

High Prevalence of Depression, Anxiety and Stress Among Secondary School Students During COVID-19 Lockdown and Social Distancing and Its Associated Factors: An Online Cross-Sectional Survey

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Abstract

Background: Stressors introduced to adolescents by COVID-19 social distancing measures may cause mental health problems to (re)surface. We studied depression, anxiety and stress among adolescents experiencing lockdown.

Methods: From May-June 2020, secondary school students were enrolled in an online cross-sectional survey through social media. We assessed presence and severity of depression (PHQ-9), anxiety (GAD-7) and stress (PSS-10) in the last month, demographics, degree of social distancing, and other associated issues.

Results: Of 392 respondents (56.4% male, 43.1% female), mostly from Thailand (59.2%) and UK (26.5%). We identified depressive symptoms in 58.7%, anxiety in 40.3% and high levels of stress in 9.7%. We found, by multivariate analysis, significant associations between being female and depression and anxiety, being in late secondary school years and depression, and changes in patterns of substance use and anxiety and stress.

Conclusions: We propose that girl-centred mental health support platforms should be readily available and tailored to fit specific countries' contexts. Schools must closely monitor and act upon any concerns which arise from their students and must also monitor mental health wellbeing as changes in academic routine due to COVID-19 could be drastic for some. Harm reduction services must adapt and utilise innovative telemedicine interventions, tailored towards adolescent users.

Background

Due to the current 2019 novel coronavirus (SARS-CoV-2) pandemic, many governments have initiated unavoidable social distancing measures to attempt to slow the spread of disease, in the form of widespread lockdown of varying severity as well as other ways. This is not new: citywide lockdowns were previously implemented in countries such as Canada and China during the 2003 severe acute respiratory syndrome (SARS) outbreaks, and efforts were made to quarantine whole villages in West Africa during the 2014 Ebola outbreak (1). For adolescents, such lockdowns result in school closures, online learning, exam cancellations as well as being restricted socially in other ways. By the end of July 2020, over a billion enrolled learners were still out of "normal" education (2).

Adolescent mental health problems are becoming an increasingly apparent issue. Adolescence can prove to be a crucial time of mental development, plagued with higher risks of developing psychiatric disorders. Children and adolescents have been shown to be one of the most vulnerable groups with regards to mental health during extended isolation (3). Even after lockdown measures in the United Kingdom (UK) were lifted, the University College London COVID-19 Social Study reported that young people were one of the groups still experiencing high levels of depression and anxiety (4).

In general, lockdown and its element of social and physical distancing elicits a toll on mental health; the World Health Organization (WHO) affirms that social dysfunction will result in elevated prevalence of psychiatric illnesses (5). Hawryluck et al. showed that persons quarantined in Toronto, Canada, during the 2004 SARS outbreak displayed a high prevalence of depression (6). Jeong et al. reported higher rates of anxiety among individuals during their isolation period compared to 4–6 months after isolation due to the 2015 Middle East Respiratory Syndrome (MERS) outbreak in Korea (7). More recently, Huang and Zhao have identified a “major mental health burden” on the Chinese public amid the COVID-19 outbreak (8).

Since the pandemic’s inception, there have been some studies conducted which have begun to assess how COVID-19 social distancing and isolation can lead to adverse mental health effects (8, 9) and further consequences such as substance abuse (10–12). However, evidence and data on how large-scale public health measures affect adolescent mental health outcomes is scarce (13). Xie et al. report higher prevalence of depression and anxiety among primary school children in home confinement during a Chinese nationwide school closure (14). Zhou et al. describe similar findings with Chinese high school students (15). Despite this, there have not been any studies examining the disparities between mental health impact from country to country, and certain associated factors such as adolescent substance use.

Thailand and the UK are two countries which, despite similar population sizes, have experienced very different trajectories regarding COVID-19 outbreak. Thailand reported the first case of COVID-19 outside of China on 13 January 2020 (16), with the virus reaching the UK shortly after later in the month (17). In response, social distancing measures were implemented by both governments. On 21 March 2020, the Bangkok Metropolitan Administration authority declared widespread shutdown of various businesses. A national public state of emergency was declared on 25 March, with a general lockdown and social distancing requirements instituted on 26 March. In the UK, governmental response was initially in the form of guidance. As the situation escalated, legislation was enacted in the form of statutory instruments, which included implementing closures of schools, businesses and non-essential services, restrictions on movement and gatherings, and enforcement. A stay-at-home order came into effect on 26 March. Despite taking action at around similar times, the two countries currently find themselves in dissimilar situations. Since then, as of 7 September 2020, Thailand has had 3,445 COVID-19 cases, compared to 347,152 cases in the UK. Their death rates per million people differ substantially: 0.8 for Thailand, but 611 for the UK (making it the sixth-highest death rate per million people globally among major countries) (18). Thus, it would be interesting to examine the differences in adolescent mental health amid a worldwide pandemic, but in differing COVID-19 situations.

We therefore aimed to pilot assess the impact of social distancing on the mental health of secondary school students in Thailand and UK, including the degree and prevalence of depression, anxiety and stress, as well as how lockdown-specific associated factors can impact this. However, there will be no geographical boundaries due to the use of online survey.

Methods

Study participants

We advertised a study survey link launched to students in Thailand and UK via snowball sampling on social media popular with youths, including Instagram, Snapchat, WhatsApp and LINE. The location of study had no physical space, and participants instead accessed the digital platform of *Google Forms* on an online system. Further distribution of the survey link was done by earlier participants via instant messaging as well as 'story reposts'. In order to answer the questions, participants had to be enrolled in school from Year 8 (Grade 7) to Year 13 (Grade 12) and be able to understand, read and write (type) English.

