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# Prevalence and Factors Associated with Depression among Hill-Tribe High School Students in Chiang Rai Province, Thailand: A Multilevel Cross-Sectional Study

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**Background:** Depression is a major mental health problem. High school-age adolescents living in the hill tribe villages are especially susceptible to depression due to their remote living environment and stigmatization, a situation that has been exacerbated by the COVID-19 pandemic.

**Objective:** To estimate the prevalence and determine the associations of individual and contextual factors with depression among hill-tribe high school students in Chiang Rai Province, Thailand, during the COVID-19 crisis.

**Materials and Methods:** A school-based, multilevel cross-sectional study was conducted. Participants were randomly selected from 18 classes of six high schools located in the hill tribe villages of Chiang Rai Province, Thailand. A validated questionnaire and the Patient Health Questionnaire for Adolescents (PHQ-A) were used to collect data. The present study was conducted between May and September 2022.The data were analyzed by the multilevel binary logistic regression at a significance level of $\alpha<0.05$.

**Results:** A total of 540 hill tribe high school students were recruited for the analysis, 71.3% were female, 81.7% were Thais, and the mean age was 16.81 years. The overall prevalence of depression was 21.9% (95% CI 18.4 to 25.4). In the multivariate multilevel analysis, nine variables were found to be significantly associated with depression: underlying disease, perceived stress, negative life events, smartphone addiction, family functioning, peer group relationship, social stigma, and study program.

**Conclusion:** A substantial proportion of the hill-tribe high school students suffered with depression during the COVID-19 pandemic. Appropriate public health interventions should be developed and implemented to reduce the problem by focusing on those who had underlying diseases, perceived stress, negative life events, anxiety, and smartphone addiction. Moreover, implementation should be integrated into their families, peers, and social environments.

**Keywords:** Depression; Hill-tribes; Adolescent; Prevalence; Associated factor

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Goals of the United Nations (UN) agenda on Sustainable Development Goals (SDGs) emphasize improving the health and well-being of all (Goal No.3) people and improving barriers in accessing resources, including healthcare services (Goal No.10)[1]. The World Health Organization (WHO) has stated that health is a basic human right and standard medical services should be accessible to all people[2]. Thailand has been recognized as one country that guarantees all citizens the right to access medical services[3]. However, some groups of people do not have equal access to healthcare services. For instance, those of lower socioeconomic status living in sub-standard conditions. This includes hill-tribe people who live on the northern border of Thailand and Myanmar[4].

Members of hill-tribes are a minority population living in northern Thailand, especially in the border areas of Thailand, Myanmar, and Laos[5]. Almost all the hill-tribe people have migrated from South China to Thailand over many centuries[5]. In 2016, the WHO estimated that 2.5 million hill-tribe people lived in Thailand, primarily in northern areas such as Chiang Rai, Chiang Mai, and Pha Yao provinces[6]. In 2015, the Chiang Rai Provincial Government

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reported that approximately 250,000 hill-tribe people lived in Chiang Rai Province across 527 villages in 18 districts[7]. Six tribes have been identified, the Akha, Lahu, Karen, Yao, Hmong, and Lisu. The hill-tribe people have unique cultures and lifestyles and have lived in the area for three generations[4]. A sizable proportion were classified as living below the national poverty line, and more than 30% have not been granted the Thai citizen identification (ID) card, which is used to access all public services, including emergency vaccines[4,8].

Besides living in poor socioeconomic conditions and having poor access to health care services, they are facing severe physical and mental health problems, especially symptoms of depression among adolescents. The WHO reported that globally, adolescents are the most impacted population with depression, especially during the COVID-19 crisis[9]. Studies report that the prevalence of depression among high school students during the COVID-19 crisis ranged from 22.3% to 58.7%[10-12].

Because scientific information on the depression of hill-tribe youth aged 15 to 23 years[8,13,14] is not available, it is difficult to implement effective public health interventions. One of the most significant impacts of the COVID-19 pandemic was that mental health problems in many populations were being ignored, and people's ability to get help was greatly restricted[15]. This was especially true of hill-tribe adolescents whose untreated mental health worsened during the pandemic[9,15].

The present study aimed to estimate the prevalence of depression and determine factors associated with depression among hill-tribe high schools in northern Thailand, especially during the COVID-19 pandemic.

## Materials and Methods

### Study design

A school-based, cross-sectional study was done to estimate the prevalence, and determinant factors associated with depression among hill-tribe high school students during the COVID-19 crisis.

