

Mental problems and risk factors for depression among medical students during the COVID-19 pandemic

A cross-sectional study

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Abstract

Prevalence of depression is high among medical students and several mental problems are identified as risk factors. Coronavirus disease 2019 (COVID-19) pandemic causes difficulties that could adversely affect mental health. However, data concerning prevalence of mental problems, and whether or not these problems remain risk factors for depression during the COVID-19 pandemic in medical students are scarce. To investigate the prevalence of depression, social media addiction, game addiction, sleep quality, eating disorder risk, and perceived stress among Thai medical students, risk factors for depression were investigated. Online surveys via our faculty's learning portals were advertised to medical students who engaged online learning and 224 respondents provided complete data. Study-related medical students' data were collected using the Patient Health Questionnaire-9 for depression, the Social-Media Addiction Screening Scale for social media addiction, the Game Addiction Screening Test for game addiction, the Pittsburgh Sleep Quality Index for sleep quality, the Eating Attitudes Test for eating disorder risk, and the Perceived Stress Scale for perceived stress. Depression was reported in 35.7% of medical students, social-media addiction in 22.3%, game addiction in 4.5%, eating disorder risk in 4.9%, poor sleep quality in 80.8%, and moderate-to-high perceived stress in 71.4%. The independent predictors of depression were lower grade point average, social media addiction, and moderate-to-high perceived stress. A high prevalence of depression, stress, and poor sleep was found among medical students during the COVID-19 pandemic. Medical students who are stressed, have lower grades, and/or who are addicted to social media warrant depression screening.

Abbreviations: BMI = body mass index, COVID-19 = coronavirus disease 2019, GAST = game addiction screening test, GPA = grade point average, MS = medical students, PHQ-9 = patient health questionnaire-9, PSQI = Pittsburgh sleep quality index, PSS-10 = perceived stress scale, S-MASS = social-media addiction screening scale.

Keywords: COVID-19, depression, eating, game, sleep, social media, students

1. Introduction

Coronavirus disease 2019 (COVID-19) was first reported in December 2019, after which it developed into a global pandemic. Among many types of adverse impact, the COVID-19 pandemic has exerted devastating effect on education. As a result of lock-downs and other types of ongoing restrictions designed to limit the spread of the disease, online learning has become the most common way that students attend class sessions. However, negative consequences of online learning have been reported, including depression.^[1] In addition to negative moods, behavioral deterioration was more prevalent during the pandemic period. Negative behavior such as compulsive buying

was mediated by the intolerance of uncertainty during the disease outbreak.^[2] In general, medical students (MS) are 2.5 to 5.2 times more depressed than age-matched general population, and the prevalence of depression among MS is approximately 27.2%.^[3] Mental health problems that were reported to be risk factors for depression among MS include social media addiction,^[4] game addiction,^[5] poor sleep quality,^[6] eating disorder risk,^[7] and perceived stress.^[8] However, data concerning whether or not these mental health problems remain risk factors for depression among MS during the COVID-19 pandemic are lacking. During the COVID-19 pandemic, findings suggested that MS had worsened mental health. For example, in the USA, two-thirds of MS believed their mental health had deteriorated

The datasets generated during and/or analyzed during the current study are not publicly available, but are available from the corresponding author on reasonable request.

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following the start of the pandemic.^[9]In Jordan, about half of MS had a severe mental disorder and they admitted that the pandemic has affected their study and social relationships.^[10]In France, nearly 40% of MS reported significant psychological distress during the pandemic.^[11]

Accordingly, the aim of this study was to investigate the prevalence of these mental health problems, and to identify mental health-related problems that are independently associated with depression. We hypothesized that depression prevalence might be higher during the pandemic because the emerging stress from online learning adaptation, the threat of the pandemic, and the tension of being a MS could all have a detrimental effect on mental health. Furthermore, specific factor such as social-media addiction might be associated with depression during the online-learning engagement because there was evidence that MS increased their time spent on social media during the pandemic, and the greater time spent on social-media was linked to mood fluctuations.^[12]The findings of this study will propose a solution to which mental problems are prominent in MS during the pandemic and warrant screening. Besides that, since depression is a serious problem due to the significant rate of suicide,^[3] the depression risk factors identified in this study will aid medical schools in developing prevention plans.

