ORIGINAL ARTICLE

Levels and risk factors associated with depression, anxiety, and stress among COVID-19 infected adults after hospital discharge in a Southern Province of Thailand

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ABSTRACT

The long-term effects on the mental health of people living with COVID-19 are emerging as a global threat to public health. This study aimed to determine the levels and risk factors associated with depression, anxiety and stress (DAS) among COVID-19 infected adults discharged from a hospital in a high-risk area in Thailand. A cross-sectional study was performed with 512 participants aged 18 years and above who had been infected with COVID-19 and discharged between 3 and 12 months in Hat Yai District, Songkhla Province, Thailand during March, 2022. A structured questionnaire was used to collect the data based on the short version of the Depression, Anxiety, and Stress Scale – 21 Items (DASS-21) with a content validity index of 0.89 and Cronbach's alpha coefficient of 0.86. Demographic information, medical history, and the present health status of each participant were also collected. Almost all the respondents had severe depression (62.7%), extremely severe anxiety (82.6%), and moderate and severe stress (45.3% and 41.0%, respectively). There was a positive correlation between depression and stress among COVID-19 survivors ($R = 0.155$, $p < 0.001$). Factors associated with depression were a medical history of pulmonary disease ($\beta = 1.443$, $p = 0.042$) and higher education status ($\beta = 1.067$, $p < 0.001$), whereas lower body mass index (BMI) ($\beta = 0.455$, $p < 0.001$) and lower monthly income ($\beta = 1.067$, $p < 0.001$) were associated with stress. Participants who were tested for COVID-19 for travel, study, job, and examination application (all $\beta > 0.575$, all $p = 0.001$), and lower BMI (all $\beta > 0.601$, all $p < 0.011$) were also associated with anxiety. The findings of our study could provide baseline information for follow-up intervention initiatives to prevent long-term effects of COVID-19.

Key words:
depression; anxiety; stress; COVID-19

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INTRODUCTION

Since March 2020, the World Health Organization (WHO) has announced the emergence of the global outbreak of Corona Virus Disease 2019 (COVID-19).[1] By February 2022, the disease has infected nearly 387 million people and caused more than 5.7 million death worldwide.[2] Thailand was the first country outside China to detect a case of COVID-19 in January 2020.[3] With the wide and rapid spread of COVID-19, Thailand's government implemented a strict national lockdown with most businesses, schools, institutions closed and restricted transportation between regions of the country. In addition, countless measures were contemporaneously applied to cope with situations such as isolation, quarantine, social distancing, frequent hand washing, and mask-wearing in public areas.[3,4] At the beginning of February 2022, the effect of the fifth wave of the pandemic remained in multiple provinces of Thailand with 2,531,051 cumulative COVID-19 cases, of which there were 22,344 deaths.[2] In the south of Thailand, Hat Yai district in Songkhla province was placed as a high-risk area with a rate of 4,149 COVID-19 cases/100,000 population.[5] In particular, there were almost 2,234 people infected with COVID-19 living in Khlong Hae sub-district among a total population of 41,516 people (5.38%).[5,6]

During the pandemic, issues concerning the mental health of individuals infected with COVID-19 should not be ignored. According to Global Burden Disease 2020, the COVID-19 pandemic resulted in increased cases of major depressive and anxiety disorders by up to 27.6% and 25.6% worldwide.[7] The existing literature implied that COVID-19 has long-term consequences with cognitive impairment, fatigue, and various psychological sequelae including depression, anxiety, sleep problem, and acute stress.[8-11] A number of studies recently found that the presence of mental health problems such as depression, anxiety, and stress has a high prevalence among people who recovered from COVID-19.[12-14] During the hospital stay, patients undergo feelings of isolation, anxiety, depressed mood, fear about consequences of the disease, treatment outcome, financial condition, and stigma leading to depressive symptoms and anxiety.[15] A systematic review reported that 11% – 28% of recovered people have depressive symptoms after more than 12 weeks of discharge from the hospital.[16] Elevating rates of psychological symptoms may stem from social isolation, physical distancing, and the immediate health impacts of the virus.[17,18] People living with severe mental illness might pass away around 10 to 20 years earlier, and have a higher risk of suicide than those without mental health issues.[19-21] Previous studies have demonstrated that at least 90% of people who died by suicide had been suffering from mental disorders, specifically depression and anxiety.[10,22,23]