### Study population

Hill-tribe students from six hill tribes, the Akha, Lahu, Hmong, Yao, Karen, and Lisu, who attended high school in Chiang Rai Province during the 2022 academic year, and who met the following criteria were invited to participate in the present study, (i) able to identify themselves as one of the six main hill-tribes, (ii) able to communicate in Thai efficiently, and (iii) able to completely provide written informed consent signed and obtained from their parents or legal guardians for those aged 18 years and below.

### Study sample and sample size calculation

The sample size was calculated using the standard formula for a cross-sectional study[16], with adjustments made for cluster effects, including intraclass correlation coefficient (ICC), to determine the total sample size[17].

The sample size was calculated by following formula: $n = [Z^2_{\alpha/2}*P*(1–P)]/d^2$, where Z was the value from the standard normal distribution according to the desired confidence level [Z=1.96 for 95% confidence interval (CI)], P was the proportion of depression in the former study, and d was desired precision. Regarding the study by Reangsing[18], the prevalence of depression was revealed to be 69.3%. Based on Z=1.96, P=69.3, 1–P=30.7, and d=0.05, at least 327 participants were required.

Afterwards, the simulation of the ICC and design effect using $N = n*Deff$, where $Deff = 1+(M–1)\rho$ was estimated. Then, n was the estimated sample size of hill-tribe high school students in the present study, Deff was the design effect=1.58, M was the number of samples in each group=30, and ρ is the ICC 0.02 (weight by 0.01 to 0.1).

Therefore, 540 samples were required for the analysis. The sample size was 540 participants from 18 number of clusters, the six tribes and two levels.

### Research instruments

A validated questionnaire and the standards tools were used for collecting data. The validated questionnaire was divided into two levels, individual and context information. At the individual level, it had 11 parts. Part 1, nine questions were used to collect demographics such as age, gender, etc. Part 2, fifteen questions were used to collect health behaviors and negative life events such as the experience of losing a loved one, experience in having conflict with peers, failed studies, etc. Part 3, a standard stress test, called the Srithanya stress scale-5 (ST-5) was used to assess stress[19]. It consisted of five questions, with four responses available for each question. The total scores range between 0 and 15 points. Those scored between 0 and 4 were classified as having a low level of stress, those scored between 5 to7 were classified as having moderate level of stress, having a score of 8 to 9 was considered having a high level of stress, and 10 to 15 was classified as having a severe

level of stress. The Cronbach's alpha coefficient was 0.80. Part 4, seven items of the standard anxiety test, so called Thai Hospital Anxiety Depression Scale (HADS)[20]. Each item provided four scales for the response with the highest score being 21. Those who scored 11 to 21 were considered to have anxiety, based on 100% sensitivity and 86% specificity[21]. The Cronbach's alpha coefficient was 0.80. Part 5, the standard test of resilience which consisted of nine items, and thus called Resilience Inventory (RI-9)[22]. Each item provided five scales for the response. The possibility score in each participant was between 9 and 45 points. Those scored in the 0$^{th}$ to 25$^{th}$ percentiles were classified as having a "low" level of resilience skill. Those who scored between the 25$^{th}$ and 75$^{th}$ percentiles, and 75$^{th}$ and over were classified into having "average" and "high" resilience skills, respectively. The Cronbach's alpha coefficient was 0.90. Part 6, the standard ten items of smartphone addiction scale-short version (SAS-SV) was used to collect smartphone addiction behaviors[23]. Each question provided six scales for the response. The total possible scores were between 6 and 60 points. Among males, those who scored 31 and over were classified as smartphone addicted, while scored of 33 and over indicated a smartphone addiction for females[24]. The Cronbach's alpha coefficient for the overall measure was 0.94. Part 7, the standard thirty-six items of the Chulalongkorn Family Inventory (CFI), was used to measure family functioning[25]. Each question provided five scales for the response. All scores ranged from 36 to 144 points, with 36 to 72 classified as poor, 73 to 108 as moderate, and 109 to 144 as good level. The Cronbach's alpha coefficient was 0.84. Part 8, the standard test of peer group relationships, consisted of twelve items, thus called Friendship Intimacy (FI)[26]. Each question provided five scales for the responses. The possible score ranges from 12 to 60 points, with 12 to 28 categories as poor, 29 to 44 as moderate, and 45 to 60 as good. The Cronbach's alpha coefficient for the overall measure was 0.88. Part 9, twelve questions were used to collect information about the teacher-student relationship. Each item provided five scales for the response. The possible score ranged from 12 to 60 points, with 12 to 28 categories as poor, 29 to 44 as moderate, and 45 to 60 as good. The Cronbach's alpha coefficient was 0.79[27]. Part 10, eight questions were used to measure the information regarding social stigma. Each item had dichotomous responses with 1 for yes and 0 for no. The eight items were summed to create a composite score ranging from 0 to 8 points. Higher scores indicated a greater level of stigma. The Cronbach's alpha coefficient was 0.75. Part 11, a standard form for detecting depression, the Thai version of the Patient Health Questionnaire for Adolescents (PHQ-A) had a sensitivity of 66.0%, a specificity of 90.0%, and a Cronbach's alpha coefficient of 0.92. The possible scores range from 0 to 27 points. Those who scored more than 9 points were considered depressed[28].