2. Methods

2.1. Study protocol

Thailand experienced the first wave of COVID-19 during March to April 2020, and this study was conducted during March to October 2020. The teaching protocol during the pandemic at our medical school was, as follows: for preclinical students, all instruction and learning were conducted online; and, for clinical students, all lectures were conducted online, but student to patient contact for bedside learning was conducted at the hospital with MS strictly practicing social distancing, wearing masks, and frequently washing hands.

This cross-sectional study was advertised to all MS via our faculty's online learning portals, and the study questionnaires were filled out and returned online. Informed consent was obtained from all MS willing to participate in the study. All data were kept totally anonymous and participants did not receive any reward or payment. The protocol for this study was approved by the Siriraj Institutional Review Board (COA no. Si 396/2019).

2.2. Participants

Of a total of 1816 potential participants reached, 224 (12.3%) MS respondents returned questionnaires. Among these, 1 participant provided missing body mass index (BMI) data. Other than BMI, we also included this participant in the analyses.

2.3. Measures

2.3.1. Demographic data. Gender, age, BMI, study year, grade point average (GPA) (range: 0.00–4.00), marital status, and monthly income were obtained.

2.3.2. Depression. The Thai version of the Patient Health Questionnaire-9 (PHQ-9) was used for evaluating depression. The PHQ-9 is a 9-item self-report questionnaire. Each item elicits information about depressive symptoms within the previous 2 weeks, and responses are rated using a Likert scale from 0 (not at all) to 3 (nearly every day). A score ≥ 9 is the optimal cutoff for detecting major depressive disorder in Thai population (sensitivity 0.84, specificity 0.77, Cronbach alpha 0.79).^[13]

2.3.3. Social media addiction. The Social-Media Addiction Screening Scale (S-MASS) was used to evaluate social media

addiction. The S-MASS was developed by Pornnoppadol et al, and it is a 16-item self-administered questionnaire. Each item is rated on a Likert scale from 0 (definitely not true) to 3 (definitely true). Questionnaire items were derived from the criteria used to evaluate for internet gaming disorder in the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) (e.g., preoccupation, withdrawal, tolerance, unsuccessful attempts to control use). The S-MASS was validated in 5068 Thai adolescents and showed excellent internal consistency (Cronbach alpha 0.90). Latent profile analysis was used to identify groups of participants according to the Bayesian Information Criterion and the integrated complete-data likelihood criterion. Total score is classified into three groups, as follows: low (0–15), moderate (16–30), and high (31–48) risk of social media addiction (unpublished data). In this study, a cutoff score of ≥ 31 indicates the presence of social media addiction.

2.3.4. Game addiction. The child and adolescent version of the Game Addiction Screening Test (GAST) was used to evaluate for gaming addiction. The GAST is a 16-item self-administered questionnaire that elicits information specific to problematic game playing domains, including preoccupation with the game, loss of control, and functional impairment. Each item is rated on a Likert scale from 0 (definitely not true) to 3 (definitely true). The GAST was developed in Thailand and was validated in Thai adolescents (Cronbach alpha 0.92). A cutoff score of ≥ 33 for males had a sensitivity of 68.5%, and a specificity of 89.3%; and a cutoff score of ≥ 23 for females had a sensitivity of 88.2%, and a specificity of 88.3% for determining the presence of gaming addiction.^[14]

2.3.5. Sleep quality. The Thai version of the Pittsburgh Sleep Quality Index (PSQI) was used to evaluate sleep quality. The PSQI is a 19-item self-report questionnaire that assesses different aspects of sleep quality, including sleep duration and use of sleep medication. A global score of > 5 suggests poor sleep quality. A PSQI score of > 5 had a sensitivity of 77.78%, a specificity of 93.33%, and a Cronbach alpha of 0.84 for evaluating sleep quality in Thai population.^[15]

2.3.6. Eating disorder risk. The Thai version of the Eating Attitudes Test was used to assess for an eating disorder. The Eating Attitudes Test is a 26-item self-report questionnaire that elicits information about attitudes toward eating, including dieting, bulimia, food preoccupation, and diet control. Each item is rated 0 (never, rarely, sometimes), 1 (often), 2 (usually), or 3 (always). A cutoff score of ≥ 20 indicates eating disorder risk. This cutoff score had a sensitivity of 0.74, a specificity of 0.94, and a total item correlation of 0.82 for identifying eating disorder risk in Thai females.^[16]