Consent by action was obtained via a digitalised consent form, explaining the objectives and contents of the survey as well as potential risks and intended benefits. We designed the online survey layout such that no study procedures would occur prior to the participant giving informed consent. Despite most participants being under 18, parental consent was waived due to the anonymous nature of the survey.

The study was approved by the Institutional Review Board of the Faculty of Medicine, Chulalongkorn University.

Study procedures

The cross-sectional survey on mental health was created using the online service *Google Forms*, and participants could access the survey and answer questions on it. The survey was open to responses from May to June 2020. Content included diagnostic instruments used to assess symptoms of depression, anxiety and stress, but also questions designed to identify general demographics, degree of social distancing and other associated factors. Open-ended questions were also implemented in order to allow participants to expand on certain issues or topics.

Prior to official deployment, 10 individuals were selected to test the questionnaire. These individuals were specifically selected so that feedback obtained later on was based on demographically diverse opinions.

Study measurements

- Depression

The 9-item Patient Health Questionnaire-9 (PHQ-9) was used to assess depressive symptoms. PHQ-9 forms the depression module of the Patient Health Questionnaire (PHQ), which is the self-administered version of the PRIME-MD diagnostic tool developed by Pfizer. It has been validated for adolescent use (19). Participants scored their frequency of experience with each of the nine DSM-IV criteria over the last two weeks (e.g. poor appetite or overeating, feeling tired or having little energy, with their 4-point Likert-scale ratings representing frequencies ('0' is not at all, '1' is several days, '2' is more than half the days, '3' is nearly every day). Scores were then totaled, with cut off points correlating to level of perceived depression (0–4 = none, 5–9 = mild, 10–14 = moderate, 15–19 = moderately severe, 20–27 = severe). Participants who scored above 4 were considered to exhibit depressive symptoms.

- Anxiety

The 7-item Generalized Anxiety Disorder Scale (GAD-7) was used to assess anxiety symptoms. GAD-7 forms the anxiety module of the PHQ. The GAD-7 items correspond with DSM-IV criteria and use the same 4-point Likert-scale ratings as PHQ-9 to assess frequency of experience with criteria over the last two weeks, and thus presence and severity of anxiety. Participants rated each item, and scores were then totaled. Cut-off points correlating to level of perceived anxiety were: 0–4 = none, 5–9 = mild, 10–14 = moderate, 15–21 = severe. Participants who scored above 4 were considered to exhibit anxiety symptoms.

- Stress

The Perceived Stress Scale (PSS-10) was used to assess participants' perception of stress. Participants scored the frequency of ten different relevant items (e.g. feeling that 'things were going your way') in the last month using a 5-point Likert-scale system (0 = never, 1 = almost never, 2 = sometimes, 3 = fairly often, 4 = very often). Four positively stated items (namely questions 2, 4, 5 and 10) had their ratings reversed (0 = 4, 1 = 3, 2 = 2, 3 = 1 and 4 = 0) before ratings were totaled to score participants. Different score intervals correlated with different levels of perceived stress (0–13 = low, 14–26 = moderate, 27–40 = high).

- General information

Participants inputted general demographical information such as gender, age, school year, country currently residing in and country studying in. We also asked questions relevant to their lockdown experience, regarding topics such as substance use (previous and current uses as well as changes in patterns of use) and issues with online learning and exam cancellations (experience, and whether this was problematic). Participants were also able to report any previously diagnosed mental illnesses, and whether they experienced any change in this during lockdown.

Statistical analysis

For depression and anxiety, higher levels correspond to having a total PHQ-9/GAD-7 score of more than 4 (0–4 = symptoms not present, 4+ = symptoms present). For stress, higher levels correspond to having a total PSS-10 score of more than 26 (0–26 = low/moderate, 26+ = high).

Demographical and lockdown-related variables were compared between participants of differing levels of depression (Present/Not present), anxiety (Present/Not present) and perceived stress ('low'/'moderate to high'). Chi-square test was used for categorical variables, while Student's t-test was used for continuous variables. Logistic (nominal) regression analysis was used to evaluate significant associations between predictive variables and presence of depression, anxiety and severity of perceived stress. Odds ratios (ORs) of predictive factors were reported, together with 95% confidence intervals (CIs). Statistical significance was set at $p < 0.05$. SPSS software (version 22) was used to perform statistical analysis.

Results

Baseline demographical and lockdown-related variables

Of 392 respondents (56.4% male, 43.1% female, 0.3% non-binary), mean (SD) age was 15.5 (1.7) years. Respondents reported currently living in Thailand (59.2%), the United Kingdom (26.5%), Hong Kong (3.3%), Singapore (1.8%), the United States (1.5%), Malaysia (1.2%), China (0.8%), Australia (0.5%), Belgium (0.5%), India (0.5%), Russia (0.5%), Saudi Arabia (0.5%), Italy (0.3%), Japan (0.3%), South Korea (0.3%), Luxembourg (0.3%), New Zealand (0.3%), Nigeria (0.3%), Turkey (0.3%) and Zambia (0.3%). Majority were in Year 12 (34.2%) and Year 10 (20.9%).

