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# Modelling an Unhealthy Behaviour Index among School-Going Adolescents in Timor-Leste: A Two-Part Approach

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## ABSTRACT

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| **Introduction** | The burden of unhealthy behaviours in the adolescent population is a worldwide public health concern. This study develops an unhealthy behaviour index and examines its associated factors within a large sample of adolescents from Timor-Leste. |
| **Methods** | The data of 3455 adolescents from a nationally representative sample were analysed. The unhealthy behaviour index was developed based on the number of involvements in unhealthy behaviours (consumption of soft drink and fast food, low intake of fruit and vegetables, physical inactivity, smoking, alcohol drinking, illicit drug use). A two-part model was applied to assess the influences of demographic, environmental, personal and parental factors on the participation decisions of unhealthy behaviours and the unhealthy behaviour index. |
| **Results** | Parental closeness was associated with participation decisions. Age, being involved in physical fights, suicide attempt and parental connectedness were correlated with unhealthy behaviour index. Bullying victimisation and truancy affected both participation and index. There were interaction effects of gender and loneliness on the unhealthy behaviour index. |
| **Conclusions** | Adolescents who engage in unhealthy behaviours are more likely to be younger, be involved in physical fights, experience bullying, attempt suicide, play truant and have no parental closeness and connectedness. The specific policy recommendations include discouraging male adolescents who do not encounter loneliness as well as those in lower-secondary education from indulging in unhealthy lifestyles. Additionally, parents should collaborate with educators on monitoring adolescents' environmental stressors, mental health condition and class attendance, and be prepared to provide support in a timely manner. |
| **Keywords** | Adolescents; index; risk; students; unhealthy behaviours |

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# INTRODUCTION

Adolescence is a crucial transition period of life. Healthy lifestyles are essential to ensure that adolescents have good health outcomes that will be carried into their adulthood. However, unhealthy behaviours, most notably smoking, alcohol drinking and use of illicit drugs are common among adolescents in Timor-Leste. Their prevalence is considered alarming and concerted efforts must be made to lower it wherever possible. A study published in 2019 demonstrated that 33.3%, 29.8% and 9.6% of adolescents in Timor-Leste initiated smoking, drinking and illicit drug use, respectively, and these unhealthy behaviours were crucial contributors to psychological distress among youths.[1] These figures were higher than those reported in other Southeast Asian (SEA) countries. For instance, in Malaysia, only 18.5%, 7.4% and 2.9% of adolescents smoked, consumed alcohol and used illicit drugs, correspondingly.[2] It is abundantly obvious that these unhealthy behaviours have adverse effects on adolescent health as they may elevate the risks of immature lung development, respiratory infection, lung cancer, impaired brain development and early-onset cardiovascular diseases.[3-6]

Excessive consumption of soft drink and fast food, as well as inadequate intake of fruit and vegetables (FV) are also the common unhealthy behaviours in the Timor-Leste adolescent population. According to a meta-analysis study published in 2023, 43.4% of adolescents in Timor-Leste included soft drink in their daily diets and 65.3% consumed fast food weekly, compared with only 28.7% (soft drink) and 54.2% (fast food) in Indonesia.[7] The study also found that 49.1% and 40.3% of youths in Timor-Leste did not consume adequate servings of fruit and vegetables, respectively, whereas only 23.9% and 13.7% of adolescents in Thailand had inadequate fruit and vegetable intake, correspondingly.[7] Soft drink and fast food consumption, coupled with low intake of FV are the root causes of obesity, poor quality of life, risk of cardiovascular disease and premature mortality.[7-11] In terms of physical activity, only 12.8% of adolescents in Timor-Leste spent enough time on physical activity, which was lower than the prevalence of physical activity in Malaysia (21.4%).[2,12] Being physically inactive is a serious issue as it has adverse effects on cardiovascular health, fitness, sleep quality and metabolic condition.[13] In the study by McMahon et al[14], adolescents who lived a physically active lifestyle tended to have better quality of life, self-esteem and mental health compared with those who were physically inactive.

There have been many studies around the globe examining factors affecting adolescent unhealthy behaviours but only a handful focused on SEA countries, especially Timor-Leste.[7,15,16] The study by Pengpid and Peltzer[15] found gender, suicidal behavioural, mental health, social, and environmental factors are able to explain the decisions of adolescents in Timor-Leste to use cannabis and amphetamine. Adade et al[16] identified that food insecurity, having close friends and parental supervision were associated with consumption of tobacco, alcohol and marijuana among Timor-Leste adolescents. In another study conducted in Timor-Leste, Shawon et al[7] found poor mental health as a contributing factor to excessive consumption of fast food and soft drink, and inadequate intake of FV. While these studies were rigorous and provided insightful findings, they focused solely on specific unhealthy behaviours. It is worth one's while to model a comprehensive indicator that can measure the degree of unhealthiness conditional on all types of unhealthy behaviours as it can be a good predictor of health outcomes.[17] The justification is that adolescents who are involved in certain unhealthy behaviours do not necessarily encounter a higher risk of developing chronic diseases compared to those who are not as they may engage in other healthy behaviours, vice versa.