2.3.7. Perceived stress. The Thai version of the Perceived Stress Scale (PSS-10) was used to measure perceived stress. The PSS-10 is a 10-item self-report questionnaire that elicits information specific to the level the respondent feels that his or her life was unpredictable, uncontrollable, and overloaded within the preceding 1 month. Each item is rated on a Likert scale from 0 (never) to 4 (very often). The total score is classified into: low (0–13), moderate (14–26), or high (27–40) perceived stress. The Thai PSS-10 was reported to have a Cronbach alpha of 0.85.^[17]

2.4. Data analysis

Descriptive statistics were used to summarize sociodemographic and mental health data. Categorical data were compared using chi-square test or Fisher exact test, and the results are given as number and percentage. Continuous data were compared using Student *t* test for normally distributed data, and using Mann-Whitney *U* test for non-normally distributed data. Continuous

data are presented as mean \pm standard deviation for normally distributed data, and as median and interquartile range [quartile 1, quartile 3] for non-normally distributed data. Variables with a P value $< .05$ from univariate analysis were entered into binary logistic regression to identify factors independently associated with depression. The results of regression analysis are shown as adjusted odds ratio and 95% confidence interval. All analyses were performed using SPSS Statistics version 18.0 (SPSS, Inc., Chicago, IL). A P value $< .05$ indicates statistical significance for all tests.

3. Results

3.1. Participant characteristics and prevalence of mental health problems

Table 1 shows the sociodemographic and mental health data of 224 Thai MS. Gender was nearly equal, the mean age was 21 years, and 58.0% were preclinical students. MS were all unmarried (data not shown). The mean GPA was 3.50. Most (92.0%) MS had a monthly income < 500 USD. The prevalence

Table 1
Sociodemographic and mental health data of the Thai medical students.

Characteristics	Participants (N = 224)
	n (%), median [Q1, Q3], or mean \pm SD
Sex	
Female	113 (50.5%)
Male	111 (49.6%)
Age	21.02 [20.02, 21.11]
Year of study	
Preclinical (year 1–3)	130 (58.0%)
Clinical (year 4–6)	94 (42.0%)
Grade point average	3.50 [3.25, 3.80]
Monthly income	
< 500 USD	209 (92.0%)
≥ 500 USD	18 (8.0%)
Depression score: PHQ-9 score (0–27)	7.00 [4.00, 9.75]
With depression (PHQ-9 ≥ 9)	80 (35.7%)
Without depression (PHQ-9 < 9)	144 (64.3%)
Social media addiction: S-MASS score (0–48)	22.74 \pm 9.72
With social media addiction (S-MASS ≥ 31)	50 (22.3%)
Without social media addiction (S-MASS < 31)	174 (77.7%)
Game addiction: GAST score (0–48)	8.00 [2.00, 15.00]
With game addiction (GAST ≥ 33 in male, ≥ 24 in female)	10 (4.5%)
Without game addiction (GAST < 33 in male, < 24 in female)	214 (95.5%)
BMI (missing data = 1)	21.36 \pm 3.14
Underweight (BMI < 18.5)	35 (15.6%)
Normal (BMI 18.0–22.9)	142 (63.4%)
Overweight (BMI 23.0–24.9)	19 (8.5%)
Obesity (BMI ≥ 25)	27 (12.1%)
Eating disorder risk: EAT-26 score (0–28)	7.00 [4.00, 11.00]
With eating disorder risk (EAT-26 ≥ 20)	11 (4.9%)
Without eating disorder risk (EAT-26 < 20)	213 (95.1%)
Sleep quality: PSQI global score (0–21)	10.00 [6.25, 14.00]
Poor (PSQI global score > 5)	181 (80.8%)
Good (PSQI global score ≤ 5)	43 (19.2%)
Perceived stress: PSS score (0–40)	16.96 \pm 5.96
High (PSS 27–40)	9 (4.0%)
Moderate (PSS 14–26)	151 (67.4%)
Low (PSS 0–13)	64 (28.6%)

BMI = body mass index (kg/m²), EAT-26 = eating attitude test, GAST = game addiction screening test, PHQ-9 = patient health questionnaire, PSQI = Pittsburgh sleep quality index, PSS = perceived stress scale, Q = quartile, SD = standard deviation, S-MASS = social-media addiction screening scale.

of depression was 35.7%, social-media addiction 22.3%, game addiction 4.5%, eating disorder risk 4.9%, poor sleep quality 80.8%, and moderate-to-high perceived stress 71.4%.

