Mental Health of Medical Students After Combating the COVID-19 Epidemic: A Cross-sectional Study in Vietnam

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Objectives: This study was conducted to investigate the prevalence of mental health (MH) symptoms and associated factors among medical students who were engaged in combating the coronavirus disease 2019 (COVID-19) epidemic in 4 provinces/cities of Vietnam.
Methods: A cross-sectional study with 580 participants was conducted at a medical university in Northern Vietnam. MH was assessed using the 21-item Depression, Anxiety, and Stress Scale, which was previously standardized in Vietnam. Data were collected through a structured self-administered questionnaire. Multivariate logistic regression was employed to examine the association between MH symptoms and relevant factors.
Results: Out of a total of 2703 medical students, 21.5% responded to the questionnaire. Among the 580 respondents, the prevalence rates of depression, anxiety, and stress were 43.3%, 44.0%, and 24.7%, respectively. Factors significantly associated with self-reported depression included being female and having a COVID-19 infection. Similarly, being female and having a COVID-19 infection were significantly associated with self-reported anxiety. Factors associated with self-reported stress included being female, having a personal or family history of MH symptoms, working more than 8 hr/day, and having a COVID-19 infection.
Conclusions: COVID-19 has adversely impacted the MH of medical students. Our findings are valuable in their potential to motivate universities, MH professionals, and authorities to offer mental healthcare services to this group. Furthermore, there is a pressing need for training courses designed to equip future healthcare workers with the skills to manage crises effectively.

Key words: Mental health, Medical student, COVID-19, Vietnam

INTRODUCTION

Coronavirus disease 2019 (COVID-19) was first reported in late 2019 in Wuhan, China, and subsequently spread rapidly, threatening global health. The disease is caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which was identified in 2019 [1]. As of May 29, 2021, the global cumulative incidence of COVID-19 had reached 169 130 935 cases, with 3 519 307 reported deaths [2].

The COVID-19 pandemic has profoundly impacted both physical well-being and mental health (MH) [3]. As future healthcare professionals, medical students have been directly or indirectly affected by the COVID-19 pandemic [4]. Recent systematic reviews and meta-analyses have highlighted the considerable mental burden that medical students around the world have faced during this time [5]. It is crucial to assess the MH status of these students, particularly during the COVID-19 pandemic, as they are known to experience higher rates of MH issues compared to the general population [6]. One meta-anal-

ysis estimated that the global prevalence of anxiety among medical students is approximately 33.8%, which is substantially higher than that in the population as a whole [7]. In China, a systematic review and meta-analysis revealed that depression and anxiety are common among medical students, with prevalence rates of 32.74% and 27.22%, respectively [8]. In Vietnam, a survey conducted across 8 medical universities found that 43.2% of medical students reported depressive symptoms [9], a stark contrast to the 2.8% prevalence rate in the general population [10].

The outbreak of the COVID-19 pandemic has sparked interest in exploring the effects of this global crisis on the MH of medical students. Numerous studies from around the world have uncovered concerning levels of MH issues in this group. For example, a study in Portugal found that 65.3% of medical students reported symptoms of anxiety, while 10% had been diagnosed with a physical or mental illness [4]. Furthermore, research by ElHawary et al. [11] involving several Canadian medical schools revealed that students with a history of depression or anxiety exhibited higher rates of depressive symptoms (66 vs. 42%) and anxiety (69 vs. 41%) than students without such a history [11]. Furthermore, studies from China [12] and Bangladesh [13] have reported high prevalence rates of MH problems among medical students during the COVID-19 pandemic. In Vietnam, a study involving 1583 medical students at Hanoi Medical University found that 7.3% screened positive for anxiety disorders and 14.5% for depression [14]. A separate study of 191 nursing students reported that 21.5% were experiencing depression [15].

Research indicates that increased rates of MH symptoms may stem from various sources, such as fear of infection, financial instability, inadequate food supplies, lack of exercise, and limited or non-existent recreational activities [16]. A systematic review and meta-analysis identified several risk factors associated with MH symptoms, including sex, age, residential area, family size, family monthly income, educational level, marital status, physical activity, smoking, alcohol consumption, fear of chronic disease, unemployment, and exposure to COVID-19–related news and social media [17]. Disrupted sleep patterns have been identified as a potential risk factor for stress, anxiety, and depression symptoms [18]. Furthermore, stress, anxiety, and depression may be exacerbated by isolation and disruptions in academic pursuits [19].