There may be interaction effects of gender and loneliness on unhealthy behaviours, but they were not examined in the past studies. Our hypothesis is that loneliness causes the likelihood of engaging in unhealthy behaviours to increase more for females than males. In other words, the association between unhealthy behaviours and loneliness is stronger in female adolescents and weaker in male adolescents. This is due to the fact that loneliness has more serious negative impacts on females.[18] As pointed out by Goosby et al[18], the risk for poor health was higher among lonely female adolescents than non-lonely male adolescents. Furthermore, lonely females were more likely to suffer from depression and be obese.[18] Loneliness was also more prevalent in female adolescents because females were usually more emotional.[19]

The present study aims to examine factors associated with unhealthy behaviours within a large sample of adolescents from Timor-Leste. It intends to contribute to the growing literature by developing an unhealthy behaviour index, that is, a measure of the levels of unhealthiness, based on the number of involvements in unhealthy behaviours. This index is important in the sense that it can measure the magnitudes of co-occurrence of unhealthy behaviours. Therefore, which groups of adolescents tend to have high or low degrees of unhealthiness can be well-identified. Additionally, the unhealthy behaviour index also offers a suitable basis for comparison and measuring the changes in the levels of unhealthiness in adolescents over time if more studies will be conducted in the future. For instance, Halpern et al[20] used indexes to compare health outcomes across countries worldwide. While

findings of the present study may not be generalisable outside Timor-Leste, they can provide policymakers in other SEA countries with supplementary information on policy formulation.

The present study also contributes to the literature by using a two-part model, an econometric model for limited dependent variables, to examine demographic, environmental, personal and parental factors corelated with unhealthy behaviours. This model is informative as it allows separate mechanisms to estimate the probability of engaging in unhealthy behaviours and the number of involvements, which is measured by an index. Therefore, an in-depth understanding of factors influencing both participation and amount decisions of unhealthy behaviours can be gained. A somewhat similar unhealthy behaviour index was developed in previous studies.[2,21,22] In addition, the present study represents an early investigation into the interaction effects of gender and loneliness on unhealthy behaviours.

Theoretical Basis

The theoretical basis used to explain the factors that determine unhealthy behaviours is developed based on the empirical findings from two comprehensive studies that focus on risk behaviours among school-going adolescents.[21,22] In the study by Cheah et al[21], age was positively associated with risk behaviours. This was due to the fact that older adolescents had better opportunities to engage in risk behaviours than their younger peers. Furthermore, the study also found male adolescents to have higher engagement in risk behaviours than female adolescents because they had higher preference for unhealthy lifestyles. In the present study, age and gender are, thus, expected to influence unhealthy behaviour index among adolescents.

Cheah et al[22] found that adolescents who had mental disorders, such as anxiety, depression and suicidal ideation, were more likely to indulge in unhealthy behaviours than those who did not because they tended to use smoking, alcohol drinking and use of illicit drugs as a method to cope with stress. Therefore, the present study hypothesises that personal factors, such as suicidal behaviours, loneliness and sleep deprivation affect unhealthy behaviour index as they are indicators of poor mental health. In addition, Cheah et al[22] pointed to the important role of truancy in risk behaviours because it was closely associated with health awareness. As such, the present study also anticipates significant relationships between environmental factors and unhealthy behaviour index.

In terms of parental factors, Cheah et al[22] observed that adolescents who lived with their parents were less probable to indulge in risk behaviours compared to those who did not because they were closely monitored by their parents. Moreover, as pointed out by Cheah et al[21], having less-educated parents was a risk factor for unhealthy behaviours. This was perhaps attributable to the fact that less-educated parents may not know how to educate their children about the dangerous of unhealthy behaviours. Hence, the present study expects that significant associations exist between parental factors and unhealthy behaviour index.

# METHODS

Data

The present study is a cross-sectional study utilising secondary data that were extracted from the Global School-Based Student Health Survey (GSHS) Timor-Leste 2015.[12] The survey was a nationwide study conducted by the Ministry of Health of Timor-Leste and World Health Organization. It covered all districts in Timor-Leste. The survey aimed at deepening understanding of health behaviours and lifestyles among school-going adolescents. The survey started in September and ended in December 2015. Although the survey was not able to reflect the most recent scenario in Timor-Leste, it was the latest, nationally representative and most comprehensive adolescent health survey during the present study.