3.2. Independent risk factors for depression

The factors found to be significantly associated with depression in univariate analysis were female gender, lower GPA, social media addiction, game addiction, eating disorder risk, poor sleep quality, and high perceived stress. Age, year of study (pre-clinical or clinical), monthly income, and BMI were not significantly associated with depression (Table 2).

Significant factors from univariate analysis were then entered into binary logistic regression analysis. The analysis revealed the following factors to be independently associated with depression: social media addiction (adjusted odds ratio [aOR]: 2.49, 95% confidence interval [CI]: 1.20–5.17; $P = .015$) and moderate-to-high perceived stress (aOR: 4.42, 95% CI: 1.86–10.48; $P = .001$). GPA was found to be independently inversely correlated with depression (aOR: 0.24, 95% CI: 0.10–0.60; $P = .002$). Of interest, female gender showed a trend toward independent association with depression (aOR: 1.90, 95% CI: 0.98–3.70; $P = .059$) (Table 3).

4. Discussion

Depression was reported in 35.7% of MS, social-media addiction in 22.3%, game addiction in 4.5%, eating disorder risk in 4.9%, poor sleep quality in 80.8%, and moderate-to-high perceived stress in 71.4%. The independent predictors of depression were lower GPA, social media addiction, and moderate-to-high perceived stress.

4.1. Prevalence of depression

At a PHQ-9 cutoff of ≥ 9 , 35.7% of our MS had depression, which is higher than previously reported rates in Thailand and worldwide during non-pandemic times. This prevalence is also higher than the 19.6% rate reported from a previous study that used the same scale and cutoff at our medical school during non-pandemic time.^[18] Another interesting comparison between our study and the previous study at our center is that the previous study had an 85.6% response rate, and our study had a 12.3% response rate. In their study, the study was announced to students in the classroom, and our study was announced online via our faculty's online learning portals. Possible explanations include a failure to observe the online ad and lack of interest to respond. Compared to other medical schools in our country that used the same scale and cutoff during non-pandemic time, the prevalence of depression in our study is higher than that 9.9% rate found in the Northern region of Thailand (response rate 68.5%),^[19] and higher than the 28.8% (response rate 77.9%) rate from another medical school located in Bangkok.^[20] Our prevalence rate is higher than the 18.3% rate (PHQ-9 ≥ 10) among worldwide MS reported from a meta-analysis.^[3] Compared to another study conducted during COVID-19, our prevalence rate is higher than 24.3% rate found among American MS (PHQ-9 ≥ 10).^[21] The very high prevalence of depression in our study highlights the need for enhanced awareness of depression screening among MS during COVID-19. The factors found to be independently associated with depression in this study (i.e., social media addiction, higher stress, and lower grades) are discussed below.

4.2. Social media addiction and its association with depression

Almost one-fourth (22.3%) of MS in our study were found to be addicted to social media, and social media addiction was

Table 2
Sociodemographic and mental health data compared between Thai medical students with and without depression.