The fourth wave of the COVID-19 pandemic in Vietnam, which represents the deadliest wave to date, began on April 27, 2021.

By November 28, 2021, 1 207 498 confirmed cases and 24 657 deaths had been reported [20]. In response to the Ministry of Health's appeal for support in combating the epidemic, students from Hai Phong University of Medicine and Pharmacy volunteered to assist with a range of tasks. These included contact tracing, sample collection, vaccination, patient care, and other COVID-19–related duties in "hotspots" such as Bac Giang [21], Binh Duong [22], and Ho Chi Minh City [23].

In Vietnam, multiple studies have examined the impact of COVID-19 on the MH of medical students within the broader context of the pandemic [14,24]. However, data on the prevalence of MH symptoms among medical students directly engaged in combating COVID-19 remain scarce. To our knowledge, only 1 study has assessed the prevalence of depression among students—in that case, nursing students—involved in the COVID-19 response [15]. Consequently, we conducted this study to estimate the prevalence of MH symptoms and identify associated factors among medical students at Hai Phong University of Medicine and Pharmacy who participated in the fight against COVID-19.

METHODS

Study Location and Participants

The study was conducted among medical students from Hai Phong University of Medicine and Pharmacy, a medical institution located in Northern Vietnam, approximately 100 kilometers from the capital city of Hanoi. The participants were students who had volunteered to combat the COVID-19 epidemic in several hotspots across Vietnam. The inclusion criteria for these students were as follows: (1) having actively engaged in the COVID-19 response in Hai Phong, Bac Giang, Binh Duong, or Ho Chi Minh City; (2) being in the first to the sixth academic year, with any of a variety of majors; and (3) consenting to participate in the study.

Study Design and Sample Size

This cross-sectional study employed an online survey platform to recruit participants through convenience sampling. We invited all students involved in epidemic prevention across 4 provinces/cities: Bac Giang, Binh Duong, Hai Phong, and Ho Chi Minh City. The list of participants combating the COVID-19 pandemic in these locations received approval from the Hai Phong University of Medicine and Pharmacy, as indicated by Decision Nos. 622/QĐ-YDHP, 832/QĐ-YDHP, 1069/QĐ-YDHP,

376/QĐ-YDHP, and 1066/QĐ-YDHP. The response rate among students was approximately 21.5%, yielding 580 individuals who consented to participate. Regarding region, 13 of 69 invited students who had combated the epidemic in Bac Giang agreed to participate, representing a response rate of 18.8%. Of 152 invited students who had worked in Binh Duong, 47 students participated, yielding a response rate of 30.9%. Hai Phong saw the participation of 445 of the 2002 invited students, a 22.2% response rate. Finally, 75 of the 88 invited students participated in Ho Chi Minh City, resulting in a response rate of 85.2%.

Data collection was conducted online via Google Forms. Before distribution, the pre-designed questionnaire was tested with a random sample of students (n=10) who were not part of the study to confirm that the questions were understandable and clear. Subsequently, the questionnaire link or QR code was disseminated to all students involved in COVID-19 prevention efforts in Hai Phong, Bac Giang, Binh Duong, and Ho Chi Minh City.

Research Instrument

This study utilized a 2-part questionnaire. The first part covered general student information, while the second assessed the MH status of the students.

The general information section collected data on sex (male or female), age (in years), and academic major, with responses including Doctor of General Medicine, Doctor of Preventive Medicine, Doctor of Traditional Medicine, Doctor of Dentistry, Bachelor of Nursing, Bachelor of Medical Technology, and Bachelor of Pharmacy. Items also covered personal or family history of MH symptoms (yes or no), history of chronic disease (yes or no), average number of working hours per day, and number of tasks performed. Additionally, respondents were asked whether they had provided direct care and treatment to patients with COVID-19, were fully equipped with protective equipment, and had been infected with COVID-19 (all yes or no).