The population of interest of the survey was school-going adolescents aged between 13 and 17 years. The survey employed a two-stage stratified cluster sampling approach to gather a large representative sample.[23] In the first stage, a total of 38 schools in Timor-Leste were selected using the probability proportional to the size of schools. In the second stage, classes in each school were chosen based on systematic equal probability sampling. All the students in the selected classes were included in the survey, except those without parents' written consent. A total of 4691 students accepted the invitations but only 3704 participated, which was equivalent to a response rate of 79%.

The respondents completed the structured questionnaires that comprised questions related to the following data: (i) demographic characteristics; (ii) lifestyles; and (iii) parental profiles. The questionnaires were prepared in the Tetem language and English. Reverse translation was conducted to ensure that the questionnaires were free from language errors. To minimise social desirability bias, the respondents were told that their anonymity was guaranteed, and their data were used for research and policy planning purposes only. The United States Centers for Disease Control and Prevention (CDC) took responsibility for raw data processing and data management prior to the downstream data analysis. The World Health Organization's Ethical Committee and the Ministries of Health and Education in Timor-Leste approved the survey.

Dependent Variable

The dependent variable of the present study was unhealthy behaviour index. It was developed based on the number of involvements in unhealthy behaviours. Following closely the studies by Cheah et al[21], Pengpid and Peltzer[15] and Cheah et al[22], eight unhealthy behaviours were used in this development: 1) soft drink consumption; 2) fast food consumption; 3) low intake of fruit; 4) low intake of vegetables; 5) physical inactivity; 6) smoking; 7) alcohol drinking; and 8) use of illicit drugs. Soft drink and fast food consumption were defined if respondents drank any types of soft drink and ate food from a fast food restaurant during the past 7 days, respectively. In the present study, low FV consumption denoted zero intake of FV. It referred to respondents who did not consume any serving of fruit or vegetables in a day. Respondents who did not spend at least 60 minutes on physical activity in the past 7 days were considered physically inactive. The present study defined smoking, drinking and use of illicit drugs if respondents smoked cigarettes, consumed alcohol and used marijuana in the past 30 days, respectively. Each of these unhealthy behaviours was given a value of 1 if the respondents engaged in it; otherwise 0. Hence, the total values ranged from 0 (healthiest) to 8 (unhealthiest), which were then transformed to an index (0%–100%).

Independent Variable

Based on the findings from past empirical studies concerning factors correlated with involvements in risk behaviours, the independent variables used in the present study consisted of demographic (age, gender), environmental (physical fight, bully, going hungry), personal (loneliness, sleep deprivation, suicide ideation, suicide plan, suicide attempt) and parental factors (parental closeness, parental connectedness).[22,24-26] The age of respondents was divided into four groups: 11–12, 13–14, 15–16 and 17–18 years. In the present study, gender was referred to as biological sex. Respondents were requested to report whether they were involved in any physical fights during the past 12 months. The questionnaires also asked respondents to declare whether they were bullied in the past 30 days.

In terms of going hungry, respondents were asked ‘During the past 30 days, how often did you go hungry because there was not enough food in your home?’. Information on loneliness and sleep deprivation was obtained from the following questions: ‘During the past 12 months, how often have you felt lonely?’ and ‘During the past 12 months, how often have you been so worries about something that you could not sleep at night?’. The possible responses for these three questions were ‘never’, ‘sometimes’ and ‘always’. Respondents who went hungry, had loneliness and faced sleep deprivation were those answering ‘sometimes’ or ‘always’.

Respondents’ suicidal behaviours were derived from the following questions: ‘During the past 12 months, did you ever seriously consider attempting suicide, make a plan about how you would attempt suicide or actually attempt suicide?’. Truancy referred to respondents who missed classes or school without permission during the past 30 days. Additionally, respondents were asked to declare whether their parents understood their problems and their free-time activities during the past 30 days. The former referred to parental closeness, while the latter referred to parental connectedness.