Since their physical school closure, 82.9% reported not having used public transport at all, while 52.3% had not talked face-to-face with someone not in their household. Around half (46.4%) found not being able to go out to shops problematic. Alcohol use was reported in 37.2% (11.0% increased usage, 14.0% reduced usage while 12.2% stayed the same). Use of cigarettes, e-cigarettes and vapes was reported in 17.6% (6.6% increased usage, 7.7% reduced usage while 3.3% stayed the same). Cannabis use was reported in 13.1% (3.6% increased usage, 6.4% reduced usage while 3.1% stayed the same). Having undergone mandatory self-quarantine was reported by 49.7%. 92.1% reported quarantining with their parents, 1.8% with family but without parents, and 5.5% with others.

Prevalence of mental health conditions

Depression was identified in 58.7% (29.8% mild, 16.1% moderate, 7.9% moderately severe, 4.8% severe), and anxiety in 40.3% (22.2% mild, 10.7% moderate, 7.4% severe). Severities of stress ranged from low (35.7%) to moderate (54.6%) to high (9.7%). 21.4% reported previous depression (9.4% worsened, 8.7% unchanged, 3.3% improved). 35.5% reported previous anxiety (15.8% worsened, 13.3% unchanged, 6.4% improved). 45.2% reported previous stress (19.4% worsened, 16.1% unchanged, 9.7% improved). For statistical analysis, we categorised depression and anxiety into two groups, one indicating presence (those who scored mild and above) and another indicating absence of mental illness symptoms. Stress was categorised to form two groups: "High" and "Moderate/Low".

Factors associated with depressive symptoms

- Univariate analysis

Table 1
Demographic and lockdown-related variables with depressive symptoms

	Exhibiting depressive symptoms		No depressive symptoms		χ^2	df	p-values
	<i>n</i>	%	<i>n</i>	%			
UK School Year							
8/9/10	67	40.1	100	59.9	41.306	1	< 0.001
11/12/13	163	72.4	62	27.6			
Female	108	63.9	61	36.1	4.015	2	0.134
Age (mean / SD)	(15.9)	(1.6)	(15.0)	(1.8)	$t_{388} =$ -5.274	-	< 0.001
Country currently living in							
Thailand	116	50.0	116	50.0	20.698	2	< 0.001
UK	77	74.0	27	26.0			
Others	37	71.2	154	28.8			
Country currently studying in							
Thailand	101	52.3	92	47.7	6.949	2	0.031
UK	108	64.7	59	35.3			
Others	20	69.0	9	31.0			
Area currently living in							
Urban	138	56.1	108	43.9	4.521	2	0.104
Peri-urban	49	57.6	36	42.4			
Rural	42	71.2	17	28.8			
Being under mandatory self-quarantine	128	65.6	67	34.4	7.769	1	0.005
Level of feeling that COVID-19 affects daily life							
Great effect	140	64.5	77	35.5	10.066	2	0.007
Univariate analysis was conducted using chi-square test and t-test. $p < 0.05$ was considered significant.							

	Exhibiting depressive symptoms		No depressive symptoms		χ^2	df	p-values
	<i>n</i>	%	<i>n</i>	%			
Slight/little effect	83	53.9	71	46.1			
No effect	7	33.3	14	66.7			
Using public transport since the physical closure of school	21	31.3	46	68.7	24.894	1	< 0.001
Level of thinking that catching COVID-19							
High chance	7	33.3	14	66.7	6.006	2	0.050
Moderate chance	84	61.3	53	38.7			
Little/no chance	139	59.4	95	40.6			
Being worried about going outside							
Not at all	83	64.8	45	35.2	18.622	2	< 0.001
Slightly/a bit worried	121	63.0	71	37.0			
Very worried	26	36.1	46	63.9			
Experience problems with sleep by thinking about COVID-19	61	67.0	30	33.0	3.415	1	0.065
Online learning							
Experience with problems	170	68.5	78	31.5	30.117	2	< 0.001
Experience without any problems	43	38.1	70	61.9			
No experience	16	53.3	14	46.7			
Cannot meet friends regularly							
Experience with problems	188	62.3	114	37.7	8.020	2	0.018
Experience without any problems	35	50.7	34	49.3			
No experience	7	35.0	13	65.0			
Cannot go out to eat							

Univariate analysis was conducted using chi-square test and t-test. $p < 0.05$ was considered significant.

	Exhibiting depressive symptoms		No depressive symptoms		χ^2	df	p-values
	<i>n</i>	%	<i>n</i>	%			
Experience with problems	142	64.3	79	35.7	9.753	2	0.008
Experience without any problems	78	54.9	64	45.1			
No experience	10	35.7	18	64.3			
Cannot go out to shop							
Experience with problems	134	73.6	48	26.4	31.840	2	< 0.001
Experience without any problems	77	47.8	84	52.2			
No experience	19	39.6	29	60.4			
Depression							
Has decreased or stayed the same	38	80.9	9	19.1	30.057	2	< 0.001
Has increased	33	89.2	4	10.8			
Never had it	159	51.6	149	48.4			
Anxiety							
Has decreased or stayed the same	44	57.1	33	42.9	49.361	2	< 0.001
Has increased	61	98.4	1	1.6			
Never had it	125	49.4	128	50.6			
Stress							
Has decreased or stayed the same	65	64.4	36	35.6	59.013	2	< 0.001
Has increased	71	93.4	5	6.6			
Never had it	94	43.7	121	56.3			
Alcohol							
Never used	123	50.4	121	49.6	19.009	2	< 0.001

Univariate analysis was conducted using chi-square test and t-test. $p < 0.05$ was considered significant.

