problems among adolescents²⁹. Similar adverse childhood experiences regarding emotional neglect and witnessing community violence are reported among school-going adolescents in Tunisia³⁰. Although the present study did not assess the interaction of these factors explicitly, other studies documented that the interaction of these factors reduced the incidences of bullying¹⁰. Notwithstanding, it is evident from this study that parent-child engagement and understanding are conducive to good healthy growth and personality development. Parents can play a pivotal role in encouraging and offering advice on better food habits, increased personal hygiene, and appropriate physical activity to make the

adolescent period more supportive.

We identified that over 40% of the adolescents in this study were exposed to second-hand smoking. Globally, adolescents are more exposed to second-hand smoking than other age groups³¹. Second-hand smoking was associated with an increased likelihood of experiencing loneliness and anxiety. Similar findings are also supported in the literature^{32,33}. The possible association of second-hand smoking with increased mental health issues may be manifested due to several reasons: physical discomfort due to the toxic agents³⁴; the adverse influence on the neurotransmitters due to increased nicotine level in the blood³⁵, and positive association between second-hand smoking and chronic health conditions such as respiratory diseases and obesity³⁶. This study revealed that adolescents who took psychoactive substances had a reduced likelihood of feeling lonely; it may be assumed that this is likely to be a short-lasting effect, and there is evidence that self-isolation leading to loneliness could increase the use of cannabis³⁷.

Mental health conditions in adolescents are complex and multifaceted. Although this study considered only three domains of mental health of adolescents - loneliness, anxiety and suicidal ideation - it demonstrates pertinent findings that could be easily implementable as policy measures. To tackle mental health issues among adolescents, the parents, schools, and community should collaborate and work together to build an inclusive and integrated school curriculum. The collaboration should promote positive home and school environments with zero tolerance to bullying and encourage an active and healthy lifestyle with healthy eating patterns. The mental health problems among adolescents should be addressed at the individual, family, and community levels with planned and targeted school and community-based awareness programs and regular screening and health promotion events. An integrated approach would help to identify and resolve these issues at the earliest and reduce their impact on the future adult population.

4.1 Study limitations

The present study has several limitations. First, the survey was conducted in 2016, therefore, it may not reflect the country's most recent mental health status, particularly during the pandemic. However, we believe some of the strategies outlined in this study could still be relevant. Second, it is estimated that 1 in 3 children are out of school in lower and middle-income countries³⁸, and in Sri Lanka, 55% of the disabled adolescent population is out of school. Hence, this study may not generalize to the adolescent population representing the disabled, school dropouts, and

school absentees. This study is less representative of the north and east provinces of Sri Lanka that experienced 30 years of civil war, resulting in higher incidences of disability and mental health trauma. Due to the self-administrated nature of the questionnaire, the responses may also be under or over-reported. The survey captured only selected features of mental health factors; hence an overall assessment of possible confounders at the individual, family, and community levels was not possible. To evaluate the scale of mental health problems in the current scenario, we recommend a comprehensive nationwide survey with appropriate survey weights based on the present adolescent population in Sri Lanka.

5. CONCLUSIONS

Using comprehensive nationwide survey data, we observed that 40% of adolescents in Sri Lanka suffered from mental health problems related to loneliness, anxiety or suicidal ideation; the estimated prevalence was more than double compared with the global average of 10-20%. Increased engagement with parents and close friends, adequate nutritional intake and physically active lifestyles reduced the likelihood of common mental health problems. On the other hand, food insecurity, truancy, exposure to second-hand smoking, engaging in a physical fight and being bullied increased the odds of adolescent mental health problems. Results suggest that future policy decisions to mitigate mental health problems among Sri Lankan adolescents should incorporate an integrated approach involving the individual, family, and community to promote positive home and school environments combined with an active and healthy lifestyle.