Statistical Analysis

A total of 3455 respondents with complete information were analysed. Missing data were handled using listwise deletion as only a small proportion of respondents reported incomplete information. Prior to performing multivariate analysis, one-way analysis of variance (ANOVA) was employed to calculate differences in the mean of the unhealthy behaviour index across all the independent variables. In terms of multivariate analysis, a two-part model was utilised to examine the participation and amount decisions of unhealthy behaviours.[27] The first part used a dichotomous choice model, i.e. probit, to estimate the probability of engaging in unhealthy behaviours (yes vs. no). Marginal effects, that is, the partial effects of each independent variable on the probability of participation, were calculated and interpreted. Respondents who did not participate in unhealthy behaviours reported a zero unhealthy behaviour index. The second part used a linear regression, i.e. ordinary least squares (OLS), to evaluate the unhealthy behaviour index. These two parts allowed the independent variables to have different impacts on the probability of participation (participation decision) and the unhealthy behaviour index (amount decision). A two-part model was chosen over a negative binomial model because it allowed separate mechanisms to estimate participation and amount decisions and assumed that the effects of an explanatory variable on participation and amount had different signs. A two-part model assumed no dependence between the disturbance term in the participation equation and that in the amount equation. In other words, non-participation represented a separate discrete choice. Madden[27] provided detailed explanations of the two-part model.

To test our hypothesis and identify whether the interaction term between gender and loneliness was important in explaining the unhealthy behaviour index, two models were constructed. Model 1 excluded the interaction term, whilst Model 2 included it. Then, pseudo-R-squared and Akaike's information criterion (AIC) of these two models were compared. The model with a higher pseudo-R-

squared and lower AIC was favoured. Additionally, variance inflation factors (VIFs) were calculated in order to ensure that the regression was free from multicollinearity. The link tests developed by Pregibon[28] were also conducted to check potential model specification errors. The significance level of $p < 0.05$ was selected. Statistical analyses were performed using Stata statistical software.[29]

## RESULTS

A large proportion of the respondents aged 15–16 years (34.4%), followed by those with the age of 17–18 (34.1%), 13–14 (24.9%) and 11–12 years (6.6%). Slightly more than half of respondents were female (53.8%). The majority of respondents did not engage in physical fights (70.9%) and experience bullying (74.4%). Half of respondents went hungry (50%). Approximately 59.8% and 51.6% of respondents suffered from loneliness and sleep deprivation, respectively. Only 9.1%, 9.4% and 10% of respondents had suicidal ideation, suicide plans and suicide attempts, respectively. The proportion of respondents who played truant was 34.8%. Around 47.5% and 62.3% of parents understood their children's problems and free-time activities, respectively (Table 1).

**Table 1** Summary statistics of variables (n = 3455)

| Variables | Count | Percent | Mean | SD | *p*-value[#] |
|---|---|---|---|---|---|
| *Demographic* | | | | | |
| Age | | | | | |
| 11–12 | 228 | 6.6 | 36.5 | 16.0 | 0.010* |
| 13–14 | 860 | 24.9 | 33.0 | 14.8 | |
| 15–16 | 1188 | 34.4 | 33.9 | 15.4 | |
| 17–18 | 1179 | 34.1 | 34.6 | 15.5 | |
| Gender | | | | | |
| Female | 1858 | 53.8 | 32.2 | 16.2 | <0.001* |
| Male | 1597 | 46.2 | 36.2 | 14.4 | |
| *Environmental* | | | | | |
| Physical fight | | | | | |
| Yes | 1006 | 29.1 | 38.1 | 16.2 | <0.001* |
| No | 2449 | 70.9 | 32.4 | 14.7 | |
| Bully | | | | | |
| Yes | 883 | 25.6 | 38.6 | 16.5 | <0.001* |
| No | 2572 | 74.4 | 32.5 | 14.6 | |
| Going hungry | | | | | |
| Yes | 1728 | 50.0 | 34.8 | 15.9 | 0.007* |
| No | 1727 | 50.0 | 33.4 | 14.8 | |
| *Personal* | | | | | |
| Loneliness | | | | | |
| Yes | 2065 | 59.8 | 34.2 | 15.6 | 0.734 |
| No | 1390 | 40.2 | 34.0 | 15.0 | |
| Sleep deprivation | | | | | |
| Yes | 1784 | 51.6 | 34.7 | 15.7 | 0.017* |
| No | 1671 | 48.4 | 33.4 | 15.0 | |
| Suicide ideation | | | | | |
| Yes | 315 | 9.1 | 38.5 | 17.4 | <0.001* |
| No | 3140 | 90.9 | 33.7 | 15.1 | |
| Suicide plan | | | | | |
| Yes | 325 | 9.4 | 37.3 | 16.2 | <0.001* |
| No | 3130 | 90.6 | 33.8 | 15.2 | |
| Suicide attempt | | | | | |
| Yes | 344 | 10.0 | 42.0 | 18.7 | <0.001* |
| No | 3111 | 90.0 | 33.2 | 14.7 | |
| Truancy | | | | | |
| Yes | 1203 | 34.8 | 37.4 | 16.1 | <0.001* |
| No | 2252 | 65.2 | 32.3 | 14.6 | |
| *Parental* | | | | | |
| Closeness | | | | | |
| Yes | 1642 | 47.5 | 34.4 | 16.3 | 0.195 |
| No | 1813 | 52.5 | 33.8 | 14.4 | |
| Connectedness | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Yes | 2153 | 62.3 | 33.9 | 15.6 | 0.391 |
| No | 1302 | 37.7 | 34.4 | 15.0 | |