Characteristics	With depression (n = 80)	Without depression (n = 144)	Difference between groups	OR	95% CI	P	Effect size
Sex, n (%)			$\chi^2 = 8.811$	2.33	1.33–4.08	.003	Phi = 0.198
Female	51 (63.8%)	62 (43.1%)					
Male	29 (36.2%)	82 (56.9%)					
Age, median [Q1, Q3]	20.85[20.04, 21.11]	21.03[20.00, 21.11]	$U = 5657.0$	1.04	0.88–1.24	.825	d = 0.030
Study year, n (%)			$\chi^2 = 0.528$	1.23	0.70–2.15	.467	Phi = 0.049
Preclinical	49 (61.3%)	81 (56.3%)					
Clinical	31 (38.7%)	63 (43.7%)					
Grade point average, median [Q1, Q3]	3.42 [3.20, 3.66]	3.60 [3.29, 3.87]	$U = 4133.5$	0.31	0.15–0.66	.002	d = 0.481
Monthly income, n (%)			$\chi^2 = 1.552$	2.05	0.65–6.44	.213	Phi = 0.083
<500 USD	76 (95.0%)	130 (90.3%)					
≥500 USD	4 (5.0%)	14 (9.7%)					
Social media addiction, n (%)			$\chi^2 = 13.924$	3.33	1.74–6.38	<.001	Phi = 0.249
Yes	29 (36.3%)	21 (14.6%)					
No	51 (63.7%)	123 (85.4%)					
Game addiction, n (%)			$\chi^2 = 5.359$	4.51	1.13–17.95	.037	Phi = 0.155
Yes	7 (8.8%)	3 (2.1%)					
No	73 (91.2%)	141 (97.9%)					
BMI (missing data = 1)			$\chi^2 = 0.006$	0.98	0.53–1.80	.940	Phi = -0.005
Underweight + obesity	22 (27.5%)	40 (27.8%)					
Normal + overweight	58 (72.5%)	103 (72.2%)					
Eating disorder risk, n (%)			$\chi^2 = 6.903$	5.22	1.34–20.28	.019	Phi = 0.176
Yes	8 (10.0%)	3 (2.1%)					
No	72 (90.0%)	141 (97.9%)					
Sleep quality, n (%)			$\chi^2 = 8.755$	3.48	1.47–8.23	.003	Phi = 0.198
Poor	73 (91.3%)	108 (75.0%)					
Good	7 (8.7%)	36 (25.0%)					
Perceived stress, n (%)			$\chi^2 = 21.031$	5.73	2.56–12.79	<.001	Phi = 0.306
Moderate to high	72 (90.0%)	88 (61.1%)					
Low	8 (10.0%)	56 (38.9%)					

Bold values indicate *P* value < .05 having statistical significance for all tests.

BMI = body mass index, CI = confidence interval, OR = odds ratio, Q = quartile, SD = standard deviation.

Table 3
Binary logistic regression analysis to determine independent risk factors for depression among Thai medical students.

Risk factors	B (SE)	Adjusted OR	95% CI	P
Female sex	0.64 (0.34)	1.90	0.98–3.70	.059
Grade point average	-1.42 (0.47)	0.24	0.10–0.60	.002
Social media addiction	0.91 (0.37)	2.49	1.20–5.17	.015
Game addiction	1.34 (0.98)	3.83	0.57–25.93	.168
Eating disorder risk	1.08 (0.77)	2.95	0.66–13.21	.158
Poor sleep quality	0.79 (0.48)	2.20	0.85–5.68	.103
Moderate to high perceived stress	1.84 (1.62)	4.42	1.86–10.48	.001

Hosmer-Lemeshow $\chi^2 = 12.884$, *df* = 8, *P* = .116, Nagelkerke $R^2 = 0.315$. Bold values indicate *P* value < .05 having statistical significance for all tests.

B = beta, CI = confidence interval, OR = odds ratio, SE = standard error.

identified as an independent risk factor for depression. This prevalence is comparable to that found in Thai high school students during non-pandemic times using the same scale and cutoff (a study from our department in 1084 students found a prevalence 21.4%, unpublished data). Our 22.3% prevalence is close to another study in Thai MS, which reported a prevalence of internet addiction of 24.4%,^[20] but the fact that different measures were used makes the findings of the two studies difficult to compare.

A survey during a COVID-19 lockdown found that MS increased the amount of time they spent on social media, and more time spent on social media was found to be associated with mood fluctuations.^[12] Another study reported social media dependence to be associated with depression among MS,^[4] which may possibly be due to upward social comparisons.^[22]

Moreover, social media was found to be used to spread fake news and hatred during COVID-19,^[23] which could aggravate depression in depressed individuals with a tendency toward being attracted to or focusing on negative information.^[24] Since online learning increases the ease of social media use, and social media use was found to associate with depression, MS should moderate their use of social media and objectively consider its reliability. MS may also consider a significant reduction in or departure from the use of social media if they feel depressed.