MH symptoms were assessed using the 21-item Depression, Anxiety, and Stress Scale (DASS-21). This instrument was validated in Vietnam in 2013, demonstrating a sensitivity of 79.1% and a specificity of 77.0%. The Cronbach alpha values for depression, anxiety, and stress were 0.86, 0.79, and 0.86, respectively [25]. The DASS-21 questionnaire comprises 21 items organized into 3 domains. Each domain contains 7 items, as follows: depression (Q3, Q5, Q10, Q13, Q16, Q17, and Q21), anxiety (Q2, Q4, Q7, Q9, Q15, Q19, and Q20), and stress (Q1, Q6,

Q8, Q11, Q12, Q14, and Q18). Participants respond to each item using a Likert scale ranging from 0 (does not apply at all) to 3 (applies very much or most of the time). To calculate the final score for each domain, the sum of the scores is multiplied by 2. The depression scores are categorized as follows: normal (0-9), mild (10-13), moderate (14-20), severe (21-27), or extremely severe (28 or higher). The anxiety scores are categorized as normal (0-7), mild (8-9), moderate (10-14), severe (15-19), or extremely severe (20 or higher). For stress, scores are interpreted as normal (0-14), mild (15-18), moderate (19-25), severe (26-33), or extremely severe (34 or higher) [26].

Statistical Analysis

The Excel file extracted from Google Forms was converted into a .sav file for use with SPSS. All analyses were conducted using SPSS version 25.0 (IBM Corp., Armonk, NY, USA). We reported frequencies and percentages for categorical variables and presented continuous variables as means with standard deviations. Chi-square tests were used to assess differences in the proportions of MH symptoms and their associated factors. We performed univariate and multivariate logistic regression analyses to explore potential associations between symptoms and factors. Variables with a p-value of less than 0.2 in the univariate analysis were included in the subsequent multivariate analysis, and a p-value of less than 0.05 was considered to indicate statistical significance.

Ethics Statement

The research protocol was approved by the Institutional Review Board of Hai Phong University of Medicine and Pharmacy, Vietnam, under Decision No. 225/QĐ-YDHP. Participants received detailed information about the study's objectives and their involvement. Those who agreed to participate were required to complete an online informed consent form, indicating their consent by selecting the "Yes, I agree" option. To protect participant confidentiality, all data collected were anonymized.

RESULTS

Of the 580 participants, the proportions showing signs of depression, anxiety, and stress were 43.3%, 44.0%, and 24.7%, respectively. The percentage of participants experiencing all 3 MH symptoms was 22.4% (Figure 1).

The prevalence of depressive symptoms among females
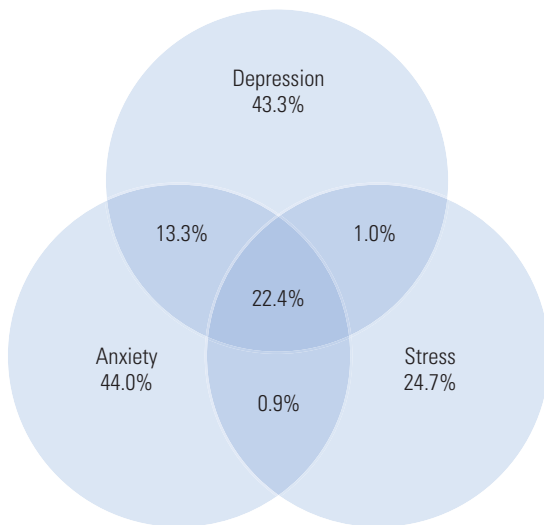
Figure 1. Venn diagram depicting the prevalence of depression, anxiety, and stress.

was higher compared to males, with rates of 47.3% for depression, 48.5% for anxiety, and 28.6% for stress. In contrast, the rates for males were 31.3% for depression, 30.6% for anxiety, and 12.9% for stress. The age group of 22-23 years had the highest rates of depression (49.1%) and anxiety (54.4%), while the highest rate of stress (30.0%) was observed in the 18-19 age group. Individuals with a personal/family history of mental health symptoms or chronic illnesses exhibited higher rates of depression, stress, and anxiety compared to their counterparts. Participants engaged in more than 8 hr/day in COVID-19 prevention efforts displayed higher rates of depression, anxiety, and stress compared to those engaged for fewer than 8 hr/day. The respective rates were 47.7% for depression, 50.0% for anxiety, and 30.0% for stress. Individuals who contracted the COVID-19 while participating in the prevention efforts demonstrated higher rates of depression, anxiety, and stress. Specifically, the rates were 60.3% for depression, 67.2% for anxiety, and 42.7% for stress (Table 1).