To date, there is a paucity of evidence regarding the evaluation of mental health illnesses among infected COVID-19 patients after hospital discharge in Thailand. Furthermore, the emphasis of research during this pandemic has been on the general population, healthcare workers, and health professional students.[24-27] Therefore, our study aimed to investigate the levels and associated factors of depression, anxiety, and stress among COVID-19 patients after hospital discharge in the southern province of Thailand. As benefits, operational guidelines for primary care units can be found in solving the psychological effects of COVID-19 patients based on each area's context of the country.

METHODS

Study design, study areas and participants

A cross-sectional study was carried out among recovered patients with the following inclusion criteria: (1) age 18 years and older, (2) had been infected with COVID-19, and (3) discharged from the Khlong Hae Health Promoting Hospital with a negative rapid antigen test for COVID-19 from 3 months to 12 months. Eligible patients were excluded from the study if they were treated with any cognitive behavioral therapy or uncooperative actions.

The sample size was calculated using the standard formula of prevalence as follows:

$n = Z^2 p(1-p)/d^2$

Here, n is the sample size; Z is the value from the standard normal distribution to reflect the confidence interval with acceptance sample error 5% (Z=1.96); d is the proportion of sampling error (d=0.04); and p is the estimated prevalence of depression, anxiety, and stress (DAS) among adults recovered from COVID-19 with 11% – 28% approximately.[16] The estimated sample size plus 10% attrition rate was around 530 participants.[28]

According to the list of 512 COVID-19 patients recorded and provided by the hospital, stratified sampling was used as the sampling technique. The total number of discharged patients from March 2020 to December 2020 in Khlong Hae Health Promoting Hospital, Songkhla province, Thailand was classified into nine subgroups based on location (nine villages). The sample size of each subgroup was proportional to the number of patients discharged. Simple random sampling was used to select the participants in each subgroup. The duration of data collection was from 1st to 30th March, 2022. Figure 1 shows the details of the study sampling process.