*Note: Mean refers to average unhealthy behaviour indexes. SD refers to standard deviation. #p-values in ANOVA. The significance level is p<0.05. *p<0.05.*
Source: GSHS 2015

The mean of the unhealthy behaviour index was 34.1%. Respondents aged between 11 and 12 years had the highest unhealthy behaviour index (36.5%). The unhealthy behaviour index was higher among males (36.2%) than females (32.2%). Respondents had a higher index if they were involved in physical fights (38.1%), bullied (38.6%) and went hungry (34.8%). Respondents with sleep deprivation had a 34.7% index of unhealthy behaviours, which was slightly higher than the index possessed by those without sleep deprivation (33.4%). Respondents with suicidal ideation, suicide plans and suicide attempts had around 34.7%–38.5% unhealthy behaviour indexes, whereas those without suicidal behaviours had only 33.2%–33.7%. The index was higher among respondents who played truant (37.4%) than those who did not (32.3%).

Model 2 was preferred over the Model 1 because it had higher values of pseudo-R-squared and adjusted R-squared, and a lower AIC. Moreover, there were no multicollinearities and model specification issues in Model 2 as its maximum VIF was low, which fell within the acceptable threshold of 10, and values of prediction squared were highly insignificant. Collectively, Model 2 fitted the data well and the interaction term between gender and loneliness must be added to the regression (Table 2).

**Table 2** Estimated results for the two-part models (n = 3455)

| Variables | Model 1 | | Model 2 | |
|---|---|---|---|---|
| | Participation | Amount | Participation | Amount |
| Constant | – | 42.291* | – | 41.124* |
| | | (1.518) | | (1.545) |
| Age | | | | |
| 11–12 | Ref. | Ref. | Ref. | Ref. |
| 13–14 | 0.004 | -3.724* | 0.004 | -3.678* |
| | (0.007) | (1.066) | (0.007) | (1.058) |
| 15–16 | 0.003 | -2.734* | 0.003 | -2.693* |
| | (0.007) | (1.044) | (0.007) | (1.037) |
| 17–18 | 0.006 | -2.042* | 0.006 | -2.041* |
| | (0.007) | (1.054) | (0.007) | (1.048) |
| Gender | | | | |
| Female | -0.001 | -2.878* | -0.004 | -0.870 |
| | (0.004) | (0.497) | (0.006) | (0.766) |
| Male | Ref. | Ref. | Ref. | Ref. |
| Physical fight | | | | |
| Yes | 0.005 | 2.873* | 0.005 | 2.848* |
| | (0.004) | (0.607) | (0.004) | (0.606) |
| No | Ref. | Ref. | Ref. | Ref. |
| Bully | | | | |
| Yes | 0.013* | 2.997* | 0.013* | 2.963* |
| | (0.004) | (0.646) | (0.004) | (0.644) |
| No | Ref. | Ref. | Ref. | Ref. |
| Going hungry | | | | |
| Yes | -0.006 | 0.742 | -0.006 | 0.779 |
| | (0.004) | (0.502) | (0.004) | (0.502) |
| No | Ref. | Ref. | Ref. | Ref. |
| Loneliness | | | | |
| Yes | -0.001 | -0.673 | -0.003 | 1.123 |
| | (0.004) | (0.512) | (0.006) | (0.763) |
| No | Ref. | Ref. | Ref. | Ref. |
| Sleep deprivation | | | | |
| Yes | -0.001 | 0.082 | -0.001 | 0.126 |
| | (0.004) | (0.504) | (0.004) | (0.504) |
| No | Ref. | Ref. | Ref. | Ref. |
| Suicide ideation | | | | |