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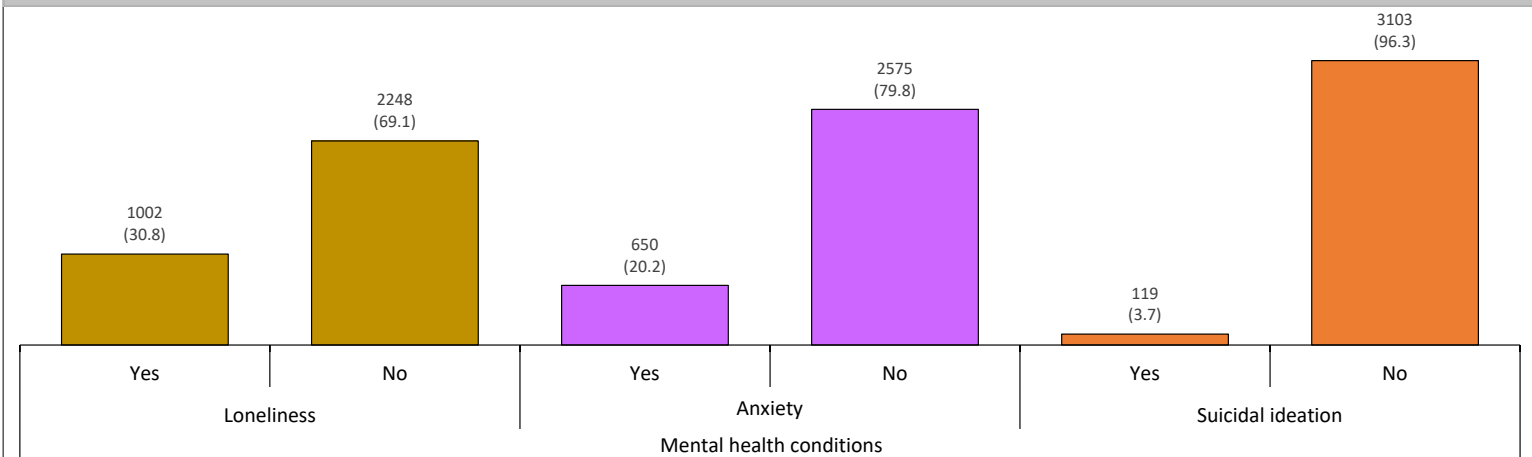
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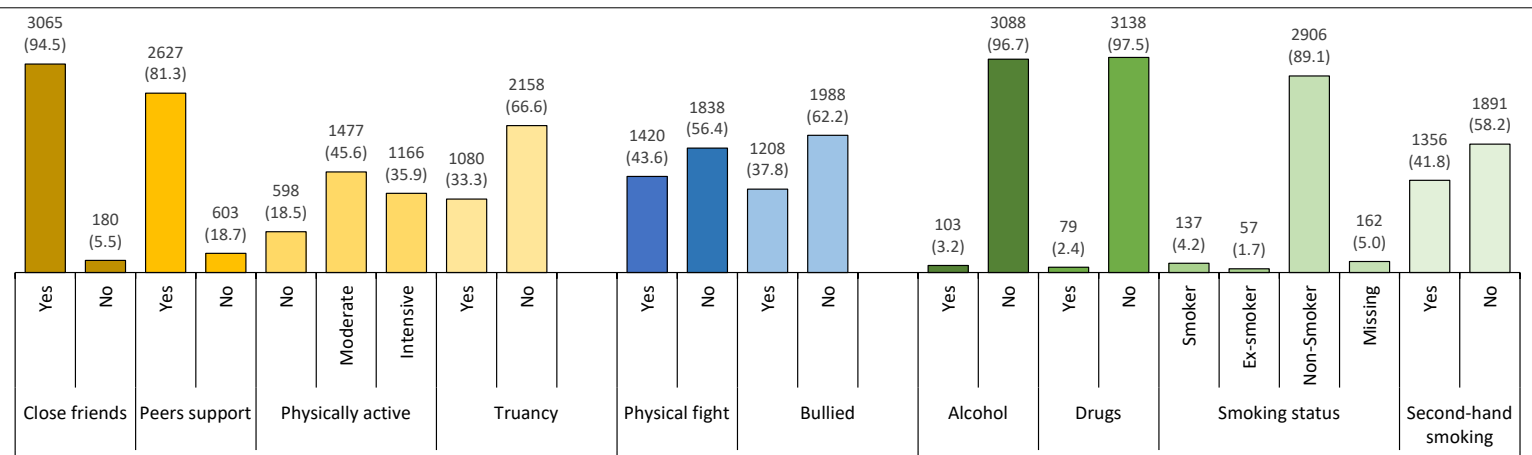