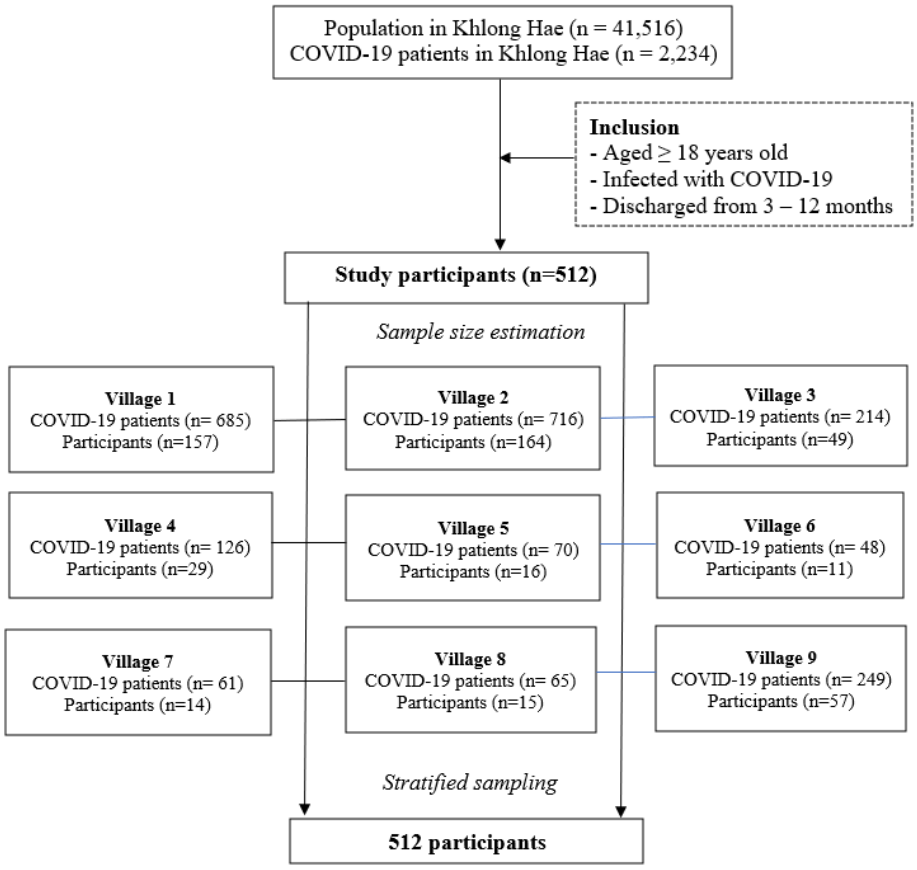

Figure 1. Consort diagram for study sampling

Study measures

The structured questionnaire was designed in three parts. The first part included questions regarding the demographic information of participants: gender, age, religion, education level, occupation, monthly income, marital status, weight, and height. The second part consisted of questions concerning the medical history and treatment conditions for COVID-19 such as the location and length of hospital stay, duration of hospital discharge, and current symptoms of COVID-19. The third part was applied using the 21-Items scale of Depression, Anxiety and Stress (DASS-21) developed by Lovibond's brothers in 1995.[29] This instrument measures depression, anxiety, and stress among adults and has been applied to a variety of cultural and ethnic groups across many different countries and was validated during the COVID-19 pandemic.[30-32] The English version of DASS-21 was translated into Thai language and applied to determine mental health problems among health professional staffs and students in the context of COVID-19 pandemic in Thailand.[21-24] Each of the three sub-scales contains seven statements reflecting negative emotions of depression, anxiety, and stress (DAS) that happened in the past week according to the 4-point Likert scale: (0 = Did not apply at all; 1 = Applied in some degree or some of the time; 2 = Applied to a considerable degree or a good part of the time; 3 = Applied very much or most of the time). Scores were calculated for each item based on participants' responses and classifications of five severity levels were as follows: depression (normal: 0 – 4; mild: 5 – 6; moderate: 7 – 10; severe: 11 – 13; extremely severe: ≥ 14); anxiety (normal: 0 – 3; mild: 4 – 5; moderate: 6 – 7; severe: 8 – 9; extremely severe: ≥ 10), and stress (normal: 0 – 7; mild: 8 – 9; moderate: 10 – 12; severe: 13 – 16; extremely severe: ≥ 17). In this study, three sub-scales of DAS were piloted by 30 participants, with a Cronbach's alpha coefficient of 0.86. The content validity index of the instrument was also assessed as a DAS domain with a value of 0.89. The results indicated high internal consistency reliability and validity of the DASS-21. The correlations between all three outcomes (depression, anxiety, and stress) were investigated using Pearson's correlation coefficient.

Data collection

The research team received permission from the authority board of Khlong Hae Health Promoting Hospital for contact information of the participants. Data were collected from 18 village health volunteers (two persons per village) who were trained to use the structured questionnaire, and method to collect data. Investigators contacted eligible participants in private, and instructed them to complete the 15-minute anonymous questionnaire. Data from participants' responses were recorded using a hard-copy questionnaire through direct interviews.

Data analysis

Depression, anxiety, and stress scores were analyzed as outcome variables using linear regression models. The explanatory variables investigated were: (1) participant's age (as determined with a cut-off median value of 52 years), (2) gender, (3) BMI, (4) religion, (5) education status, (6) monthly income, (7) occupation, (8) marital status, (9) diabetes status, (10) hypertension status, (11) cardiovascular status, (12) kidney disease, (13) gout status, (14) pulmonary disease, (15) other diseases, (16) reason for COVID-19 test, (17) treatment sites, (18) number of hospitals for treatment, (19) types of room for treatment, (20) length of hospital stay,

(21) length of hospital discharge time, and (22) current symptoms. Univariable models were initially screened, and those with a P < 0.2 were kept as potential candidates for multivariable models. The final multivariable models for each outcome variable of depression, anxiety, and stress were built using the comparison of Akaike's Information Criterion (AIC), with variables contributing towards lower AIC value selected in the fit models. Variables with P < 0.05 in the final multivariable models were considered significant factors associated with depression, anxiety, and stress of COVID-19 infected people after discharge. All statistical analyses were done using the R program (http://www.r-project.org/), and the packages "lme4" and "MASS" were applied to build the models.