| | | | | |
|---|---|---|---|---|
| Yes | 0.004<br>(0.007) | 1.834<br>(1.146) | 0.004<br>(0.007) | 1.818<br>(1.144) |
| No | Ref. | Ref. | Ref. | Ref. |
| Suicide plan | | | | |
| Yes | -0.001<br>(0.008) | -0.850<br>(1.082) | -0.001<br>(0.008) | -0.797<br>(1.079) |
| No | Ref. | Ref. | Ref. | Ref. |
| Suicide attempt | | | | |
| Yes | 0.005<br>(0.006) | 6.219*<br>(1.056) | 0.005<br>(0.006) | 6.196*<br>(1.054) |
| No | Ref. | Ref. | Ref. | Ref. |
| Truancy | | | | |
| Yes | 0.009<br>(0.004) | 3.101*<br>(0.543) | 0.009*<br>(0.004) | 3.109*<br>(0.543) |
| No | Ref. | Ref. | Ref. | Ref. |
| Closeness | | | | |
| Yes | -0.008*<br>(0.005) | -0.045<br>(0.531) | -0.008*<br>(0.005) | -0.041<br>(0.531) |
| No | Ref. | Ref. | Ref. | Ref. |
| Connectedness | | | | |
| Yes | -0.002<br>(0.005) | -1.037*<br>(0.537) | -0.002<br>(0.005) | -1.013*<br>(0.536) |
| No | Ref. | Ref. | Ref. | Ref. |
| Female-loneliness | – | – | 0.006<br>(0.007) | -3.369*<br>(0.994) |
| Pseudo $R^2$ | 0.038 | – | 0.039 | – |
| Adjusted $R^2$ | – | 0.083 | – | 0.086 |
| Prediction squared | -0.285 | 3.940 | -0.397 | 3.986 |
| *p*-value | 0.643 | 0.106 | 0.501 | 0.097 |
| AIC | 28247.820 | | 28239.750 | |
| Maximum VIF | 4.180 | | 4.180 | |

*Note: For participation decisions of unhealthy behaviours, marginal effects from probit regressions are presented. For amount decisions of the unhealthy behaviour index, estimates from OLS regressions are presented. Female-loneliness refers to the interaction term between gender and loneliness. Robust standard errors in parentheses. Ref refers to reference group. AIC refers to Akaike's information criterion. VIF refers to variance inflation factors. The significance level is $p<0.05$. *$p<0.05$.*

Source: GSHS 2015

In the participation equation, the marginal effects were interpreted as changes in the probability of engaging in unhealthy behaviours. In the amount equation, the estimated coefficients were interpreted as changes in the index. Compared to respondents aged 11–12 years, those with the age of 13–14, 15–16 and 17–18 years had 3.7%, 2.6% and 2% lower indexes of unhealthy behaviours, respectively. The index was 2.8% higher among respondents who were involved in physical fights than those who were not. Therefore, it is important for policymakers to devote more attention to younger adolescents who engage in physical fights than older ones without involvement in physical fights. Efforts should be made to prevent physical fights at school. Respondents who were bullied were 1.3% more likely to engage in unhealthy behaviours and had a 3% higher index than those who were not. Respondents had a 6.2% higher index if they had attempted suicide. Teachers and parents are thus advised to adopt measures that can strengthen students' mental health and eliminate environmental stressors. Truancy was associated with 0.9% and 3.1% increases in the probability of engaging in unhealthy behaviours and the unhealthy behaviour index, respectively, hence, policies aimed at reducing the prevalence of unhealthy behaviours should focus on improving students' attendance rates and using effective methods to curb truancy. Respondents whose parents understood their problems were 0.8% less likely to indulge in unhealthy behaviours than those without parental closeness. Respondents whose parents understood their free-time activities had a 1% lower index compared with those having no parental connectedness. As such, parents are suggested to play a more important role in children's development. They should spend more time with their children and seek a better understanding of the problems faced by them. The gender-loneliness interaction term was negatively associated with the unhealthy behaviour index. More specifically, the index was 3.4% lower among females who suffered from loneliness than males without loneliness. This

finding implies that special policy attention should be paid to male adolescents who do not encounter loneliness. They should be provided with social support whenever necessary.

## DISCUSSIONS

In spite of the harmful effects of unhealthy behaviours on health, the present study found that a large number of adolescents engaged in unhealthy behaviours; this translated to an alarming unhealthy behaviour index of 34.1%. While the prevalence of multiple unhealthy behaviours evidenced in previous studies that focused on the adolescent population in other countries could not be directly compared with the index estimated in the present study, it was worth mentioning.[21,22,30] As reported by Cheah et al[21], approximately 47% of Malaysian adolescents engaged in at least two unhealthy behaviours. In a more recent study, about 21.5% of adolescents were involved in at least one unhealthy behaviour.[22] Hale and Viner[30] found that up to 25.6% of adolescents in the UK adopted multiple risk behaviours.