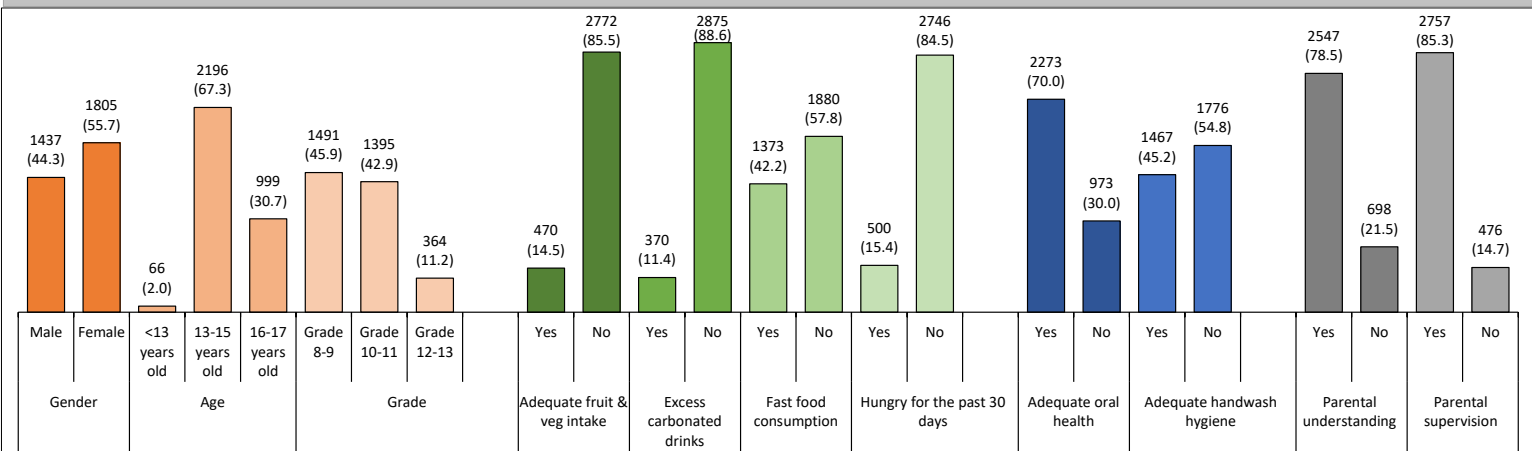
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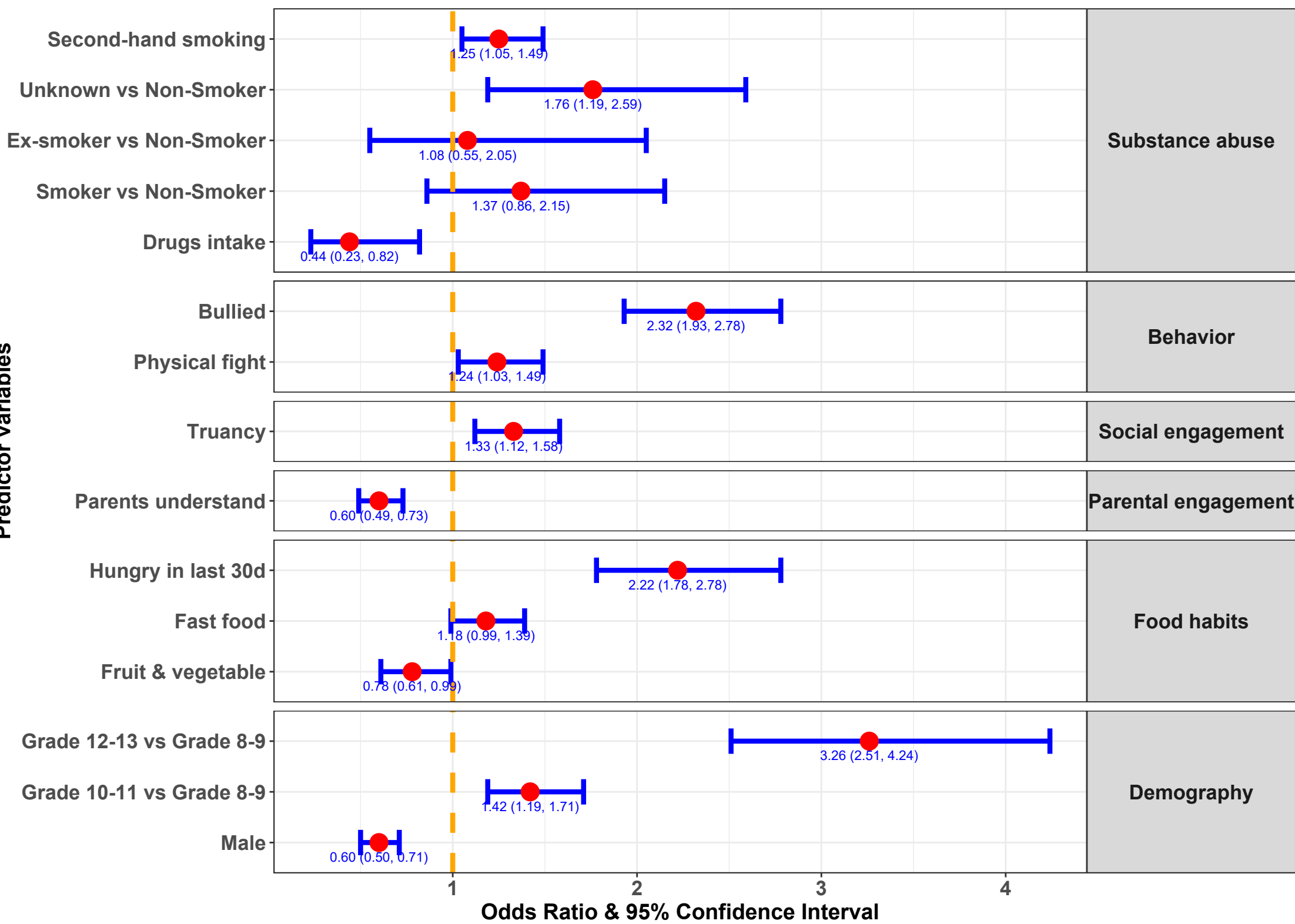
Response variables