Ethical considerations

The Human Research Ethics Committee approved this study (Ref:. WUEC-22-067-01). The rights of participants were protected in accordance with the ethical standards of the Helsinki Declaration in 1975 and amended in 2013.[33] The respondents were informed of an invitation full of explanations for voluntary participation in the study. They could refuse to participate or withdraw at any time to complete the questionnaire after agreeing to participate through a consent form.

RESULTS

Participants' characteristics

There was a total of 512 participants in this study. The majority of the respondents were female (65.2%), with a median age of 52 [IQR 25-61] years old. There were an equivalent number of respondents following the religions of Islam and Buddhism (50.6% and 49.4%); as well as their marital status, with 48.8% of respondents being single and 51.2% already married. More than half of the participants (55.8%) had an education status of either senior high school or lower, and the monthly income ranged from less than 5,000 baht to over 20,000 baht. The respondents' occupations varied, including students, workers, private officers, government officers, pensioners, and health staff. A detailed description of participants' demographic information is provided in Table 1.

Table 1. Description of participants' demographic information

Participants' characteristics (n=512)	Frequency (n)	Percentage (%)
Gender		
Male	178	34.8
Female	334	65.2
BMI		
<18.5 kg/m^2 (malnutrition)	42	8.2
18.5 – 22.9 kg/m^2 (normal nutritional status)	249	48.6
23.0 – 24.9 kg/m^2 (overweight)	171	33.4
25.0 – 29.9 kg/m^2 (obesity)	50	9.8
Religion		
Buddhism	253	49.4
Islam	259	50.6
Education		
Lower primary	80	15.6

Participants' characteristics (n=512)	Frequency (n)	Percentage (%)
Primary school	65	12.7
Junior high school	83	16.2
Senior high school	58	11.3
Associate degree	82	16.0
Bachelor's degree	64	12.5
Upper bachelor's degree	80	15.6
Monthly income		
0 – 5,000 baht	91	17.8
5,000 - 10,000 baht	113	22.1
10,000 - 15,000 baht	107	20.9
15,000 - 20,000 baht	107	20.9
Over 20,000 baht	94	18.4
Occupation		
Students	74	14.5
General workers	76	14.8
Private officers	83	16.2
Government officers	106	20.7
Health staff	81	15.8
Pensioners	27	5.3
Others	65	12.7
Marital status		
Single	250	48.8
Married	262	51.2
Age (years old) (Median [Interquartile Range])	52 [25-61]	

Over half of the participants reported their current chronic conditions including diabetes (51.8%), hypertension (51.4%), and cardiovascular disease (50.2%). The body mass index (BMI) was in the range of normal weight in 82% of participants, 8.2% were underweight, and 9.8% were overweight. Around 64 adults infected with COVID-19 were treated in the field hospitals with the overall treatment duration being mostly within 14-days (87.5%) in the ward room (both shared or single room) (64.7%); only 16.6% and 18.8% of the participants were treated in the intensive care unit (ICU), and negative pressure rooms. The median length of time after discharge from the hospital was 8 months [IQR 6-10] until March, 2022 (interview time), with 20.9% of participants presenting with symptoms related to the respiratory systems. A full description of participants' medical history is presented in Table 2.

Table 2. Description of medical history and treatment conditions for COVID-19

Participants' characteristics (n = 512)	Frequency (n)	Percentage (%)
Chronic diseases		
Diabetes	265	51.8
Hypertension	263	51.4
Cardiovascular disease	257	50.2
Kidney disease	27	5.3
Gout	31	6.1
Pulmonary disease	6	1.2
Other diseases	95	18.6
Reasons of COVID-19 test		
At risk of COVID-19 infection	422	82.4
Other reasons (travel, job, study, examination)	90	17.6
Treatment sites		
Hospital	186	36.3
Field hospital	326	63.7
The number of hospitals for treatment		
1 hospital	366	71.5
2 hospitals	126	24.6
3 hospitals	20	3.9
Types of room for treatment		
Negative pressure room	96	18.8
ICU room	85	16.6
Wards	179	35.0
Single wards	152	29.7
Length of stay in the hospital		
7 days	30	5.9
10 days	34	6.6
14 days	448	87.5
Current symptoms (%)		
Not related to respiratory system	405	79.1
Related to respiratory system	107	20.9
Length from hospital discharged (months) (Median [Interquartile Range])	8 [6 - 10]	