There were interaction effects of gender and loneliness on the unhealthy behaviour index with gender moderating the relationship between being lonely and the number of involvements in unhealthy behaviours. In particular, lonely females had a lower involvement when compared with non-lonely males. Perhaps this is because adolescents usually engage in unhealthy behaviours with their peers; thus, they are unlikely to suffer from loneliness. As pointed out by Montgomery et al[31], adolescent peers played a vital role in influencing unhealthy behaviour engagement. Moreover, males are likely to have higher preference for unhealthy behaviours compared to females.[26] This finding is in contrast to the evidence from previous studies that showed poor mental health to be a risk factor for use of illicit drugs, smoking, alcohol drinking, physical inactivity and inadequate intake of FV.[25,32-34] It is apparent that the hypothesis of the present study that loneliness results in the tendency to engage in unhealthy behaviours to increase more for female adolescents than males is not supported.

Gender did not have an independent effect on unhealthy behaviours when the gender-loneliness interaction term was included in the regression model, indicating that the partial effect of the loneliness variable on unhealthy behaviours depended on the value of the gender variable. These findings seem to contradict those of previous studies, which showed independent relationships between gender and health behaviours.[24,35-38] For instance, Lee et al[26] found that male adolescents were more likely to smoke and consume alcohol than female adolescents because of traditional gender norms, and Riediger et al[39] identified that females were more likely to consume FV than males as they were more aware of the health benefits of FV.

In the study by Cheah et al[21], older adolescents were involved in unhealthier behaviours than their younger peers. Likewise, the positive relationships between age of adolescents and smoking and alcohol consumption were evidenced in rural Ethiopia.[40] Similar findings were shared by Mehanovic et al[41], who examined the correlates of illicit drugs use in Nigeria, and Benny et al[6], using Canadian data about cannabis. Studies elsewhere also found older age to be a risk factor for inadequate FV intake and physical inactivity.[42,43] By contrast, in the present study, older adolescents had a lower involvement in unhealthy behaviours than their younger peers with the highest unhealthy behaviour index in the age group of 11–12 years. We rationalise this finding by arguing that older adolescents have better health knowledge and are more aware of the harmfulness of unhealthy behaviours compared with younger adolescents as they tend to have better exposure to health information at school.

Findings from the present study showed that the number of involvements in unhealthy behaviours as well as the likelihood of participation increased if the adolescents were involved in physical fights or bully-victims, which are in line with the results of published literature.[15,25] For instance, a systematic review study found that involvement in physical fights and being bullied were closely associated with various risk behaviours.[25] Specifically, adolescents who were bullied and involved in physical fights had a higher tendency to use alcohol, tobacco and illicit drugs compared to those who were not. Pengpid and Peltzer[15] conducted cross-sectional research in SEA and also found bully and physical fights to be risk factors for use of illicit drugs because adolescents often had the misperception that participation in unhealthy behaviours was an effective method for coping with the stress induced by fights and bully.

In the present study, significant relationships existed between parental factors and unhealthy behaviours. In particular, adolescents having parents who understood their problems and free-time activities were less likely to be involved in unhealthy behaviours and had a lower unhealthy behaviour index than those without such parents. These findings are consistent with those of past studies. For example, Bozzini et al[25] found that a poor parental attachment was a determining factor for risk behaviours, and Obeid et al[44] found ease of sharing problems with family members to be a protective factor for smoking and alcohol drinking. Likewise, findings of Ho et al[32] and Lee et al[26] showed that poor family relationships and weak communication with parents could lead to smoking. Darfour-Oduro et al[45] added that adolescents were unlikely to consume FV if they were not well-

supervised by their parents. With these findings, it can be concluded that adolescent-parent relationships play a major role in promoting a healthy lifestyle.

Though suicidal behaviour and truancy may be associated with unhealthy behaviours, many studies did not examine their associations. In the study by Cheah et al[22], adolescents who had suicidal ideation and played truant were more likely to use alcohol, cigarettes and illicit drugs compared to those who did not. Two reasons were cited by the authors. First, adolescents with suicidal thoughts tended to indulge in risk behaviours with the aim of lowering their unhappiness levels. Second, adolescents who played truant were often less aware of their health and had more time on their hands; thus, they had greater tendencies and opportunities to indulge in risk behaviours. Findings from the present study are consistent with Cheah et al's[22] that suicide attempts and truancy were risk factors for unhealthy behaviours.

The relationship between risk behaviours and going hungry observed in previous studies was noteworthy. Pengpid and Peltzer[15] found that adolescents who went hungry due to inadequate food were more likely to use illicit drugs than those who did not. In a similar vein, findings of Darfour-Oduro et al[45] suggested that food insecurity could lead to insufficient intake of FV. Furthermore, Khan et al[46] found poor sleep quality to be correlated with frequent consumption of soft drink and fast food. Surprisingly, however, the present study found no significant associations between unhealthy behaviours and going hungry and sleep deprivation, thereby concluding that food security and sleep quality may play no role in lifestyle behaviours among adolescents in Timor-Leste.