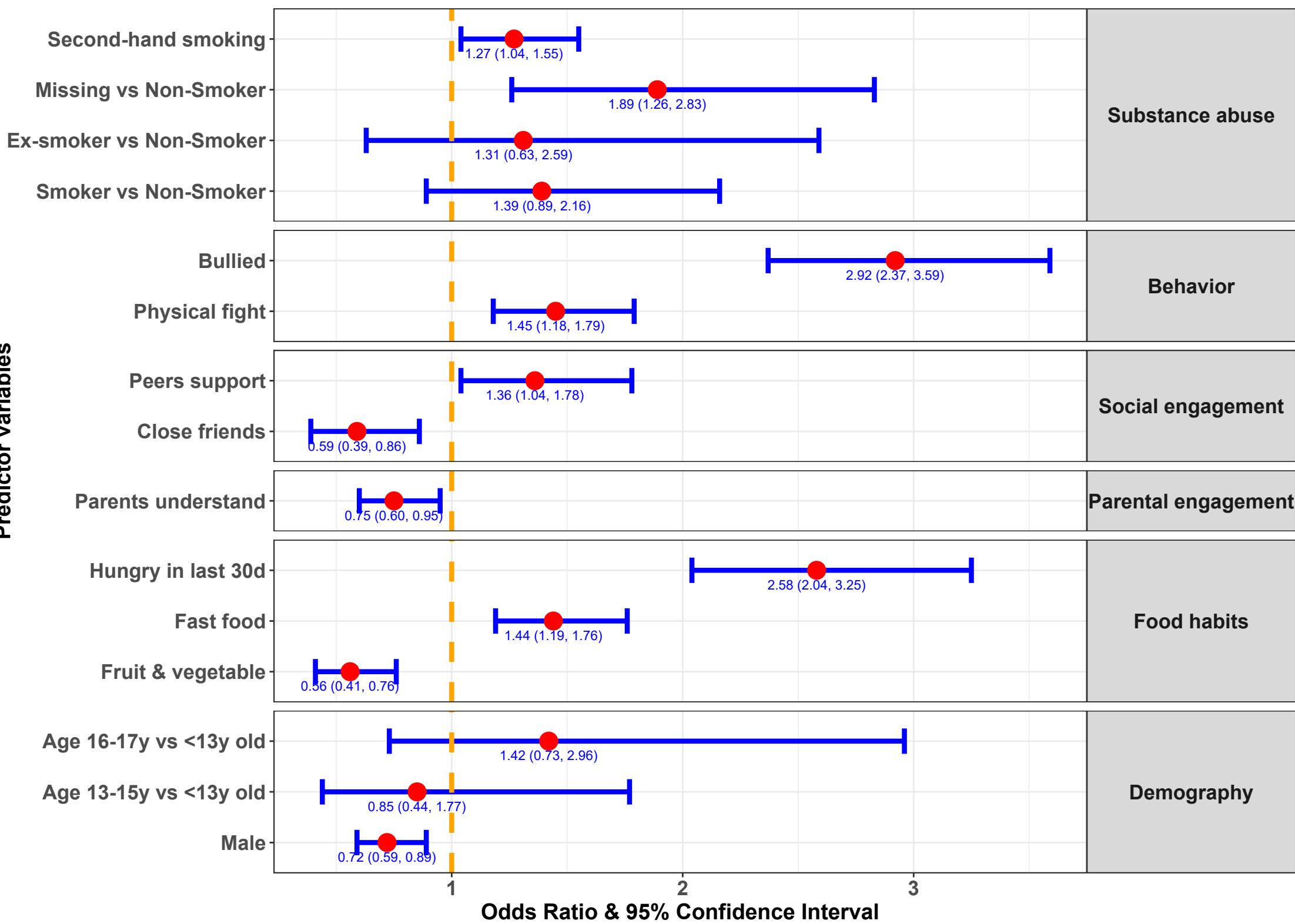


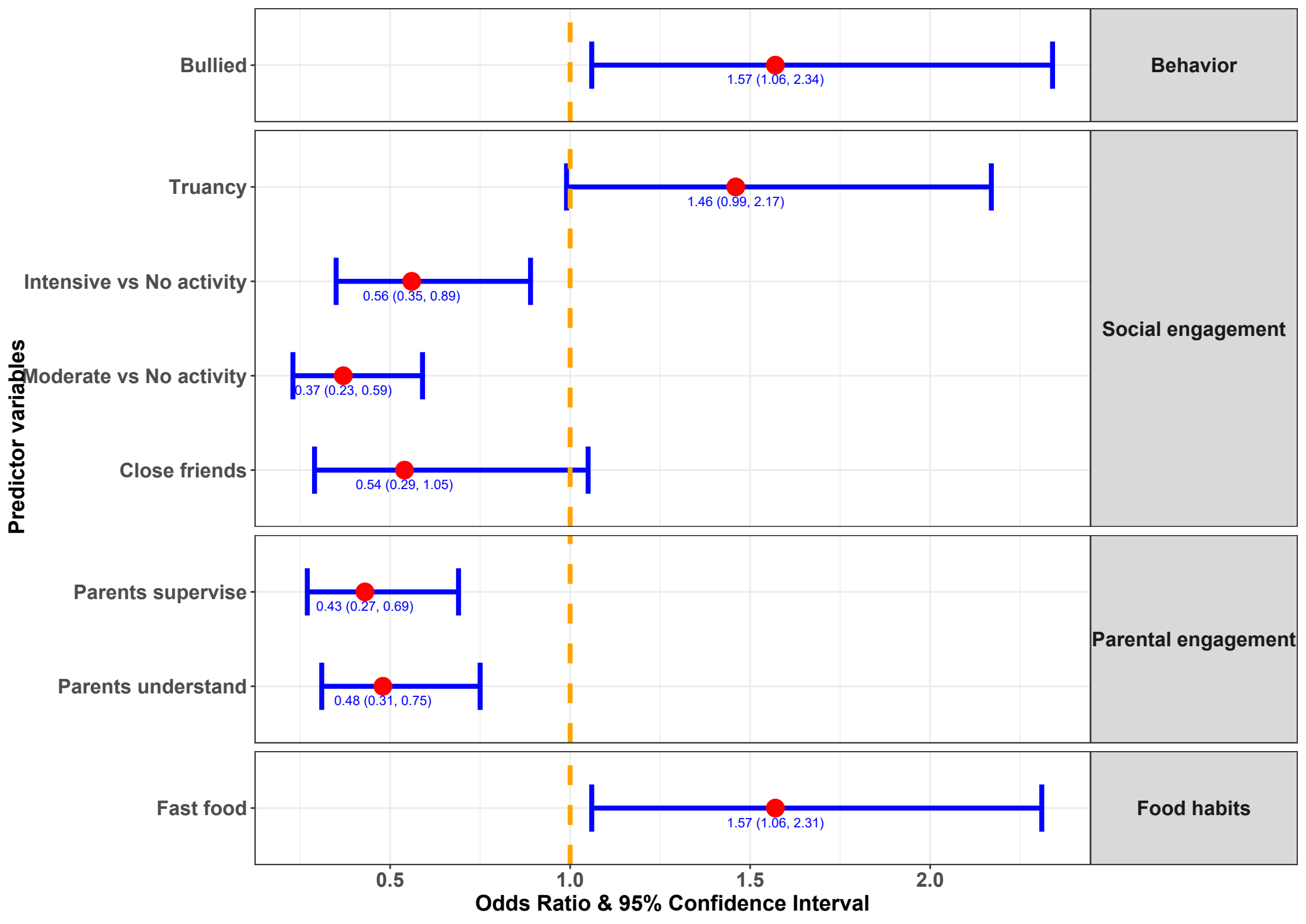
Predictor variables



Predictor variables







Assessment of mental health conditions among adolescents in Sri Lanka:

Findings from the cross-sectional Global School-based Health Survey