Level classifications of DASS-21 among study participants

All participants (100%) in the study experienced depression, and anxiety (ranging from moderate to extremely severe). We found that the highest number of participants were in the mental health status of severe depression (62.7%), extremely severe anxiety (82.6%), and moderate stress (45.3%) (Table 3). The mean scores for the three sub-scales of the DASS-21 were 11.92 (SD = 1.74) for

depression, 10.93 (SD = 1.57) for anxiety, and 11.97 (SD = 2.07) for stress. There was a significant correlation between the depression and stress scores (Pearson's coefficient R = 0.155, p < 0.001). However, no correlations were found between anxiety and depression or stress (Figure 2).

Table 3. Levels of depression, anxiety, and stress among study participants

Levels of Depression, Anxiety and Stress	n (%)		
	Depression	Anxiety	Stress
Normal	0	0	11 (2.1)
Mild	0	0	52 (10.2)
Moderate	99 (19.3)	10 (2.0)	232 (45.3)
Severe	321 (62.7)	79 (15.4)	210 (41.0)
Extremely severe	92 (18.0)	423 (82.6)	7 (1.4)
Rate from moderate to extremely severe	512 (100.0)	512 (100.0)	449 (87.7)

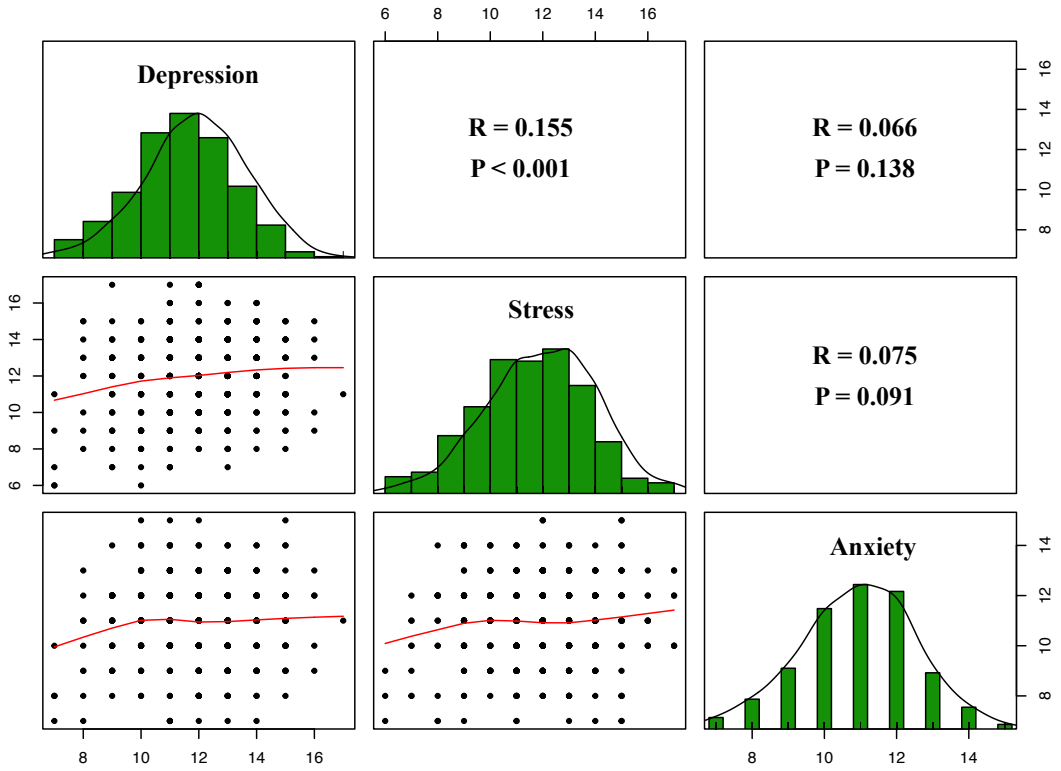

Figure 2 The correlation between levels of depression, anxiety, and stress among participants

Risk factors associated with depression, anxiety, and stress of study participants