The reported MH symptoms ranged from mild to extremely severe. Regarding depression, 17.1% of participants reported moderate symptoms, 16.4% mild, 5.9% severe, and 4.0% extremely severe. For anxiety symptoms, the reported levels also ranged from mild to extremely severe, with 9.7% of participants experiencing mild symptoms, 17.4% moderate, 7.4% severe, and 9.5% extremely severe. Among those reporting stress symptoms, the most common level was mild (10.2%), while the least common was extremely severe (1.6%), as shown in Table 2.

Table 1. Distributions of mental health issues and general characteristics

Variables	Total	Depression	Anxiety	Stress
Sex				
Male	147 (25.3)	46 (31.3)	45 (30.6)	19 (12.9)
Female	433 (74.7)	205 (47.3)	210 (48.5)	124 (28.6)
Age (y)				
18-19	30 (5.2)	13 (43.3)	13 (43.3)	9 (30.0)
20-21	217 (37.4)	103 (47.5)	100 (46.1)	58 (26.7)
22-23	114 (19.7)	56 (49.1)	62 (54.4)	33 (28.9)
≥24	219 (37.8)	79 (36.1)	80 (36.5)	43 (19.6)
Mean±SD	22.56±2.95	22.20±2.36	22.19±2.22	22.05±2.05
Academic major				
Doctor	477 (82.2)	211 (44.2)	214 (44.9)	120 (25.2)
Other	103 (17.8)	40 (38.8)	41 (39.8)	23 (22.3)
Personal/family history of mental health symptoms				
No	554 (95.5)	236 (42.6)	240 (43.3)	130 (23.5)
Yes	26 (4.5)	15 (57.7)	15 (57.7)	13 (50.0)
History of chronic disease				
No	562 (96.9)	240 (42.7)	244 (43.4)	135 (24.0)
Yes	18 (3.1)	11 (61.1)	11 (61.1)	8 (44.4)
Average no. of hours worked per day (hr)				
≤8	270 (46.6)	103 (38.1)	100 (37.0)	50 (18.5)
>8	310 (53.4)	148 (47.7)	155 (50.0)	93 (30.0)
No. of tasks performed				
One task	256 (44.1)	113 (44.1)	114 (44.5)	68 (26.6)
Multiple tasks	324 (55.9)	138 (42.6)	141 (43.5)	75 (23.1)
Directly cared for/treated patients with COVID-19				
No	451 (77.8)	195 (43.2)	200 (44.3)	113 (25.1)
Yes	129 (22.2)	56 (43.4)	55 (42.6)	30 (23.3)
Fully equipped with protective equipment				
Yes	528 (91.0)	227 (43.0)	221 (41.9)	125 (23.7)
No	52 (9.0)	24 (46.2)	34 (65.4)	18 (34.6)
Infected with COVID-19				
No	449 (77.4)	172 (38.3)	167 (37.2)	87 (19.4)
Yes	131 (22.6)	79 (60.3)	88 (67.2)	56 (42.7)

Values are presented as number (%).
SD, standard deviation; COVID-19, coronavirus disease 2019.

Table 2. Levels of depression, anxiety, and stress

Level	Depression	Anxiety	Stress
Normal	329 (56.7)	325 (56.0)	437 (75.3)
Mild	95 (16.4)	56 (9.7)	59 (10.2)
Moderate	99 (17.1)	101 (17.4)	49 (8.4)
Severe	34 (5.9)	43 (7.4)	26 (4.5)
Extremely severe	23 (4.0)	55 (9.5)	5 (1.6)

Values are presented as number (%).