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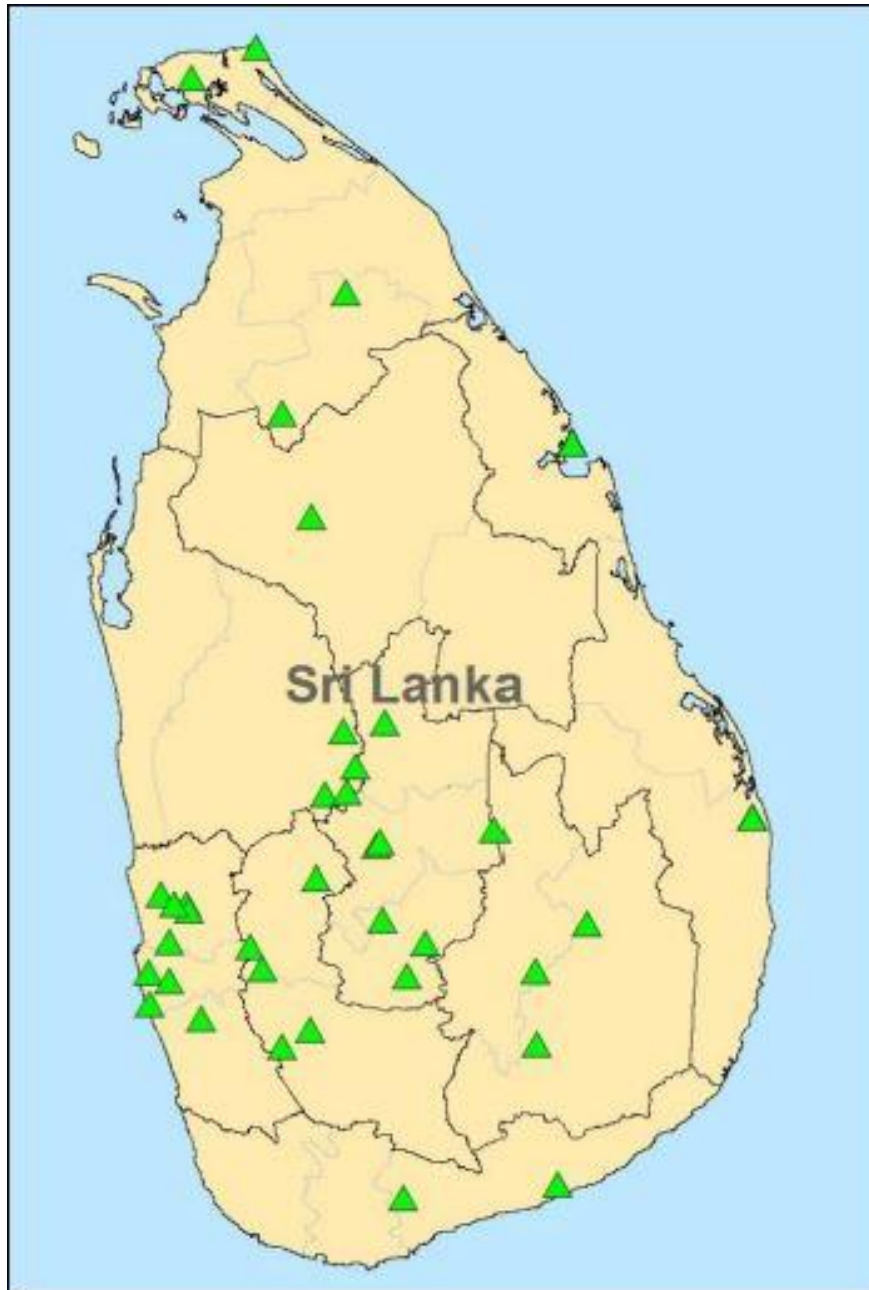
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Supplementary Figure S1: Distribution of schools across the country selected for the Global School-based Health Survey.