The statistical models used to investigate the factors associated with depression, anxiety, and stress are presented in **Table 4-6**. In univariate models, depression was associated with BMI, education status, occupation, diabetes, gout, pulmonary disease, type of treatment room and length of hospital stay. However, findings in the multivariate analysis showed that only a medical history of pulmonary disease (β = 1.443, p = 0.042) and higher education status (β = 1.067, p < 0.001) remained significantly associated with depression. For the anxiety models,

factors including age, BMI, religion, education, diabetes, kidney diseases and reasons for the COVID-19 test were considered as potential variables. Our results only found that respondents who were tested for COVID-19 for travel, job, study, or examination application (all $\beta > 0.575$, all $p = 0.001$) and lower BMI (all $\beta > 0.601$, all $p < 0.011$) were significantly associated with anxiety in the multivariable model. Similarly, for the stress model, factors associated with stress in the final model were lower body mass index (BMI) ($\beta = 0.455$, $p < 0.001$) and lower monthly income ($\beta = 1.067$, $p < 0.001$).

Table 4 Risk factors associated with depression of participants

Model for depression	Univariable models			Multivariable model		
	β	95% CI	p	β	95% CI	p
BMI (Baseline = <18.5 kg/m^2)						
18.5 – 22.9 kg/m^2	0.329	-0.24-0.90	0.259			
23.0 – 24.9 kg/m^2	0.235	-0.36-0.82	0.435			
25.0 – 29.9 kg/m^2	0.601	-0.12-1.32	0.100			
Education (Baseline = lower primary)						
Primary	0.607	0.04-1.17	0.035	0.602	0.04-1.16	0.035
Junior	0.674	0.14-1.20	0.013	0.711	0.18-1.24	0.008
Senior	0.758	0.18-1.34	0.011	0.749	0.17-1.33	0.011
Associate degree	0.552	0.02-1.08	0.041	0.511	-0.02-1.04	0.058
Bachelor's degree	0.169	-0.40-0.74	0.559	0.251	-0.32-0.81	0.384
Upper bachelor's degree	1.100	0.57-1.63	<0.001	1.067	0.54-1.60	<0.001
Occupation (Baseline= Private officers)						
Students	0.406	-0.14-0.95	0.145			
General workers	0.462	-0.08-1.00	0.095			
Government officers	0.564	0.06-1.06	0.027			
Health staffs	0.579	0.05-1.11	0.033			
Pensioners	0.739	-0.02-1.50	0.055			
Others	0.754	0.19-1.31	0.009			
Diabetes (Baseline = No)						
Yes	0.284	-0.02-0.59	0.066	0.253	-0.05-0.55	0.096
Gout (Baseline = No)						
Yes	0.605	-0.03-1.24	0.061	0.580	-0.04-1.21	0.069
Pulmonary disease (Baseline = No)						
Yes	1.603	0.20-3.00	0.025	1.443	0.05-2.83	0.042
Treatment room (Baseline= ICU)						
Negative pressure room	0.140	-0.37-0.65	0.590			
Wards	0.484	0.03-0.93	0.035			
Single wards	0.407	-0.06-0.87	0.085			
Length of stay in the hospitals (Baseline=7 days)						
10 days	0.428	-0.43-1.28	0.328			
14 days	0.595	-0.05-1.24	0.070			

Multivariable Intercept= 11.177, SE = 0.210

Table 5. Risk factors associated with anxiety of participants

Model for anxiety	Univariable models			Multivariable model		
	β	95% CI	p	β	95% CI	p
Age (Baseline: ≤ 52 years old)						
> 52 years old	0.179	-0.09-0.45	0.197	0.209	-0.06-0.48	0.129
BMI (Baseline = 25.0 – 29.9 kg/m^2)						
<18.5 kg/m^2	0.083	0.16-1.45	0.014	0.822	0.19-1.46	0.011
18.5 – 22.9 kg/m^2	0.656	0.18-1.13	0.007	0.628	0.16-1.10	0.009
23.0 – 24.9 kg/m^2	0.602	0.11-1.09	0.017	0.601	0.11-1.09	0.016
Religion (Baseline = Muslim)						
Buddhism	0.209	-0.06-0.48	0.132	0.206	-0.06-0.47	0.133
Education (Baseline = Senior)						
Lower primary	0.763	0.23-1.29	0.005			
Primary	0.638	0.08-1.19	0.024			
Junior	0.855	0.33-1.38	0.001			
Associate degree	0.540	0.01-1.07	0.044			
Bachelor's degree	0.419	-0.14-0.97	0.139			
Upper bachelor's degree	0.550	0.02-1.08	0.041			
Diabetes (Baseline = No)						
Yes	0.193	-0.08-0.47	0.165	0.201	-0.07-0.47	0.143
Kidney disease (Baseline = No)						
Yes	0.469	-0.13-1.08	0.131	0.550	-0.05-1.15	0.072
Reasons of COVID-19 test (Baseline = At risk of COVID-19 infection)						
Other reasons (travel, job application)	0.575	0.22-0.93	0.002	0.575	0.22-0.93	0.001