	Exhibiting depressive symptoms		No depressive symptoms		χ^2	df	p-values
	<i>n</i>	%	<i>n</i>	%			
Reduced	38	69.1	17	30.9			
Used the same or increased	68	74.7	23	25.3			
Cigarettes, e-cigarettes, vapes							
Never used	171	52.9	152	47.1	25.531	2	< 0.001
Reduced	24	80.0	6	20.0			
Used the same or increased	35	89.7	4	10.3			
Cannabis							
Never used	182	53.5	158	46.5	30.254	2	< 0.001
Reduced	23	92.0	2	8.0			
Used the same or increased	25	96.2	1	3.8			
Other drugs							
Never used	196	55.2	159	44.8	17.901	2	< 0.001
Reduced	22	91.7	2	8.3			
Used the same or increased	11	91.7	1	8.3			
Univariate analysis was conducted using chi-square test and t-test. $p < 0.05$ was considered significant.							

df, degrees of freedom; SD, standard deviation; UK, United Kingdom.

Higher levels of depression were found in Years 11 and higher (72.4% vs 40.1%, $p < 0.001$), residents of the UK and other countries versus Thailand (74.0%, 71.2% vs 50.0%, $p < 0.001$), those who studied in the UK and other countries versus Thailand, (69.0%, 64.7% vs 52.3%, $p = 0.031$) and older participants ($M = 15.90$, $SD = 1.58$ for depressed vs $M = 15.01$, $SD = 1.755$ for not depressed, $p < 0.001$) (Table 1).

Depression was higher in those who reported previous depression, anxiety, and stress ($p < 0.001$). Higher levels of depression were also reported in those who had undergone mandatory self-quarantine, felt COVID-19 had affected their daily life, reported not using public transport since school closure, believed that they would have low chance of contracting COVID-19 themselves, and had no worries about going outside ($p < 0.05$). In addition, those who perceived problems with the consequences of social distancing,

including not being able to meet friends, inability to eat out, inability to go shopping and online learning, all displayed higher levels of depression ($p < 0.05$) (Table 1).

Those who reported use of alcohol, cigarettes/e-cigarettes/vapes, cannabis, and/or other drugs experienced higher levels of depression than those who never used them. Furthermore, those who experienced unchanged or increased use of alcohol, cigarettes/e-cigarettes/vapes and cannabis during lockdown experienced higher levels of depression than those who experienced reduced use of these substances ($p < 0.001$) (Table 2).

- Multivariate analysis

By multivariate logistic regression analysis, we found that older year groups (Year 11/12/13 compared to Years 8/9/10, OR = 2.255, 95% CI = 1.11–4.58), females (compared to males, OR = 2.46, 95% CI = 1.19–5.08) and participants not located in the UK or Thailand (compared to being in Thailand, OR = 3.07, 95% CI = 1.055–8.94) had significantly increased risk of depression (Table 2).

Table 2

Demographic and lockdown-related variables with depressive symptoms using multivariate analysis

Variables	Exhibiting depressive symptoms		
	ORs	95% CI	p-values
UK School Year			
11/12/13	2.255	1.11–4.58	0.024
8/9/10	1		
Gender			
Female	2.46	1.19–5.08	0.015
Male	1		
Depression			
Has decreased or stayed the same	4.91	1.33–18.20	0.017
Has increased	0.88	0.145–5.38	0.892
Never had it	1		
Anxiety			
Has decreased or stayed the same	0.575	0.19–1.71	0.320
Has increased	15.43	1.46–163.05	0.023
Never had it	1		
Stress			
Has decreased or stayed the same	1.64	0.63–4.30	0.313
Has increased	17.62	4.04–76.81	0.000
Never had it	1		
Country currently living in			
UK	2.29	0.94–5.625	0.07
Others	3.07	1.055–8.94	0.04
Thailand	1		
Cannabis			
Used the same or increased	5.76	0.34–96.69	0.224

Multivariate analysis was conducted using logistic nominal regression. $p < 0.05$ was considered significant.

Variables	Exhibiting depressive symptoms		
	ORs	95% CI	p-values
Reduced	10.20	1.19–87.18	0.034
Never used	1		
Multivariate analysis was conducted using logistic nominal regression. $p < 0.05$ was considered significant.			

OR, odds ratio; CI, confidence interval; UK, United Kingdom.

Higher levels of depression were found to be significantly associated with an increase in levels of previous anxiety (OR = 15.43, 95% CI = 1.46-163.05), and previous stress (OR = 17.62, 95% CI = 4.04–76.81) during lockdown, compared to those who reported never having previous anxiety or stress. Those who reported decreased or equal levels of previous depression during lockdown still had higher levels of depression than those who never had previous depression before the lockdown (OR = 4.91, 95% CI = 1.33–18.20).

Compared to those who had never used cannabis, previous users who experienced decreased use during lockdown had higher levels of depression (OR = 10.20, 95% CI = 1.19–87.18).