The sampling was conducted using two-stage clustering method. In first stage, schools were selected and in second stage, the classrooms are sampled within the selected school. Source: Ministry of Health, Nutrition and Indigenous Medicine, Sri Lanka

Supplementary Table S1: The variables used for the study from the Global School-based Health Survey (GSHS) questionnaire^s and data recording strategy.

Variable	(Question No.) Survey Question	Coding
Predictor Variables		
Demography		
Gender	(Q2) ^a What is your sex?	0= Female 1= Male
Age	(Q1) How old are you?	0= 12 years or younger 1= 13 and 15years old 2= 16 years or older
Grade	(Q3) In what grade are you?	0= Grade 8 and 9 1= Grade 10 and 11 2= Grade 12 and 13
Food Habits		
Adequate fruit & vegetable intake ^b	(Q7) During the past 30 days, how many times per day you usually eat fruit? (Q8) During the past 30 days, how many times per day you usually eat vegetable?	0 = less than 2 times 1 = 2 or more times 0 = less than 3 times 1 = 3 or more times
Carbonated drink consumption	(Q9) During the past 30 days, how many times per day did you usually drink carbonated drinks?	0 = less than 2 times 1 = 2 or more times
Fast food intake	(Q10) During the past 7 days, on how many days did you eat food from a fast-food restaurant?	0 = 0 days 1 = 1 or more days
Food insecurity	(Q6) During the past 30 days, how often did you go hungry because there was not enough food in your home?	0 = Never and Rarely 1 = Sometimes, Most of the time and Always
Personal Hygiene		
Oral hygiene	(Q11) During the past 30 days how many times per day did you usually clean or brush your teeth?	0 = less than 2 times 1 = 2 or more times
Hand hygiene ^c	(Q12, 13 & 14) During the past 30 days how often did you wash your hands before eating; toilet or latrine; how often did you use soap when washing hands	0 = Never, Rarely, Sometimes, Most of the time 1 = Always
Parental Engagement		
Parental understanding	(Q56) During the past 30 days, how often did your parents or guardian understand your problems and worries?	0 = Never and Rarely 1 = Sometimes, Most of the time and Always
Parental supervision	(Q57) During the past 30 days, how often did your parents or guardian really know what you were doing with your free time?	0 = Never and Rarely 1 = Sometimes, Most of the time and Always
Social Engagement		
Close friends	(Q27) How many close friends do you have?	0 = 0 friends 1 = 1, 2, 3 or more friends
Peers support	(Q54) During the past 30 days, how often were most of the students in your school kind and helpful	0 = Never and Rarely 1 = Sometimes, Most of the time and Always
Physically active	(Q49) During the past 7 days, on how many days were you physically active for total of at least 60	0 = 0 days 1 = 1, 2, 3 days (Moderate)

	minutes per day? Add up all the time you spent in any kind of physical activity each day)	2 = 4, 5, 6 days (Intensive)
Truancy	(Q53) During the past 30 days, on how many days did you miss classes or school without permission	0 = 0 days 1 = 1 or more days
Behavior		
Physical fight	(Q16) During the past 12 months, how many times were you in a physical fight	0 = 0 times 1 = 1 or more times
Bullied	(Q20) During the past 30 days on how many days were you bullied?	0 = 0 times 1 = 1 or more times
Substance Abuses		
Current alcohol consumption	(Q53) During the past 30 days, on how many days did you have a least one drink containing alcohol?	0 = 0 days 1 = 1 or more days
Drugs intake	(Q42) During the past 30 days, how many times have you used marijuana?	0 = 0 times 1 = 1 or more time
Smoking status ^d	(Q28) How old were you when you first tried a cigarette? (Q29) During the past 30 days, on how many days did you smoke cigarette? (Q31) During the past 12 months, have you ever tried to stop smoking cigarettes?	0 = Smoker 1 = Ex-Smoker 2 = Non-Smoker 3 = Unknown*
Secondhand smoking	(Q32) During the last 7 days, on how many days have people smoked in your presence	0= No Secondhand smoker 1= Secondhand smoker
Response Variable – Mental Health		
Loneliness	(Q22) During the past 12 months, how often have you felt lonely	0 = Never and Rarely 1 = Sometimes, Most of the time and Always
Anxiety	(Q23) During the past 12 months, how often have you been so worried about something that you could not sleep at night	0 = Never and Rarely 1 = Sometimes, Most of the time and Always
Suicidal ideation ^e	(Q24) During the past 12 months, did you ever seriously consider attempting suicide (Q25) During the past 12 months did you make a plan how you would attempt suicide	0 = No 1 = Yes 0 = No 1 = Yes

[§]The standard questionnaire of the Global School-based Health Survey (GSHS) is available from the following web link:

https://extranet.who.int/ncdsmicrodata/index.php/catalog/648/related_materials

* The smoking status of these participants cannot be determined based on their responses

^a Question reference to the questionnaire.