Factors on the contextual level were collected by six questions, 1) residential area, 2) tribe, 3) family structure, 4) school characteristics, 5) school types, and 6) study program.

The validity and reliability of the questionnaires were assessed. The content validity of the questionnaires was examined and revised by three experts, including one psychologist, one health education and behavior scientist, and one expert in family health and epidemiologist. The content validity index of 0.8 was accepted for content validity. Afterwards, the questions were tested with 30 selected high school students attending three schools in the hill-tribe villages with characteristics similar to those of the present study population. The Cronbach's Alpha coefficients were obtained equal to 0.7 to 0.92, which was considered acceptable.

**Data gathering procedure.**

Four districts in Chiang Rai were purposely selected as the study area due to most of the hill-tribe people living in these areas: Muang, Mae Fah Luang, Mae Chan, and Mae Suai Districts, Chiang Rai Province, Thailand. High schools with more than 200 hill-tribe children were selected. Three high schools in Mae Fah Luang District, and one each in Mae Suai, Muang, and Mae Chan District met the criteria. Therefore, six schools were selected for collecting data.

Assessing schools was granted by the district government officer and the school directors. Only one high school in Mae Suai, Muang, and Mae Chan Districts met the selection criteria. Thirty samples were randomly selected among hill-tribes attending grades 4 to 6 from the lists of high school students selected in the academic year 2021. Each of the six high schools was located in four districts. After having the list of selected students, they were provided with information regarding the study, including a consent form. Those 18 years and over were asked to give the consent form before completing the questionnaire. Students under 18 years of age were required parents or guardian to complete consent form before they

could fill out the questionnaire. Paper-based, self-administered questionnaires collected data from participants in private rooms.

### Statistical analysis

Data were analyzed by the PASW Statistics, version 18.0 (SPSS Inc., Chicago, IL, USA) and Stata/SE, version 17 (StataCorp LLC, College Station, TX, USA) for the analysis. Descriptive statistics were used to explain the characteristics of participants. Those categorical variables were presented in the form of percentages, while continuing data were presented in the form of mean and standard deviation (SD). Chi-square and Fisher's exact tests were used to compare characteristics between participants with and without depression. Multilevel binary logistic regression analysis with controlling cluster effect was performed to determine the associations among the factors on individual-level and contextual levels and depression at the significance level of $\alpha<0.05$.

### Ethics approval

All research protocols were approved by the Research Ethics Committee of the Faculty of Public Health, Mahidol University, Thailand (No. MUPH 2022-068). All participants were recruited into the present study on a voluntary basis. All the study procedures were performed in accordance with the relevant guidelines, regulations, and within the declaration of Helsinki of 1975, as revised in 2000. All authors approved the submission and revised version of the manuscript.

## Results

Five hundred forty hill-tribe high school students from six high schools in Chiang Rai Province were recruited. The mean age was 16.8 years (SD 1.12), 71.3% were female, and 81.7% were Thais. Thirty-one (5.7%) participants reported that they had an underlying disease, 6.7% had a family history of mental health problems, 2.4% smoked, and 18.0% used alcohol. The authors found that, 46.8% had moderate to severe stress, 69.4% had experience with negative life events, 12.0% had anxiety, 21.7% had low-level resilience, and 42.4% were smartphone addicts. Three-point-three percent had poor level of family functioning, 1.7% had low level of peer group relationships, and 1.7% had poor teacher-student relationship. One hundred and ten (20.4%) had moderate to high social stigma (Table 1).