Factors associated with anxiety symptoms

- Univariate analysis

Table 3
Demographic and lockdown-related variables with anxiety symptoms

Variables	Exhibiting anxiety symptoms		No anxiety symptoms		χ^2	df	p-values
	<i>n</i>	%	<i>n</i>	%			
UK School Year					25.627	1	< 0.001
8/9/10	43	25.7	124	74.3			
11/12/13	115	51.1	110	48.9			
Female	85	50.3	84	49.7	13.961	2	0.001
Age (mean/SD)	(15.2)	(1.8)	(15.2)	(1.6)	$t_{388} =$ -4.232	-	0.005
Country currently living in							
Thailand	82	35.3	150	64.7	6.924	2	0.031
UK	51	49.0	53	51.0			
Others	25	48.1	27	51.9			
Country currently studying in					2.014	2	0.365
Thailand	72	37.3	121	62.7			
UK	72	43.1	95	56.9			
Others	14	48.3	15	51.7			
Area currently living in							
Urban	94	38.2	152	61.8	4.371	2	0.112
Peri-urban	32	37.6	53	62.4			
Rural	31	52.5	28	47.5			
Being under mandatory self-quarantine?	85	43.6	110	56.4	1.739	1	0.187
Level of feeling that COVID-19 affects daily life							
Great effect	95	43.8	122	56.2	2.984	2	0.225
Slight/little effect	6	28.6	15	71.4			
Univariate analysis was conducted using chi-square test and t-test. $p < 0.05$ was considered significant.							

Variables	Exhibiting anxiety symptoms		No anxiety symptoms		χ^2	df	p-values
	<i>n</i>	%	<i>n</i>	%			
No effect	57	37.0	97	63.0			
Using public transport since the physical closure of school	9	13.4	58	86.6	24.256	1	< 0.001
Level of thinking that catching COVID-19							
High chance	6	28.6	15	71.4	1.741	2	0.419
Moderate chance	53	38.7	84	61.3			
Little/no chance	99	42.3	135	57.7			
Being worried about going outside							
Not at all	52	40.6	76	59.4	11.265	2	0.004
Slightly/a bit worried	89	46.4	103	53.6			
Very worried	17	23.6	55	76.4			
Problems with sleep by thinking about COVID-19?	50	54.9	41	45.1	10.556	1	0.001
Online learning							
Experience with problems	112	45.2	136	54.8	7.504	2	0.023
Experience without any problems	34	30.1	79	69.9			
No experience	11	36.7	19	63.3			
Cannot meet friends regularly							
Experience with problems	129	42.7	173	57.3	3.546	2	0.170
Experience without any problems	24	34.8	45	65.2			
No experience	5	25.0	15	75.0			
Cannot go out to eat							
Experience with problems	101	45.7	120	54.3	6.925	2	0.031
Experience without any problems	50	35.2	92	64.8			
No experience	7	25.0	21	75.0			

Univariate analysis was conducted using chi-square test and t-test. $p < 0.05$ was considered significant.

Variables	Exhibiting anxiety symptoms		No anxiety symptoms		χ^2	df	p-values
	<i>n</i>	%	<i>n</i>	%			
Cannot go out to shop							
Experience with problems	91	50.0	91	50.0	13.646	2	0.001
Experience without any problems	54	33.5	107	66.5			
No experience	13	27.1	35	72.9			
Depression							
Has decreased or stayed the same	33	70.2	14	29.8	58.802	2	< 0.001
Has increased	31	83.8	6	16.2			
Never had it	94	30.5	214	69.5			
Anxiety							
Has decreased or stayed the same	36	46.8	41	53.2	71.787	2	< 0.001
Has increased	53	85.5	9	14.5			
Never had it	69	27.3	184	72.7			
Stress							
Has decreased or stayed the same	45	44.6	56	55.4	69.822	2	< 0.001
Has increased	60	78.9	16	21.1			
Never had it	53	24.7	162	75.3			
Alcohol							
Never used	81	33.2	163	66.8	14.963	2	0.001
Reduced	27	49.1	28	50.9			
Used the same or increased	50	54.9	41	45.1			
Cigarettes, e-cigarettes, vapes							
Never used	120	37.2	203	62.8	9.148	2	0.010
Reduced	14	46.7	16	53.3			

Univariate analysis was conducted using chi-square test and t-test. $p < 0.05$ was considered significant.

Variables	Exhibiting anxiety symptoms		No anxiety symptoms		χ^2	df	p-values
	<i>n</i>	%	<i>n</i>	%			
Used the same or increased	24	61.5	15	38.5			
Cannabis							
Never used	126	37.1	214	62.9	12.305	2	0.002
Reduced	15	60.0	10	40.0			
Used the same or increased	17	65.4	9	34.6			
Other drugs							
Never used	136	38.3	219	61.7	8.499	2	0.014
Reduced	13	54.2	11	45.8			
Used the same or increased	9	75.0	3	25.0			
Univariate analysis was conducted using chi-square test and t-test. $p < 0.05$ was considered significant.							

df, degrees of freedom; SD, standard deviation; UK, United Kingdom.

Higher levels of anxiety were found in Years 11 and higher (51.1% vs 25.7%, $p < 0.001$), females (50.3% vs 32.6%, $p = 0.001$), residents of the UK and other countries versus Thailand (49.0%, 48.1% vs 35.3%, $p = 0.031$) (Table 4.1) and older participants ($M = 15.97$, $SD = 1.56$ for anxious vs $M = 15.24$, $SD = 1.75$ for not, $p = 0.005$) (Table 3).

Anxiety was higher in those who reported previous depression, anxiety, and stress ($p < 0.001$). Higher levels of anxiety were also reported in those who reported not using public transport since school closure, and 'sometimes or regularly' had sleep problems due to thinking about COVID-19 ($p < 0.05$). In addition, those who perceived problems with the consequences of social distancing, including online learning, inability to eat out and inability to go shopping, all displayed higher levels of anxiety ($p < 0.05$). Conversely, the lowest levels of anxiety were found in those who were the most worried about going outside ($p = 0.004$) (Table 3).