^b Adequate vegetable and fruit intake is a combination of two questions Q7 & Q8, final is coded as 0 or 1, where 0= fruit (No) vegetable (No) & 1= fruit (Yes) vegetable (Yes)

^c Hand hygiene is a combination of three questions Q13, Q14 & Q15, final is coded as 0 or 1, where 0= in all three questions (Never, Rarely, Sometimes, Most of the time) & 1= in all three questions (Always)

^d Smoking status is determined by combination of three questions Q29, Q30 & Q31, final coded as smoker, Ex-smoker, non-smoker and unknown

^e Suicidal ideation is a combination of two question Q24 & Q25, final coded as 0 or 1, where 0= No in both question and 1= yes in both question

Supplementary Table S2: Estimates of odds ratio (OR) and corresponding 95% confidence interval (95% CI) from unadjusted (single variable) and adjusted (multivariable) logistic regression models of loneliness.

Variable	Loneliness			
	Unadjusted OR (95% CI)	P-value	Adjusted OR (95% CI)	P-value
Demography				
Gender				
	Female	1	1	
	Male	0.87 (0.74-1.01)	0.60 (0.50-0.71)	<0.001
Age				
	<13 years old	1		
	13-15 years old	1.17 (0.69-2.17)		0.551
	16-17 years old	1.94 (1.12-3.57)		0.024
Grade				
	Grade 8-9	1	1	
	Grade 10-11	1.25 (1.06-1.47)	1.42 (1.19-1.71)	0.001
	Grade 12-13	2.70 (2.13-3.42)	3.26 (2.51-4.24)	<0.001
Food Habits				
Adequate fruit & veg intake				
	No	1	1	
	Yes	0.78 (0.63-0.97)	0.78 (0.61-0.99)	0.044
Excess carbonate drinks				
	No	1		
	Yes	0.94 (0.74-1.19)		0.613
Fast food consumption				
	No	1	1	
	Yes	1.31 (1.13-1.52)	1.18 (0.99-1.39)	0.053
Hungry for the past 30 days				
	No	1	1	
	Yes	2.89 (2.37-3.50)	2.22 (1.78-2.78)	<0.001
Personal Hygiene				
Adequate oral health				
	No	1		
	Yes	0.80 (0.68-0.94)		0.005
Adequate handwash hygiene				
	No	1		
	Yes	0.78 (0.67-0.90)		0.001
Parental Engagement				
Parental understanding				
	No	1	1	
	Yes	0.58 (0.48-0.69)	0.60 (0.49-0.73)	<0.001
Parental supervision				
	No	1		
	Yes	0.65 (0.53-0.79)		<0.001
Social Engagement				
Close friends				
	No	1		
	Yes	0.66 (0.48-0.90)		0.008
Peers support				
	No	1		
	Yes	1.07 (0.88-1.30)		0.497
Physically active				

Truancy	No Active	1			
	Moderate Active	0.74(0.61-0.91)	0.003		
	Intensive Active	0.79 (0.64-0.97)	0.025		
Truancy	No	1		1	
	Yes	1.70 (1.45-1.98)	<0.001	1.33 (1.12-1.58)	0.001
Behavior					
Physical fight					
Bullied	No	1		1	
	Yes	1.68 (1.44-1.95)	<0.001	1.24 (1.03-1.49)	0.020
Bullied	No	1		1	
	Yes	2.72 (2.33-3.18)	<0.001	2.32 (1.93-2.78)	<0.001
Substance abuse					
Alcohol					
Drugs	No	1			
	Yes	1.85 (1.24-2.76)	0.002		
Smoking status	No	1		1	
	Yes	1.38 (0.86-2.19)	0.178	0.44 (0.23-0.82)	0.011
Second-hand smoking	Non-Smoker	1			
	Smoker	1.78 (1.25-2.52)	0.001	1.37 (0.86-2.15)	0.182
	Ex-Smoker	1.23 (0.69-2.12)	0.467	1.08 (0.55-2.05)	0.825
	Unknown	1.94 (1.40-2.67)	<0.001	1.76 (1.19-2.59)	0.004
Second-hand smoking	No	1		1	
	Yes	1.67 (1.43-1.93)	<0.001	1.25 (1.05-1.49)	0.010

Supplementary Table S3: Estimates of odds ratio (OR) and corresponding 95% confidence interval (95% CI) based on the unadjusted (single variable) and adjusted (multivariable) logistic regression models of anxiety.

Variable	Anxiety			
	Unadjusted		Adjusted	
	OR (95%)	P value	OR (95%)	P-value
Demography				
Gender				
Female	1		1	
Male	1.11 (0.93-1.32)	0.236	0.72 (0.59-0.89)	0.002
Age				
<13 years old	1		1	
13-15 years old	0.68 (0.39-1.24)	0.188	0.85 (0.44-1.77)	0.651
16-17 years old	1.03 (0.59-1.91)	0.909	1.42 (0.73-2.96)	0.325
Grade				
Grade 8-9	1			
Grade 10-11	1.21 (1.00-1.46)	0.048		
Grade 12-13	1.75 (1.34-2.28)	<0.001		
Food Habits				
Adequate fruit & veg intake				
No	1		1	
Yes	0.58 (0.43-0.76)	0.001	0.56 (0.41-0.76)	0.001
Excess carbonate drinks				
No	1			
Yes	1.20 (0.91-1.55)	0.170		
Fast food consumption				
No	1		1	
Yes	1.62 (1.36-1.93)	<0.001	1.44 (1.19-1.76)	0.001
Hungry for the past 30 days				
No	1		1	
Yes	3.74 (3.04-4.59)	<0.001	2.58 (2.04-3.25)	<0.001
Personal Hygiene				
Adequate oral health				
No	1			
Yes	0.81 (0.67-0.97)	0.023		
Adequate handwash hygiene				
No	1			
Yes	0.86 (0.72-1.01)	0.080		
Parental Engagement				
Parental understanding				
No	1		1	
Yes	0.66 (0.55-0.81)	<0.001	0.75 (0.60-0.95)	0.017
Parental supervision				
No	1			
Yes	0.55 (0.44-0.69)	<0.001		
Social Engagement				
Close friends				
No	1		1	
Yes	0.54 (0.39-0.75)	0.001	0.59 (0.39-0.86)	0.007
Peers support				
No	1		1	
Yes	1.21 (0.97-1.54)	0.099	1.36 (1.04-1.78)	0.027
Physically active				
No Active	1			