4.3. Game addiction and its association with depression

We found that 4.5% of MS had game addiction; however, game addiction was not found to be an independent risk factor for depression. This is the first study to investigate game addiction among MS in Thailand, and our results showed a low prevalence of game addiction during the pandemic. The prevalence found in this study is very close to the 4.06% prevalence of game addiction among Thai adolescents during non-pandemic time using the same scale and cutoff.^[14] Our prevalence rate is slightly lower than those reported from other Asian countries (4.8%–5.9%), but higher than those reported from Europe (1.2%–2.5%) and North America (0.3%–1.0%) using various scales.^[25]

No association was found between game addiction and depression in this study. This result is contrast to other studies in MS,^[5,26] and in contrast to a comprehensive review of studies conducted in adolescents that found that 6 of 7 studies reported significant association.^[27] The fact that different scales were used may explain these differences between studies. Interestingly, a previous study in Thai MS reported that 79.6% of MS responded that the most common method that they used

to reduce stress was self-management, which included playing games.^[28] More studies among MS that employ more specific game use/game addiction criteria are needed to improve our understanding to what extent game playing facilitates or ameliorates depression.

4.4. Poor sleep quality and its association with depression

Over three-quarters (80.8%) of MS in our study reported having poor sleep quality; however poor sleep quality was not found to be an independent risk factor for depression. The prevalence poor sleep quality in this study is higher than the rates reported from previous studies conducted in Thailand MS, and among MS worldwide during non-pandemic time using the same scale and cutoff. A study conducted at our medical school in 2015 found a 46.6% prevalence of poor sleep quality.^[29] Studies conducted in other countries reported a prevalence of poor sleep quality ranging from 33.9% to 65.7%.^[6,30]

Our finding that poor sleep quality is not an independent risk factor for depression contrasts with the finding of a previous study in MS study at our school that found inadequate sleep to be significantly associated with depression.^[18] We found poor sleep quality to be significantly higher among depressed MS in univariate analysis, but that association was not sustained in binary logistic regression analysis. Factors such as social media addiction and perceived stress might impact depression more than sleep quality itself. However, the very high prevalence of poor sleep quality in this study warrants special attention.

4.5. Eating disorder risk and association with depression

A smaller proportion (4.9%) of MS in our study had eating disorder risk. However, neither eating disorder risk nor BMI was associated with depression. By way of comparison, a meta-analysis of studies that investigated these associations reported a prevalence of eating disorder risk of 10.5% among MS, and a Thai study in university students reported a prevalence of 4.3% (all during non-COVID-19 time).^[31]

In contrast to studies among Chinese and Malaysian female MS,^[7,32] our study did not find association between eating disorder risk and depression. Gender might influence this difference in results. Contrary to the finding of a meta-analysis that underweight and obesity were associated with depression in population,^[33,34] we did not observe this association among MS. Mediouni et al proposed the term “depreobesity” to describe the link between coexisting depression and obesity which has been linked to the pandemic impact, including that the quarantine and containment measures reduce physical activities, and that pandemic-related stress and depression urge people to eat unhealthy foods to improve their mood.^[35,36] Because eating habits are linked to mental health, depreobesity may occur during the epidemic and should be monitored. However, given the low prevalence of eating disorder in our study, screening for eating disorders in MS may not be as important as other indicators reported in this study.

4.6. Perceived stress and its association with depression

Regarding perceived stress, 4.0% of MS in our study reported having high stress, 67.4% had moderate stress, and 28.6% reported low perceived stress. Moderate-to-high perceived stress was identified as an independent risk factor for depression. Using the same scale, the mean stress score in this study was 17.0, which is higher than the previously reported mean of 13.5 that was found at another medical school in Thailand during non-pandemic time.^[17] In our study, moderate-to-high perceived stress accounted for 71.4% of our MS. Compared to other studies conducted during the pandemic using the same scale and

cutoff, our rate is lower than that found among Chinese MS (82.3%),^[37] among dental students in Pakistan (96.9%),^[38] and among nursing students in India (96.0%).^[39] During COVID-19, Thai MS may have had relatively higher stress compared to non-pandemic time; however, compared to medical and healthcare students in other countries during COVID-19, Thai MS had lower stress.

Consistent with our finding, perceived stress was reported to be a risk factor for depression among MS during non-pandemic time,^[8,40] and among MS during the COVID-19 pandemic.^[41] A factor that is considered to have exerted a lot of adverse influence is the change from face-to-face classroom learning to online learning. Characteristics of online learning, including less interaction, inability to concentrate, and inability to solve internet problems, were found to be predictors of stress.^[37] A multi-school study of Thai MS during COVID-19 found the greatest concern of MS during the pandemic to be changes in the teaching and evaluation system (“fear of system error during the exam” and “uncertainty about teaching and learning”).^[42] Therefore, to prevent or lower the prevalence of depression caused by this factor, medical schools should provide an effective and reliable online learning system with built-in remedies in case internet or other types of technology-related problems are encountered by students. The more confidence the students have in the efficacy and reliability of the online process, the less likely they are to become stressed and become depressed.