Those who reported use of alcohol, cigarettes/e-cigarettes/vapes, cannabis, and/or other drugs experienced higher levels of anxiety than those who never used them. Additionally, those who experienced unchanged or increased use of all four substance categories during lockdown experienced higher levels of anxiety than those who experienced reduced use ($p < 0.05$) (Table 3).

- Multivariate analysis

We found that females (compared to males, OR = 3.075, 95% CI = 1.60–5.92) and participants who had not used public transport at all since the physical closure of their school (compared to those who sometimes used it, OR = 8.31, 95% CI = 2.49-27.755) had significantly increased risk of anxiety (Table 4).

Table 4

Demographical and lockdown-related variables with anxiety symptoms using multivariate analysis

Variables	Exhibiting anxiety symptoms		
	ORs	95% CI	p-values
Gender			
Female	3.075	1.60–5.92	0.001
Male	1		
Using public transport since the physical closure of school			
Not at all/No	8.31	2.49–27.755	0.001
Sometimes/Yes	1		
Depression			
Has decreased or stayed the same	6.585	2.13–20.30	0.001
Has increased	3.21	0.88–11.63	0.076
Never had it	1		
Anxiety			
Has decreased or stayed the same	1.08	0.42–2.80	0.876
Has increased	4.61	1.54–13.795	0.006
Never had it	1		
Stress			
Has decreased or stayed the same	1.13	0.50–2.54	0.774
Has increased	3.89	1.52–9.92	0.005
Never had it	1		
Multivariate analysis was conducted using logistic nominal regression. $p < 0.05$ was considered significant.			

OR, odds ratio; CI, confidence interval.

Higher levels of anxiety were found to be significantly associated with an increase in levels of previous anxiety (OR = 4.61, 95% CI = 1.54-13.795), and previous stress (OR = 3.89, 95% CI = 1.52–9.92) during lockdown, compared to those who reported never having previous anxiety or stress. Those who reported

decreased or equal levels of previous depression during lockdown still had higher levels of anxiety than those who never had previous depression before the lockdown (OR = 6.585, 95% CI = 2.14–20.30).

Factors associated with perceived stress

- Univariate analysis

Table 5

Demographical and lockdown-related variables with high levels of perceived stress using chi-square test and t-test

Variables	High levels of perceived stress		Low/moderate levels of perceived stress		χ^2	df	p-value
	<i>n</i>	%	<i>n</i>	%			
UK School Year							
8/9/10	5	3.0	162	97.0	14.919	1	< 0.001
11/12/13	33	14.7	192	85.3			
Female	29	17.2	140	82.8	29.323	2	< 0.001
Age (mean/SD)	(16.5)	(1.1)	(15.4)	(1.7)	$t_{388} =$ -3.726	-	< 0.001
Country currently living in							
Thailand	21	9.1	211	90.9	2.682	2	0.262
UK	14	13.5	90	86.5			
Others	3	5.8	49	94.2			
Country currently studying in							
Thailand	15	7.8	178	92.2	4.384	2	0.112
UK	22	13.2	145	86.8			
Others	1	3.4	28	96.6			
Area currently living in							
Urban	12	20.3	47	79.7	8.893	2	0.012
Peri-urban	7	8.2	78	91.8			
Rural	19	7.7	227	92.3			
Being under mandatory self-quarantine	25	12.8	170	87.2	4.333	1	0.037
Level of feeling that COVID-19 affects daily life							
Great effect	26	12.0	191	88.0	3.100	2	0.212
Univariate analysis was conducted using chi-square test and t-test. $p < 0.05$ was considered significant.							

Variables	High levels of perceived stress		Low/moderate levels of perceived stress		χ^2	df	p-value
	<i>n</i>	%	<i>n</i>	%			
Slight/little effect	10	6.5	144	93.5			
No effect	2	9.5	19	90.5			
Using public transport since the physical closure of school	1	1.5	66	98.5	6.209	1	0.013
Level of thinking of catching COVID-19							
High chance	2	9.5	19	90.5	0.696	2	0.706
Moderate chance	11	8.0	126	92.0			
Little/no chance	25	10.7	209	89.3			
Being worried about going outside							
Not at all	11	8.6	117	91.4	0.292	2	0.864
Slightly/a bit worried	20	10.4	172	89.6			
Very worried	7	9.7	65	90.3			
Problems with sleep by thinking about COVID-19?	17	18.7	74	81.3	10.935	1	0.001
Online learning							
Experience with little or many problems	32	12.9	216	87.1	9.295	2	0.010
Experience without any problems	3	2.7	110	97.3			
No experience	3	10.0	27	90.0			
Cannot meet friends regularly							
Experience with problems	35	11.6	267	88.4	5.626	2	0.060
Experience without any problems	3	4.3	66	95.7			
No experience	0	0.0	20	100.0			
Cannot go out to eat							

Univariate analysis was conducted using chi-square test and t-test. $p < 0.05$ was considered significant.