Table 3. Multivariate logistic regression analysis of factors related to depression, anxiety, and stress among participants

Variables	Depression	Anxiety	Stress
Sex			
Male	1.00 (reference)	1.00 (reference)	1.00 (reference)
Female	1.80 (1.19, 2.71)**	1.90 (1.25, 2.88)**	2.46 (1.42, 4.26)**
Personal/family history of mental health symptoms			
No	1.00 (reference)	1.00 (reference)	1.00 (reference)
Yes	1.75 (0.77, 3.98)	1.60 (0.69, 3.70)	3.34 (1.44, 7.72)**
History of chronic disease			
No	1.00 (reference)	1.00 (reference)	1.00 (reference)
Yes	1.85 (0.69, 4.98)	1.73 (0.63, 4.80)	2.19 (0.80, 6.04)
Average no. of hours worked per day (hr)			
≤8	1.00 (reference)	1.00 (reference)	1.00 (reference)
>8	1.29 (0.92, 1.82)	1.40 (0.97, 1.96)	1.60 (1.06, 2.43)*
Fully equipped with protective equipment			
Yes	Not included	1.00 (reference)	1.00 (reference)
No	Not included	1.85 (0.98, 3.50)	1.03 (0.53, 2.01)
Infected with COVID-19			
No	1.00 (reference)	1.00 (reference)	1.00 (reference)
Yes	2.27 (1.51, 3.41)***	3.08 (2.02, 4.70)***	2.81 (1.82, 4.35)***

Values are presented as odds ratio (95% confidence interval).
COVID-19, coronavirus disease 2019.
*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Factors significantly associated with depression included female (odds ratio [OR], 1.80; 95% confidence interval [CI], 1.19 to 2.71) and infection with COVID-19 (OR, 2.27; 95% CI, 1.51 to 3.41). Similarly, anxiety was significantly related to both female (OR, 1.90; 95% CI, 1.25 to 2.88) and COVID-19 infection (OR, 3.08; 95% CI, 2.02 to 4.70). Factors significantly associated with stress included female (OR, 2.46; 95% CI, 1.42 to 4.26), personal or family history of MH symptoms (OR, 3.34; 95% CI, 1.44 to 7.72), working more than 8 hr/day on average (OR, 1.60; 95% CI, 1.06 to 2.43), and COVID-19 infection (OR, 2.81; 95% CI, 1.82 to 4.35) (Table 3).

DISCUSSION

Prevalence of Mental Health Symptoms

In this cross-sectional study of 580 medical students who volunteered to combat the COVID-19 epidemic in 4 provinces or cities in Vietnam, a substantial proportion of students experienced adverse psychological effects. The MH symptoms reported by the participants ranged from mild to extremely severe. This vulnerability may stem from the fact that these students are relatively young and have limited life experience,

which makes them more susceptible to MH crises as they are still developing their decision-making and emotional regulation skills [27]. Furthermore, their participation in the epidemic response occurred in Bac Giang, Binh Duong, Hai Phong, and Ho Chi Minh City during the peak of the outbreak, which was characterized by high morbidity and mortality rates. These regions enforced rigorous social distancing protocols and faced challenges regarding facilities, food, and nutrition, which likely impacted the MH of the students.

Our results indicate that the percentages of participants reporting symptoms of depression, anxiety, and stress were 43.3%, 44.0%, and 24.7%, respectively. These figures exceed those reported by a study conducted at Hanoi Medical University, in which the rates of participants testing positive for anxiety and depression were 7.3% and 14.5%, respectively [14]. A study at Wannan Medical College in China found the prevalence rates of symptoms of depression, anxiety, and stress to be 31.9%, 32.9%, and 14.6%, respectively [28]. The discrepancy between these results and our study can be attributed to the fact that the participants in the previous studies were not involved in combating the epidemic. Our findings suggest that MH issues were common among students after their engagement in the COVID-19 pandemic response. Addressing MH among students necessitates effective collaboration between university departments and students [29]. Before and during students' involvement in pandemic response efforts, universities should conduct educational activities, such as seminars and lectures, to equip these individuals with coping skills for challenging and stressful situations [29]. The period following their involvement in the pandemic response is critical for MH intervention among students. Universities can offer various forms of support during this time, including informational campaigns, psychological counseling, and support groups. Student unions can contribute by providing student-led services like peer support groups and advice hotlines [30]. Although the students involved would not be professional counselors, many students often prefer to seek advice from their peers, particularly senior students, during difficult times [31]. Additionally, web-based platforms are emerging as a promising avenue for students to access support [32].