At the contextual level, more than half (65.6%) had both parents living together, 78.3% lived in rural areas, and 56.5% were Akha. A large proportion (83.3%) were in day school, 83.3% were in public school, and 40.2% studied mechanics and sports programs. The prevalence of depression was 21.9% (Table 1).

The prevalence of depression was estimated using PHQ-A, with a cutoff score of 10 or greater for depression at 21.9% (95% CI 18.4 to 25.4) (Table 1).

In the univariate multilevel binary logistic regression, 14 variables were found to be associated with having depression, which are gender, underlying disease, family history of mental problems, perceived stress, negative life events, anxiety, resilience, smartphone-addiction, family functioning, peer group relationship, teacher-student relationships, social stigma, school type, and study program.

In the multivariate multilevel modeling analysis, nine variables were found to be associated with depression among the hill-tribe high school students, which are underlying disease, perceived stress, negative life events, smartphone addiction, family functioning, peer group relationship, social stigma, and study program (Table 2).

## Discussion

In the present study, the prevalence of depression was 21.9% among the hill-tribe high school students living in Chiang Rai Province, Thailand. Panyawong et al.[29] reported the prevalence of depression among the Thai high school students was 17.5%. This reflects that depression is greater among hill-tribe students than among Thai students. There were reasons to present this scenario, including the fact that the socio-economic status of Thai families is higher, and parent education is more robust than in hill-tribe families. Moreover, access to health care services for Thai students is better than the hill-tribe students due to the availability, distance, and having fewer linguistic and economic problems[4]. This is supported by systematic and meta-analysis that reported the prevalence of depression among low-income and low-education adolescents, which was higher than those living in high-income and high educational status[30]. The problem of depression among high school students showed high prevalence during the COVID-19 crisis period[11,12]. It is possible that the high prevalence of depression among hill-tribe high school students in the present study could be the result of the impacts of their basic risk factors on top of the pandemic of COVID-19.

Underlying disease acted as one of the significant factors in those having depression among the hill-tribe high school students. This was supported by a

**Table 1.** Characteristics of participants having depression

| Characteristics | Total; n (%) | Depression; n (%) | | $\chi^2$ | p-value |
|---|---|---|---|---|---|
| | | Yes | No | | |
| Total | 540 (100) | 118 (21.9) | 422 (78.1) | N/A | N/A |
| Age (years) | | | | 7.07[a] | 0.029* |
| <17 | 210 (38.9) | 56 (26.7) | 154 (73.3) | | |
| 17 | 193 (35.7) | 42 (21.8) | 151 (78.2) | | |
| >18 | 137 (25.4) | 20 (14.6) | 117 (85.4) | | |
| Sex | | | | 16.92 | <0.001* |
| Male | 155 (28.7) | 16 (10.3) | 139 (89.7) | | |
| Female | 385 (71.3) | 102 (26.5) | 283 (73.5) | | |
| Having Thai ID card | | | | 0.502 | 0.479 |
| No | 99 (18.3) | 19 (19.2) | 80 (80.8) | | |
| Yes | 441 (81.7) | 99 (22.4) | 342 (77.6) | | |
| Underlying disease | | | | 7.77 | 0.005* |
| No | 509 (94.3) | 105 (20.6) | 404 (79.4) | | |
| Yes | 31 (5.7) | 13 (41.9) | 18 (58.1) | | |
| Family history of mental problems | | | | 6.56 | 0.010* |
| No | 504 (93.3) | 104 (20.6) | 400 (79.4) | | |
| Yes | 36 (6.7) | 14 (38.9) | 22 (61.1) | | |
| Perceived stress | | | | 227.10 | <0.001* |
| Mild | 287 (53.2) | 12 (4.2) | 275 (95.8) | | |
| Moderate | 159 (29.4) | 34 (21.4) | 125 (78.6) | | |
| High | 55 (10.2) | 36 (65.5) | 19 (34.5) | | |
| Severe | 39 (7.2) | 36 (92.3) | 3 (7.7) | | |
| Negative life events | | | | 14.87 | <0.001* |
| No | 165 (30.6) | 19 (11.5) | 146 (88.5) | | |
| Yes | 375 (69.4) | 99 (26.4) | 276 (73.6) | | |
| Anxiety | | | | 90.93 | <0.001* |
| No | 475 (88.0) | 74 (15.6) | 401 (84.4) | | |
| Yes | 65 (12.0) | 44 (67.7) | 21 (32.3) | | |
| Resilience | | | | 23.71 | <0.001* |
| Low | 117 (21.7) | 44 (37.6) | 73 (62.4) | | |
| Average | 276 (51.1) | 54 (19.6) | 222 (80.4) | | |
| High | 147 (27.2) | 20 (13.6) | 127 (86.4) | | |
| Smartphone addiction | | | | 19.51 | <0.001* |
| No | 311 (57.6) | 47 (15.1) | 264 (84.9) | | |
| Yes | 229 (42.4) | 71 (31.0) | 158 (69.0) | | |
| Family functioning | | | | 36.78[a] | <0.001* |
| Poor | 18 (3.3) | 13 (72.2) | 5 (27.8) | | |
| Moderate | 389 (72.0) | 93 (23.9) | 296 (76.1) | | |
| Good | 133 (24.7) | 12 (9.0) | 121 (91.0) | | |
| Peer group relationship | | | | 13.96 | 0.001* |
| Poor | 39 (7.2) | 17 (43.6) | 22 (56.4) | | |
| Moderate | 298 (55.2) | 67 (22.5) | 231 (77.5) | | |
| Good | 203 (37.6) | 34 (16.7) | 169 (83.3) | | |
| Teacher-student relationship | | | | 5.48[a] | 0.056 |
| Poor | 9 (1.7) | 2 (22.2) | 7 (77.8) | | |
| Moderate | 198 (36.7) | 54 (27.3) | 144 (72.7) | | |
| Good | 333 (61.6) | 62 (18.6) | 271 (81.4) | | |