4.7. Sociodemographics and its association with depression

Lower GPA was also found to be an independent risk factor for depression among MS during COVID-19 time, which is in contrast to the finding of the previous study conducted at our medical school.^[18] Other studies that investigated for association between GPA and depression during the COVID-19 pandemic in other countries reported conflicting results.^[43,44] Since academics is the greatest stressor among MS,^[45] and online learning requires a lot of adaptation, MS with lower academic achievement may be vulnerable to depression during the COVID-19 pandemic.

Consistent with other Thai MS studies that were conducted during non-pandemic times, we found female gender not to be associated with depression.^[18,20,46]

Age was also not associated with depression because almost all MS in Thailand enter university right after graduating from high school, so there was virtually no difference in age among students studying in the same year of medical school training. Moreover, no significant effect of preclinical or clinical training on depression was observed, which is consistent with the findings of another study conducted at a different medical school in Thailand, and with a meta-analysis – both of which were conducted during non-COVID-19 time.^[3,20]

Monthly income was also not found to be a risk for depression, which may be explained by the fact that most Thai MS receive a monthly allowance from their parents. Furthermore, our university provides several types of grants to assist MS with academic and non-academic financial needs.

4.8. Strengths and limitations

The strength of this study includes that this is the first study during the COVID-19 pandemic to examine the prevalence of crucial mental problems at once, and the first study to investigate game addiction among MS in Thailand. Furthermore, we used logistic regression analysis to identify mental problems that independently associate with depression. Our study displays a wilder perspective of MS’ mental health during the pandemic, leading to prioritizing the intervention needs.

This study has some limitations. First, the cross-sectional design of our study prevented us from identifying temporal relationships between mental health problems and the COVID-19 pandemic. Second, we did not collect factors that may affect depression, such as psychiatric comorbidity. Third, the S-MASS and GAST are not internationally used scales, so this could make a comparison of our results and other results difficult. However, the main reason for choosing them was to reduce cultural and language barriers since they were originally developed for use in Thai adolescents. Fourth, the survey response rate was 12% or 224 respondents, which may limit the cross-sectional research's generalizability and validity. Nonetheless, the response rate in our study is comparable to the rate from other online survey studies in MS,^[11,21] which reflects the caveat of online surveys. The explanations include that the study was advertised via online learning portals, which MS may have overlooked; that MS were uninterested in the research topic; and that there was no payment or reward for responding to the survey. Fifth and last, this research survey reflected the situation at the beginning of the pandemic in 2020, when everyone was unprepared for it. Nowadays in 2022, students are more adapted to studying online than they were previously, and the school's online learning system is more stable. As a result, the pandemic's current and future impact may be less profound.

5. Conclusion

Depression among MS may be more prevalent during the COVID-19 pandemic. We found one-third of MS had depression during the COVID-19 pandemic. As high as 8 of 10 MS had poor sleep, and 7 of 10 reported moderate-to-high perceived stress during the COVID-19 pandemic. Independent risk factors for depression among MS during the COVID-19 pandemic were lower GPA, social media addiction, and moderate-to-high perceived stress.

This study evokes mental health professionals a call for early detection by vigilant screening depression in this instant. Early screening and prompt treatment could help prevent the consequences of functional impairment or suicide. Depression screening should focus primarily on those with low academic achievement, addicted to social media, or reported high stress since they are at the highest risk. Moreover, an exceptionally high rate of stress and poor sleep quality among MS reflects the further need for stress reduction intervention and sleep promotion in MS during the pandemic. We suggest the following future research opportunities. First, we encourage doing a qualitative study to explore the roots of depression risk factors in order to develop specific interventions. Second, a longitudinal assessment of mental health during various pandemic phases will reveal the pandemic's full trajectory impact. Finally, while an online survey study is convenient, it has a low response rate; an online multisite study will help recruit more participants and increase the study's generalizability.

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