Multivariable Intercept = 9.913, SE = 0.252

Table 6 Risk factors associated with stress of participants

Model for stress	Univariable models			Multivariable model		
	β	95% CI	p	β	95% CI	p
BMI (Baseline = 23.0 – 24.9 kg/m^2)						
<18.5 kg/m^2	0.470	-0.23-1.17	0.189	0.502	-0.22-1.23	0.174
18.5 – 22.9 kg/m^2	0.443	0.04-0.85	0.032	0.455	0.04-0.87	0.032
25.0 – 29.9 kg/m^2	0.671	0.02-1.33	0.045	0.638	-0.02-1.29	0.057
Monthly income (Baseline = 5,000 - 10,000 baht)						
0 – 5,000 baht	0.620	004-1.19	0.035	0.609	0.03-1.19	0.039
10,000 - 15,000 baht	0.264	-0.29-0.81	0.348	0.291	-0.26-0.84	0.301
15,000 - 20,000 baht	0.310	-0.24-0.86	0.269	0.317	-0.23-0.86	0.258
Over 20,000 baht	0.216	-0.35-0.79	0.457	0.217	-0.35-0.79	0.454
Treatment room (Baseline = Negative pressure room)						
ICU room	0.311	-0.30-0.92	0.316	0.305	-0.31-0.92	0.332
Wards	0.334	-0.18-0.85	0.205	0.402	-0.12-0.93	0.134
Single wards	0.415	-0.12-0.95	0.127	0.494	-0.04-1.03	0.071

Multivariable Intercept= 11.031, SE = 0.313

DISCUSSION

This study used the DASS-21 to determine mental health problems among people who had recovered from COVID-19. Our results indicated high rates of mental health problems regarding the status of depression, anxiety, and stress among survivors after COVID-19. The findings were consistent with previous reports showing that nearly half and up to 96.2% of COVID-19 patients faced depression, anxiety and stress.[34,35] The increased rates of DAS normally happened in the community where people are living in a high-risk area with the high prevalence of COVID-19 cases.[36] The prevalence of DAS in our study (ranged from 87.7% - 100% from moderate to extremely severe scale) was supremely higher compared to similar studies recently conducted in Thailand focusing on the other groups of participants working as health care workers (15.3% – 22.5%).[24-26] and students (18.8% – 31%).[27] In comparison to seven middle-income countries of Asia, Thailand was placed as the first country leading in depression, anxiety, and stress in the general population, indicating the impact of the COVID-19 pandemic on mental health.[37] This could possibly be explained by restricted social interaction including the fear of public as well as inadequacy of accessible information leading to psychiatric disorders in both COVID-19 in-patients (35%) and out-patients (48%).[38]

Given the high prevalence of mental health outcomes, we sought to ascertain the factors related to DAS. Our results identified risk factors for depressive symptoms including participants who had a higher education status and a medical history of pulmonary disease. Our findings were aligned with the fact that recovered COVID-19 patients who had postgraduate and higher degrees were more depressed and had more severe levels of depression.[39,40] During the COVID-19 pandemic, individuals with higher education may have greater access to information about the severity of the illness, especially in the context of a person having been infected with COVID-19. In addition, underlying chronic diseases must be considered as they are risk factors that increase the severity of depression.[39,41] Furthermore, previous studies indicated that people who suffered from chronic diseases including hypertension, heart disease, cancer, asthma/respiratory problems, and diabetes were associated with depression.[42,43] Our findings support the evidence that participants who had pre-existing comorbidities were more likely to have experienced depressive symptoms in the preceding medical history.