N/A=not applicable

[a] Fisher's exact test, * Significant level at $\alpha<0.05$

**Table 1.** (continued)

| Characteristics | Total; n (%) | Depression; n (%) | | $\chi^2$ | p-value |
|---|---|---|---|---|---|
| | | Yes | No | | |
| Social stigma | | | | 10.44[a] | 0.004* |
| Low | 430 (79.6) | 82 (19.1) | 348 (80.9) | | |
| Moderate | 94 (17.4) | 29 (30.9) | 65 (69.1) | | |
| High | 16 (3.0) | 7 (43.8) | 9 (56.2) | | |
| Residential area | | | | 1.26 | 0.262 |
| Rural | 423 (78.3) | 88 (20.8) | 335 (79.2) | | |
| Urban | 117 (21.7) | 30 (25.6) | 87 (74.4) | | |
| Tribe | | | | 1.31[a] | 0.941 |
| Akha | 305 (56.5) | 71 (23.3) | 234 (76.7) | | |
| Lahu | 106 (19.6) | 22 (20.8) | 84 (79.2) | | |
| Hmong | 55 (10.2) | 12 (21.8) | 43 (78.2) | | |
| Yao | 32 (5.9) | 5 (15.6) | 27 (84.4) | | |
| Karen | 23 (4.3) | 5 (21.7) | 18 (78.3) | | |
| Lisu | 19 (3.5) | 3 (15.8) | 16 (84.2) | | |
| Family structure | | | | 2.24[a] | 0.523 |
| Both parents lived together | 354 (65.6) | 72 (20.3) | 282 (79.7) | | |
| Single parent | 125 (23.1) | 29 (23.2) | 96 (76.8) | | |
| Divorce | 53 (9.8) | 15 (28.3) | 38 (71.7) | | |
| Foster | 8 (1.5) | 2 (25.0) | 6 (75.0) | | |
| School characteristic | | | | 2.51 | 0.113 |
| Boarding | 90 (16.7) | 14 (15.6) | 76 (84.4) | | |
| Day school | 450 (83.3) | 104 (23.1) | 346 (76.9) | | |
| School type | | | | 18.36 | <0.001* |
| Private school | 90 (16.7) | 35 (38.9) | 55 (61.1) | | |
| Public school | 450 (83.3) | 83 (18.4) | 367 (81.6) | | |
| Study program | | | | 15.06 | <0.001* |
| Mathematics and science | 137 (25.4) | 38 (27.7) | 99 (72.3) | | |
| International languages | 217 (40.2) | 57 (26.3) | 160 (73.7) | | |
| Mechanic and sports | 186 (34.4) | 23 (12.4) | 163 (87.6) | | |

N/A=not applicable

[a] Fisher's exact test, * Significant level at $\alpha<0.05$

study conducted in India[31] and in the United Arab Emirates[32], which reported that those high school students who had underlying diseases had greater chances of having depression than those did not. This suggests that anyone who has a chronic health problem has a greater chance of developing a mental health problem, especially depression, on their own and in their families[32].