Factors Associated With Mental Health Symptoms

Our analysis indicates that female medical students are at a higher risk of experiencing symptoms of depression, anxiety, and stress compared to male students. These findings align

with previous results [5,13,33]. One possible explanation is that female may have been more vulnerable to mental trauma even before the pandemic [34]. Females are around twice as likely to experience anxiety and depression as males [35]. Additionally, females often express their emotions more openly and may be more affected by social expectations and pressures [12]. Recent evidence also points to hormonal fluctuations in females as a key biological factor contributing to the sex differences in the risk of anxiety and depression [36].

Our results indicate that participants with a personal or family history of MH issues exhibited higher rates of depression, anxiety, and stress symptoms. Specifically, these students were 3.34 times as likely to experience stress symptoms as their counterparts without such a history. These findings align with research on medical students in the United States, which also suggested that students with pre-existing MH conditions exhibited significantly higher levels of anxiety and stress than those without these conditions [37]. A study conducted by Wathelet et al. [38] corroborates this observation. Our data also revealed that over half of the participants averaged more than 8 hr/day engaged in anti-epidemic tasks, and these individuals displayed a relatively high prevalence of depression, anxiety, and stress symptoms. Supporting this, research by Che et al. [39] suggests that long working hours may have increased the risk of mental disorders in nurses during the COVID-19 pandemic, particularly among those working more than 60 hr/wk. Similarly, research in Southern Vietnam has demonstrated that medical staff working more than 8 hr/day exhibit higher rates of these symptoms than those working fewer hours [40]. The detrimental impact of excessive working hours on MH must be recognized, especially during crises like the COVID-19 pandemic. This relationship suggests that reducing daily working hours could be an effective strategy to alleviate stress. Notably, we found no significant associations of either personal/family MH history or working hours with depression or anxiety. This contrasts with research from France [38], the United States [37], and China [39], which reported the opposite. Such discrepancies may be due to various factors, including differences in the participant populations and the contexts of the studies. Our research focused on medical students combating the COVID-19 epidemic, whereas the studies from France and the United States examined different student populations during the pandemic, and the research from China involved nurses.

Our findings indicate that participants who contracted COVID-19 during their involvement in anti-epidemic efforts tend-ed to exhibit higher levels of depression, anxiety, and stress than those who were not infected. Although this result is not yet corroborated by similar studies, it suggests that experiencing COVID-19 infection can have a substantial impact on MH. This may be because COVID-19, a global pandemic, has prompted widespread life changes and social disruptions. Infection with the virus can provoke anxiety, fear, and stress stemming from concerns about one's own health and the potential to spread the virus to others. Additionally, psychological strain can be exacerbated by the imposition of quarantine measures.

Limitations and Strengths of the Study

The present study has several limitations. First, the use of convenience sampling methods, the employment of online surveys, and the low response rate may have introduced sampling bias. However, we believed that during the rapid outbreak of the COVID-19 pandemic, an online survey would attract more participants than in-person interviews. Second, our cross-sectional study design precludes establishing a cause-and-effect relationship and does not allow for assessing the long-term effects of MH symptoms. Third, diagnosing MH conditions typically requires a clinical examination; thus, the symptoms reported in our study are based on self-reporting and may not correspond precisely with clinical diagnoses. Lastly, we did not collect data on certain variables, including living status, household finances, exercise habits, smoking, alcohol consumption, concerns about educational disruptions, and clinical experience.

While we acknowledge its limitations, our study also has several strengths. First, it represents the earliest effort to assess the rates of MH symptoms and their associated factors among medical students who volunteered in Vietnam's COVID-19 outbreak hotspots, spanning 7 academic majors. Second, the research employed the standardized DASS-21 questionnaire, demonstrating its suitability for evaluating MH symptoms in the Vietnamese context. Third, our findings offer empirical support that can guide policymakers in implementing appropriate interventions to alleviate the impact of MH symptoms on students. Finally, our findings suggest that MH management and coping strategies should be incorporated into the curricula of university medical programs. This integration will better equip students and academic institutions to prepare for and address future pandemics mentally.

NOTES

Author Contributions

Conceptualization: Cap DM, Nguyen TT. Data curation: Nguyen AQ. Formal analysis: Cap DM. Methodology: Cap DM, Nguyen AQ. Writing – original draft: Cap DM, Nguyen TT, Nguyen AQ. Writing – review & editing: Cap DM.

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