Variables	High levels of perceived stress		Low/moderate levels of perceived stress		χ^2	df	p-value
	<i>n</i>	%	<i>n</i>	%			
Experience with problems	27	12.2	194	87.8	4.304	2	0.116
Experience without any problems	8	5.6	134	94.4			
No experience	3	10.7	25	89.3			
Cannot go out to shop							
Experience with problems	23	12.6	159	87.4	3.367	2	0.186
Experience without any problems	12	7.5	149	92.5			
No experience	3	6.3	45	93.8			
Depression							
Has decreased or stayed the same	4	8.5	43	91.5	30.341	2	< 0.001
Has increased	13	35.1	24	64.9			
Never had it	21	6.8	287	93.2			
Anxiety							
Has decreased or stayed the same	8	10.4	69	89.6	23.431	2	< 0.001
Has increased	16	25.8	46	74.2			
Never had it	14	5.5	239	94.5			
Stress							
Has decreased or stayed the same	8	7.9	93	92.1	41.307	2	< 0.001
Has increased	22	28.9	54	71.1			
Never had it	8	3.7	207	96.3			
Alcohol							
Never used	19	7.8	225	92.2	3.282	2	0.194
Reduced	6	10.9	49	89.1			

Univariate analysis was conducted using chi-square test and t-test. $p < 0.05$ was considered significant.

Variables	High levels of perceived stress		Low/moderate levels of perceived stress		χ^2	df	p-value
	<i>n</i>	%	<i>n</i>	%			
Used the same or increased	13	14.3	78	85.7			
Cigarettes, e-cigarettes, vapes							
Never used	26	8.0	297	92.0	6.666	2	0.036
Reduced	4	13.3	26	86.7			
Used the same or increased	8	20.5	31	79.5			
Cannabis							
Never used	27	7.9	313	92.1	11.119	2	0.004
Reduced	4	16.0	21	84.0			
Used the same or increased	7	26.9	19	73.1			
Other drugs							
Never used	32	9.0	323	91.0	2.182	2	0.336
Reduced	4	16.7	20	83.3			
Used the same or increased	2	16.7	10	83.3			
Univariate analysis was conducted using chi-square test and t-test. $p < 0.05$ was considered significant.							

df, degrees of freedom; SD, standard deviation; UK, United Kingdom.

Higher levels of high stress were found in Years 11 and higher (14.7% vs 3.0%, $p < 0.001$), females (17.2% vs 3.6%, $p < 0.001$) (Table 6.1) and older participants ($M = 16.50$, $SD = 1.08$ for high stress vs $M = 15.24$, $SD = 1.75$ for low/moderate stress, $p < 0.001$) (Table 6.2).

High stress levels were greater in those who reported previous depression, anxiety, and stress which had increased/worsened due to lockdown ($p < 0.001$). Higher levels of high stress were also reported in those who lived in rural areas, reported not using public transport since school closure, 'sometimes or regularly' had sleep problems due to thinking about COVID-19, had undergone mandatory self-quarantine, and perceived problems with online learning ($p < 0.05$) (Table 6.1).

Those who reported use of cigarettes/e-cigarettes/vapes and cannabis experienced higher levels of high stress than those who never used them. Additionally, those who experienced unchanged or increased use of the two substances experienced higher levels of high stress than those who experienced reduced use ($p < 0.05$) (Table 6.1).

- Multivariate analysis

Significantly increased risk of high stress was found in those who had no worry (OR = 2.705, 95% CI = 1.02–7.205) or slight worry (OR = 2.78, 95% CI = 1.19–6.53) about going outside, compared to those very worried. Those who found not being able to go shopping problematic (compared to those who were able to go shopping, OR = 4.03, 95% CI = 1.24–13.06) had significantly increased risk of high stress.

Participants who experienced increased or unchanged alcohol use during lockdown were found to not have as high levels of high stress as those who had never used alcohol (OR = 0.27, 95% CI = 0.11–0.69) (Table 6).

Table 6

Demographic and lockdown-related variables with high levels of high perceived stress using multivariate analysis

Variables	Higher levels of high stress		
	ORs	95% CI	p-values
Depression			
Has decreased or stayed the same	14.61	2.83–75.42	0.001
Has increased	0.66	0.14–3.02	0.590
Never had it	1		
Anxiety			
Has decreased or stayed the same	0.52	0.17–1.56	0.242
Has increased	4.53	0.14–3.02	0.045
Never had it	1		
Stress			
Has decreased or stayed the same	2.08	0.845–5.14	0.111
Has increased	15.43	3.665–64.98	0.000
Never had it	1		
Being worried about going outside			
Not at all	2.705	1.02–7.205	0.046
Slightly/a bit worried	2.78	1.19–6.53	0.019
Very worried	1		
Cannot go out to shop			
Experience with little or many problems	4.03	1.24–13.06	0.02
Experience without any problems	1.49	0.49–4.54	0.48
No experience	1		
Alcohol			
Used the same or increased	0.27	0.11–0.69	0.006
Reduced	0.53	0.18–1.53	0.241
Never used	1		
Multivariate analysis was conducted using logistic nominal regression. $p < 0.05$ was considered significant.			

OR, odds ratio; CI, confidence interval.

Higher levels of high stress were found to be significantly associated with an increase in levels of previous anxiety (OR = 4.53, 95% CI = 1.03–19.83), and previous stress (OR = 15.43, 95% CI = 3.665–64.98), compared to those who never had anxiety or stress during lockdown. Those who reported decreased or equal levels of previous depression during lockdown still had higher levels of high stress than those who never had previous depression before the lockdown (OR = 14.61, 95% CI = 2.83–75.42).

Discussion

We conducted an online survey study which found a high prevalence of mental health conditions among secondary school students across a range of countries during COVID-19 lockdown in May and June 2020. Approximately 60% had depression, 40% had anxiety and 10% experienced a high level of stress. Being female enhanced depression and anxiety. Being enrolled in the last three years of high/secondary school enhanced depression. Changes in patterns of substance use were also significantly associated with anxiety and stress.