Findings of the present study have several important practical implications. One of which is that public health administrators are advised to pay special attention to male school-going adolescents who do not experience loneliness if the goal of lowering the prevalence of adolescent unhealthy behaviours is to be achieved in an effective manner. Nationwide preventive strategies aimed specifically at curbing unhealthy lifestyle in this population can be given serious consideration. In addition to establishing developmental screening suggested in the National Health Sector Strategic Plan (NHSSP) 2011-2030, detailed information about the adverse effects of unhealthy social activities on men's health in adulthood, for example, can be widely advertised.[47] Such advertisement can be included in the social media apps that are often accessed by youngsters. However, this does not mean that female adolescents with loneliness can be ignored completely as loneliness itself may lead to severe health problems. Secondly, health experts and school authorities could work together in discouraging students in lower-secondary education from indulging in unhealthy lifestyles. More work can be done to ensure that this group of students receive adequate health related information through continuous education and parental teaching. The strategy related to formulation of a comprehensive child health policy introduced in the NHSSP 2011-2030 should consider organising various nationwide school-based health awareness campaigns at school.[47]

Thirdly, parents and educators should take extra responsibility in monitoring the students' environmental stressors, and ensuring that schools are safe, so that students do not face the issues related to bullying and physical fighting. In addition, policymakers are advised to elevate their efforts to discourage unhealthy lifestyles among adolescents without strong relationships with their parents and family members. Information about the importance of parental attachment should also be well-highlighted in schools. As a supplementary strategy to the home care programmes introduced in the NHSSP 2011-2030, school authorities could organise various activities aimed at providing parents with valuable advice regarding how to stay connected to children.[47] Lastly, in order to safeguard adolescents from participation in unhealthy behaviours, educators should make every attempt to keep an eye on their students' mental health condition and class attendance. They have to be willing to provide students with poor mental health and attendance records with counselling services and support in a timely manner. Clinical psychologists and psychiatrists, for example, can be invited to offer psychological support at school from time to time. This policy is added to one of the strategies of NHSSP 2011-2030 that mental health professionals must be well-trained and possess specific standards of skills.[47]

One of the limitations of the present study is that cross-sectional data did not allow for causalities. Reporting bias may occur as well due to self-reported data. Also, the sample used in the present study was somewhat dated and could not reflect the most recent scenario in Timor-Leste. The GSHS Timor-Leste 2015 is by far the latest adolescent health survey conducted by the World Health Organization, and there is no more recent survey. Furthermore, the present study did not provide any cut-off point for the unhealthy behaviour index. Moreover, owing to data limitation, the present study could not explore potential cultural differences in unhealthy behaviours in Timor-Leste. Despite these limitations, the present study has numerous strengths. Firstly, given the comprehensive dataset with a large sample size, the present study was able to develop an unhealthy behaviour index and generate reliable findings, which could assist policymakers in targeting adolescents with high levels of unhealthiness. Secondly, using a two-part

model, the present study analysed not only the decisions to be involved in unhealthy behaviours, but also the degrees of involvement. Lastly, the present study took account of the interaction effects of gender and loneliness to offer a deeper understanding of how gender moderated the relationship between loneliness and involvement in unhealthy behaviours.

## CONCLUSION

Lowering the prevalence of chronic diseases is a widespread societal objective. The present study explores the correlates of the unhealthy behaviour index among school-going adolescents. Its findings showed that demographic, environmental, personal and parental factors played an important role in explaining the participation decisions and index of unhealthy behaviours. In particular, adolescents were more likely to engage in unhealthy behaviours or have a higher unhealthy behaviour index if they were younger, engaged in physical fights, experienced bullying, attempted suicide and played truant. Having no parental closeness and connectedness also increased the likelihood of engaging in unhealthy behaviours as well as the index. Additionally, there is an interactive effect of gender and loneliness on unhealthy behaviours. Policymakers are, therefore, suggested to focus primarily on improving health awareness among young adolescents, ensuring no physical fights and bullying at school, as well as monitoring students' mental health and attendance. Furthermore, educators should pay more attention to male adolescents than females, especially those having good connectedness with peers. Use of panel data to explore factors that have causal impacts on unhealthy behaviour index and determine its cut-off point is advised to be the direction for future research. Such research is suggested to consider more explanatory variables and use unhealthier behaviours to form the index. If budget constraint is not an issue, a nationwide primary survey can be carried out to collect up-to-date data.

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