In relation to anxiety, the present study found an association between lower BMI and increased anxiety. This result was not in line with previous findings, which have indicated that being overweight is related to more anxiety outcomes.[44,45] In our study, self-reporting of weight and height might not exactly reflect the current BMI status because participants were living in a high-risk area, and the duration of social distancing could have resulted in a lack of regular measurement of body size. However, a sizable proportion of the population experienced worsening of their mental health and frequently reported unhealthy weight-related behaviors including eating “junk food” and being sedentary, which may increase risk of obesity during the pandemic of COVID-19.[46] Besides, people who had reasons to go out such as applying for a job, pursuing study, and traveling had high probability of anxiety symptoms. This could be explained by the fact that people naturally fear becoming infected if they come into contact with many people due to worries about the COVID-19 pandemic.[27]

Another notable finding was the significant link between personal characteristics and stress, such as BMI and lower monthly income. The present study found that people with a BMI of 18.5 – 22.9

kg/m^2 were associated with stress compared to the higher BMI group (23.0 – 24.9 kg/m^2). Our findings were not consistent with those of previous studies in which higher BMI was associated with stress.[47] In fact, a narrative review found that overeating in response to stress seems to be especially common in obese individuals and people with pre-existing mental health disorders.[46] Again, directed measurement of weight and height might be helpful to precisely identify the current BMI, which is better than the self-reporting of participants in our study. In addition, lower monthly income has been proven to be significantly associated with stress among people who recovered from COVID-19. Higher income and perceived financial status were significant predictors of better mental health outcomes.[41] In fact, financial distress due to the pandemic has been reported as a key correlation to poor mental health.[36,42] In 2020, Thailand's gross domestic product was predicted to decrease by around 6.1% as a consequence of economic disruption due to the COVID-19 pandemic.[43] Besides, the growth of unemployment rate in Thailand was also expected to be up to 1.96% in 2021.[44] Therefore, individuals who were forced to find jobs and experiencing other financial challenges had restricted access to social and psychological support, making them more vulnerable to mental disorders.[45] The results suggest that public health policy should prioritize minimizing financial disruption during the COVID-19 pandemic.

In fact, there have been additional calls for action to improve public mental health support as a result of the rising mental health burden brought on by the COVID-19 pandemic.[53] Use of dialectical and cognitive behavior therapy to treat psychiatric symptoms of patients with COVID-19 after discharge has been applied to show its effects and efficacy.[54-56] These evidence-based treatments, especially internet cognitive behavior therapy can prevent not only psychiatric symptoms but also the spread of infection during the pandemic.[54-56] Therefore, such interventions could be beneficial for vulnerable groups in the community who are at high risk of psychological morbidities, including depression, anxiety and stress.

The following limitations of the study should be considered; this cross-sectional study was conducted on locals living only in a high-risk district of Thailand's southern province without control groups at different risk levels of COVID-19 exposure during the pandemic. The findings could not be considered strong evidence to show the existence of long-term cause-effect associations between COVID-19 and negative outcomes of mental health, including depression, anxiety, and stress. Further studies should be conducted in comparison with other regions with various levels of COVID-19 risk. People without a history of COVID-19 infection and living in high-risk areas could be an interest group to compare with those who were infected with COVID-19 in future studies. In short, the emotional feelings of respondents might be different in various situations of cultures, study settings, target populations and phases of the COVID-19 pandemic.[37,38,57-59]

CONCLUSIONS

Almost all adults who recovered from COVID-19 lived in high-risk areas with high rates of mild to extremely severe depression, anxiety and stress. The short-term consequences of COVID-19 on physical health and long-term effects on mental health were noticed after such in-patients are discharged. For those who were tested for COVID-19 for travel, study, job, and examination application, higher education status, and lower monthly income, lower BMI, and pulmonary disease

were identified as factors associated with higher scores of depression, anxiety, and stress. Primary health care units and local authorities need to establish a social and psychological environment that supports essential demands in specific high-risk communities. Specifically, improving perceived education, ensuring household income for daily life, effective treatment of chronic conditions and personal weight management would contribute to helpful strategies to reduce the burden of mental health problems in the context of COVID-19.

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