Although one must take into account the environment in which adolescents live in, as it will ultimately affect their mental health, it is clear to see that our findings demonstrate a higher prevalence of depressive, anxiety and stress symptoms. Compared to previous studies done during arguably more normal times, our prevalence of depressive symptoms was higher than 53.2% in Norwegian secondary school students (20), 55.9% in Nigerian secondary school students (21), 52.9% in Chinese adolescents (22). Similarly, our findings indicate a higher prevalence of anxiety compared to around 10% in Canadian secondary school students (23) and higher-education students from the UK (24) from studies conducted during non-COVID19 times. High stress level was also found to be more common than the 4% among Thai students aged 15–19 years (25) before COVID-19.

Furthermore, a recent study conducted on Chinese adolescents aged 12–18 years also demonstrated similar findings of elevated prevalence (43.7% exhibiting depressive symptoms, 37.4% exhibiting symptoms of anxiety) during COVID-19 (15). There were no reports of stress prevalence among secondary school students during COVID-19.

In our study, being female was found to be significantly associated with higher levels of depression and anxiety. This was found to be in accordance with previous studies concerning lockdown mental health (9, 26, 27), as well as during more general times (28, 29). However, Cao et al. did not find gender to be significantly associative with higher levels of anxiety during COVID-19 lockdown (30).

Being enrolled in senior high school (Years 11–13 or Grades 10–12) was found to be significantly associated with higher levels of depression, but not anxiety, in our study. Zhou et al. found similarly significant associations with both anxiety and depression during COVID-19 (15).

A combination of emotions such as boredom, anxiety, depression and fear may lead to increased substance use as a means of coping (31). With many countries closing down shops and public services (32), with some even enacting coronavirus alcohol bans (33), many may find themselves in forced abstinence (12, 34). Access to recreational substances normally used which have been limited, for example due to lockdown or otherwise, can exacerbate mental health effects (10, 11, 35). We found that reports of decreased cannabis use were significantly associated with higher levels of depression. Furthermore, increased or unchanged alcohol use was found to be associated with lower levels of stress. Despite likely being a protective factor in this study, adolescent alcohol use has been found to predict development of alcohol problems into young adulthood (36), so should be treated with caution. In times of lockdown, those with substance use disorders tend to be ignored (10). This problem is further worsened due to the fact that adolescents who use substances tend to not want to disclose their use, for example to their parents. Therefore, there is a chance that those concealing their use within their household may face adverse effects. Lack of access to supervised substance use may also increase hazardous use, due to interruption of opening hours of harm reduction services as well as general fears of COVID-19 infection among clients (37). The United Nations Office on Drugs and Crime (UNODC) reported in May 2020 that COVID-19 may have adverse effects on drug supply chains. This may lead to harmful adaptations by both producers, such as reduced street purity, and users, such as a shift towards drug injection as well as sharing paraphernalia (38).

There are some limitations in this study. This is a cross-sectional study and we were therefore not able to assess any long-term impacts or progressions of mental health conditions like a longitudinal study would be able to. Furthermore, due to our use of snowball sampling, we were unable to record or know the number of people who had been formally 'invited' to take part in the survey. Moreover, we found that other studies examining the psychological impacts of lockdown, particularly concerning past outbreaks, assessed post-traumatic stress disorder (PTSD) as well. We did not choose to assess this as the progression of the COVID-19 pandemic is far from over. Different countries will also have been affected with varying severity, which could ultimately lead to different PTSD outcomes. Almost 60% of our participants lived in Thailand, where COVID-19 has struck relatively less hard. As of 7 September 2020, Thailand has had 3,445 COVID-19 cases, compared to 347,152 cases in the UK. Their death rates per million people are also extremely different, with 0.8 for Thailand, but 611 for the UK (18). Nevertheless, it will be important to assess it once lockdown ends, as studies have demonstrated the long-lasting PTSD caused by lockdown and quarantine (31).

Conclusions

In conclusion, amidst lockdown measures, around half of adolescents exhibited depression and/or anxiety. Particular attention must be paid to females, older adolescents and substance users. Girl-centred mental health support platforms (39, 40) should be readily available, and tailored to fit specific countries' contexts. Schools must closely monitor and act upon any concerns which arise from their students, especially the more senior individuals who may be particularly stressed about academic commitments such as exam cancellations (13), university preparation and work experience opportunities. However,

apart from their parents, schools must also monitor the child's mental health wellbeing in general as school forms a very important aspect of their life and these changes due to COVID-19 could be drastic for some. Harm reduction services must receive support to maintain service delivery, perhaps adapting and utilising innovative interventions such as telemedicine-delivered prescription and treatment (41), as well as a focus on more tailoring towards adolescent users.

Declarations

Ethics approval and consent to participate

The study was approved by the Institutional Review Board of the Faculty of Medicine, Chulalongkorn University. Consent by action was obtained via a digitalised consent form, explaining the objectives and contents of the survey as well as potential risks and intended benefits. Despite most participants being under 18, parental consent was waived due to the anonymous nature of the survey.

Consent for publication

Not applicable

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request. All data generated or analysed during this study are included in this published article.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

GP conceptualized and designed the study, collected data, performed formal analysis, wrote the first draft of manuscript, reviewed and edited the manuscript. RK designed the study, supervised data collection, performed formal analysis, reviewed and edited the manuscript. Both authors read and approved the final manuscript.

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