Another factor detected as a significant factor for depression among the hill-tribe high school students was individual perceived stress. The present study finding coincided with a report from India[33] indicating that adolescent or high school students perceived high level of stress were more likely to develop depression than those having low level of stress in daily life. Lazarus et al.[34] confirmed that individual perceived stress caused by the living environment and social interactions, particularly in high school students, was more likely to develop depression. Finally, with the COVID-19 crisis, hill-tribe high school students faced challenges in studying, such as a lack of learning materials, unstable internet signal for daily class attendance, and fear of COVID-19 infection if attending class in person. In addition, hill-tribe students had to attend Thai high school programs from 08.00 a.m. to 04.00 p.m., and then were expected to attend Chinese class from 04.30 p.m. to 08.00 p.m. The long study time of all the hill-tribe students increased stress and depression levels.

In the present study, those hill-tribe high school students who had negative life events had a greater chance of having depression than those who did not.

**Table 2.** Univariate and multivariate multilevel binary logistic regression analyses identifying factors associated with depression among hill-tribe high school students

| Factor | Univariate multilevel logistic regression | | | Multivariate multilevel logistic regression | | |
|---|---|---|---|---|---|---|
| | OR | 95% CI | p-value | AOR | 95% CI | p-value |
| Individual level | | | | | | |
| Underlying disease | | | | | | |
| • No | 1.00 | | | 1.00 | | |
| • Yes | 2.38 | 1.28 to 4.43 | 0.006* | 3.92 | 1.17 to 13.07 | 0.026* |
| Perceived stress | | | | | | |
| • Mild | 1.00 | | | 1.00 | | |
| • Moderate-to-severe | 15.03 | 8.63 to 26.20 | <0.001* | 10.88 | 5.11 to 23.15 | <0.001* |
| Negative life events | | | | | | |
| • No | 1.00 | | | 1.00 | | |
| • Yes | 2.46 | 1.58 to 3.83 | <0.001* | 2.24 | 1.36 to 3.69 | 0.001* |
| Anxiety | | | | | | |
| • No | 1.00 | | | 1.00 | | |
| • Yes | 9.90 | 6.16 to 15.91 | <0.001* | 2.97 | 1.82 to 4.85 | <0.001* |
| Smartphone addiction | | | | | | |
| • No | 1.00 | | | 1.00 | | |
| • Yes | 2.28 | 1.66 to 3.12 | <0.001* | 1.88 | 1.08 to 3.28 | 0.027* |
| Family functioning | | | | | | |
| • Poor | 20.64 | 7.81 to 54.50 | <0.001* | 7.57 | 1.33 to 43.04 | 0.022* |
| • Moderate | 2.93 | 1.39 to 6.16 | 0.005* | 1.33 | 0.48 to 3.68 | 0.589 |
| • Good | 1.00 | | | 1.00 | | |
| Peer group relationship | | | | | | |
| • Poor | 3.67 | 1.58 to 8.55 | 0.003* | 2.97 | 1.11 to 8.00 | 0.031* |
| • Moderate | 1.39 | 0.80 to 2.41 | 0.239 | 1.68 | 0.95 to 2.97 | 1.677 |
| • Good | 1.00 | | | 1.00 | | |
| Social stigma | | | | | | |
| • Low | 1.00 | | | 1.00 | | |
| • Moderate | 1.88 | 1.15 to 3.01 | 0.012* | 2.13 | 0.91 to 4.99 | 0.083 |
| • High | 3.37 | 1.07 to 10.63 | 0.038* | 6.87 | 1.92 to 24.53 | 0.003* |
| Contextual level | | | | | | |
| Study program | | | | | | |
| • Mathematics and science | 2.42 | 1.51 to 3.88 | <0.001* | 2.66 | 1.56 to 4.53 | <0.001* |
| • International languages | 2.08 | 1.27 to 3.40 | 0.004* | 1.97 | 1.03 to 3.79 | 0.042* |
| • Mechanics and sports | 1.00 | | | 1.00 | | |

OR=odds ratio; AOR=adjusted odds ratio; CI=confidence interval

* Significant level at $\alpha<0.05$

The negative life events included having a family financial problem, the loss of an important person in their life, and experiencing domestic violence. This is supported by a study conducted in the United Kingdom[35] reporting that negative life event was strongly related to depression. Moreover, Gungor et al.[36] reported that a negative life event was associated with depression among college students in the United States. Recently, a study conducted among Chinese college students reported that negative life events were strongly associated with student depression[37].