	Moderate Active	0.78 (0.62-0.99)	0.036		
	Intensive Active	0.90 (0.71-1.14)	0.375		
Truancy	No	1			
	Yes	1.59 (1.32-1.89)	<0.001		
Behavior					
Physical fight	No	1		1	
	Yes	2.23 (1.87-2.66)	<0.001	1.45 (1.18-1.79)	0.001
Bullied	No	1		1	
	Yes	3.89 (3.24-4.68)	<0.001	2.92 (2.37-3.59)	<0.001
Substance Abuse					
Alcohol	No	1			
	Yes	3.00 (1.97-4.54)	<0.001		
Drugs	No	1			
	Yes	1.95 (1.16-3.19)	0.009		
Smoking status	Non-Smoker	1		1	
	Smoker	2.59 (1.79-3.72)	<0.001	1.39 (0.89-2.16)	0.144
	Ex-Smoker	1.99 (1.09-3.49)	0.020	1.31 (0.63-2.59)	0.452
	Unknown	2.42 (1.71-3.39)	<0.001	1.89 (1.26-2.83)	0.002
Second-hand smoking	No	1		1	
	Yes	1.87 (1.57-2.23)	<0.001	1.27 (1.04-1.55)	0.017

Supplementary Table S4: Estimates of odds ratio (OR) and corresponding 95% confidence interval (95% CI) based on the unadjusted (single variable) and adjusted (multivariable) logistic regression models of suicidal ideation.

Variable	Anxiety			
	Unadjusted		Adjusted	
	OR (95%)	P-value	OR (95%)	P-value
Demography				
Gender				
Female	1			
Male	0.91 (0.62-1.31)	0.604		
Age*				
<13-15 years old	1			
16-17 years old	0.98 (0.03-0.05)	0.921		
Grade				
Grade 8-9	1			
Grade 10-11	1.14 (0.77-1.69)	0.521		
Grade 12-13	1.25 (0.67-2.20)	0.459		
Food Habits				
Adequate fruit & veg intake				
No	1			
Yes	0.92 (0.52-1.52)	0.754		
Excess carbonate drinks				
No	1			
Yes	1.57 (0.92-2.55)	0.076		
Fast food consumption				
No	1		1	
Yes	1.49 (1.03-2.15)	0.034	1.57 (1.06-2.31)	0.023
Hungry for the past 30 days				
No	1			
Yes	1.63 (1.03-2.51)	0.031		
Personal Hygiene				
Adequate oral health				
No	1			
Yes	0.76 (0.52-1.12)	0.156		
Adequate handwash hygiene				
No	1			
Yes	0.73 (0.49-1.05)	0.097		
Parental Engagement				
Parental understanding				
No	1		1	
Yes	0.29 (0.20-0.43)	<0.001	0.48 (0.31-0.75)	0.001
Parents Supervision				
No	1		1	
Yes	0.24 (0.16-0.35)	<0.001	0.43 (0.27-0.69)	0.001
Social Engagement				
Close friends				
No	1		1	
Yes	0.45 (0.26-0.86)	0.009	0.54 (0.29-1.05)	0.053
Peers support				
No	1			
Yes	0.76 (0.50-1.20)	0.227		
Physically active				
No activity	1		1	
Moderate activity	0.32 (0.20-0.49)	<0.001	0.37 (0.23-0.59)	<0.001

Truancy	Intensive activity	0.40 (0.26-0.62)	<0.001	0.56 (0.35-0.89)	0.015
	No	1		1	
	Yes	1.69 (1.16-2.45)	0.005	1.46 (0.99-2.17)	0.056
Behavior					
Physical fight	No	1			
	Yes	1.48 (1.02-2.14)	0.037		
Bullied	No	1		1	
	Yes	2.10 (1.45-3.07)	<0.001	1.57 (1.06-2.31)	0.025
Substance Abuse					
Alcohol	No	1			
	Yes	1.97 (0.75-4.25)	0.119		
Drugs	No	1			
	Yes	2.38 (0.82-5.51)	0.069		
Smoking status	Non-Smoker	1			
	Smoker	2.28 (1.05-4.38)	0.023		
	Ex-Smoker	3.65 (1.37-8.11)	0.004		
	Unknown	1.20 (0.46-2.56)	0.673		
Second-hand smoking	No	1			
	Yes	1.09 (0.75-1.58)	0.642		

*There is no data for age group <13 years with suicidal ideation, so the age categories less than 13 years and 13-15 years were merged into one group