In addition, those who had experienced social stigma, which is one of the negative events of life, were more likely to have depression than those who did not. During the interview, some participants reflected on details of having trouble in their lives, such as being stigmatized as a hill-tribe person by their peers, not being fluent in the Thai language, and being poor made them feel uncomfortable. Engel et al.[38] reported that social stigma was associated with depression among adolescents and the young adult in the United States. Therefore, it involves the

rejection or discrimination of an individual based on the perceivable social stigma that distinguishes them from other members of society. It may also be described as a label associated with a person with unwanted characteristics that form a stereotype and cause them to perceive themselves as different and rejected by society. Then, adding a negative life event and a social stigma could lead to depression among the adolescent. This might be because of the low maturity of age that could impact mental health problems[9].

In the present study, having poor peer group relationships among the hill-tribe high school students was detected as one of the factors associated with depression. A study in Germany reported that adolescents who had poor peer relationships had a greater chance of developing depression than those who had good peer relationships[39]. A study in Thailand confirmed that high school students who had poor relationships with their peers faced more depression than those who had good relationships with their peers[40]. The reason may be that high school friends are also essential for the hill-tribe high school students during this stage. It profoundly influences adolescents to seek autonomy, particularly from their parents, and desire to be loved and accepted by their peers[40]. One more significant factor that was strongly associated with depression among the hill-tribe high school students was poor family functioning. A study conducted among Chinese medical students in 2020, reported that those who had been poorly cared for and not supported by their family were more likely to develop depression than those who lived with good family support[41]. Moreover, a study conducted in the United States confirmed that poor family functioning was related to depression among adolescents[38]. Family functioning is related to family structure, role, communication, problem-solving, affective responsiveness, affective involvement, and behavioral control. Nevertheless, poor family functioning is defined as a family's inability to complete duties critical to their well-being[41].

Anxiety was detected as a factor associated with depression among the hill-tribe high school students. Individual anxiety leads to a person feeling uncertain, and that continuous feeling of anxiety could cause stress and depression[42]. Studies[43,44] reported that anxiety was statistically associated with depression in those female adolescents exposed to the pandemic of COVID-19. It is clear that anxiety could impact depression, particularly in adolescent girls facing uncertain events in their lives.

The present study found that smartphone addiction was associated with depression. During the COVID-19 pandemic, all school teachings moved to online learning, and with globalization, people are connected with others by electronic means. This lack of personal connection led to hill-tribe high school students having depression[45]. In addition, with programs being so competitive in Thailand, students feel pressure to get into their desired programs. Programs like mathematics, science, and international languages require hours of study, and more students in these programs were likely to develop depression than students studying in other programs. A study in Korea[45] and China[10] reported that smartphone-addicted high school students were statistically associated with depression. A study in Iran reported that high school students who were attending mathematics programs were more likely to have depression than those who were attending others[46]. Those high school students addicted to smartphones and studying in demanding programs such as mathematics could develop depression due to lack of social opportunities and the pressure of doing well in their programs.

Limitations were found in the present study. First, the condition of a cross-sectional study, identifying the causal effect of the exposures or contributed factors in the present study and depression might not completely demonstrate an association. Finally, recall bias could happen when assessing variables, such as experiences of social stigma and negative life events.

## Conclusion

A large proportion of the hill-tribe high school students are suffering from depression, particularly with the COVID-19 pandemic. Factors acted as contributors to depression among the hill-tribe high school students in both individual and contextual related factors. Appropriate public health interventions should be developed and implemented to reduce the problem by focusing on those who have underlying disease, perceived stress, negative life events, anxiety, and smartphone addiction. Moreover, implementation should be integrated into their family, peer, and social environments.

## What is already known on this topic?

Depression is a major mental health problem among adolescents in developed and developing countries. Factors have been reported as risk factors for depression, such as gender, underlying diseases, and stress.

## What does this study add?

The prevalence of depression among hill-tribe high school students in Chiang Rai, Thailand, is 21.9%. Nine biopsychosocial variables are associated with depression, which are underlying disease, perceived stress, negative life events, smartphone addiction, family functioning, peer group relationships, social stigma, and study program.


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## Conflicts of interest

The authors declare that they have no competing interests.

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