

The Relationship between Mental Health and Sleeping Quality in COVID-19: The Moderating Effect of the Attachment Style

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Abstract. During the epidemic, the mental health and sleeping quality of college students were affected to varying degrees, which may influence the quality of life and well-being. This cross-sectional aimed to determine the frequency of psychologically negative states and poor sleeping quality among undergraduate students during the Covid-19 pandemic and explore the correlation between mental health and sleeping quality and the moderating effect of the attachment style. Relevant information was collected with an online questionnaire, which was distributed among 72 undergraduate students at prestigious universities in Shanghai and Nanjing. The mental health status of the subjects was assessed using the Depression, Anxiety, and Stress Scale - 21 (DASS-21), the sleep quality of the students using the Pittsburgh Sleep Quality Index (PSQI) questionnaire and the attachment style using the Experiences in Close Relationships Inventory (ECR). The study revealed that 70% of the subjects were suffering stress of different levels, two-thirds of them were undergoing varying degrees of depression, and nearly 85% were bearing anxiety after the outbreak of COVID-19. The prevalence of poor sleeping quality among college students was 36.2%. The study concluded that stress, anxiety and depression index were all in direct proportion to the level of sleeping problems. The attachment style may play a more or less role in moderating the direct proportion. The findings could help choose appropriate interventions to try to solve the mental and sleep problems for people with different attachment styles.

Keywords: the COVID-19; mental health; sleeping quality; attachment style.

1. Introduction

At the end of 2019, there were cases of pneumonia of unknown cause with ties to Huanan Market, where live animals were available for sale, in Wuhan, Hubei Province, China, and the virus was subsequently confirmed to be a new type of coronavirus (COVID-19)[1]. On January 30th, 2020, the WHO designated the outbreak an international health emergency, and on March 11, 2020, it was declared a pandemic. [2,3]. At present, small-scale cluster outbreaks keep occurring in China from time to time. Under the demand from the continuous strategy of preventing imported cases and domestic resurgence, all the universities are in imperforation or a semi-closed state (the students cannot leave school without approval). The outbreak and the continuation had adverse effects on the mental health of college students, with more and more common insomnia symptoms [4]. In a study involving 194 cities in China, there was a higher moderate to severe anxiety rate (29%) and a higher moderate to severe depressive rate (17%) [5]. Moreover, due to the spread of COVID-19, insomnia is more severe in young people and women, and poor sleep hygiene practices have spread across society. [6]. The undergraduate students, a subgroup of the general population, are mostly far away from home and study in other places alone (for example, according to ECNU statistics, only 16.8% of the freshman are from Shanghai in 2022), which may lead to a higher risk of catching psychological disorders when facing considerable strain, frequent exams, and unstable life.

Based on existing research, there are a significant proportion of college students showed significant symptoms of stress, anxiety, depression, and insomnia [7-9]. During COVID-19, undergraduate students are facing a desperate state of mental health. Moreover, affected by the epidemic situation, the prevalence of clinical insomnia for college students is 20.05% and their sleeping quality was worse than before [10,11].

According to previous studies, previous studies have evidenced that sleeping quality negatively correlates with anxiety level, depression level and stress level [11,12]. Furthermore, the attachment

style plays an important role in regulating both mental health and sleeping quality [13,14]. To be specific, subjects with the insecure attachment style are more likely to suffer sleeping problems and have a greater risk of mental illness [13,14].

In spite of the abundant existing research on attachment style, mental health, and sleeping disorder, they lingered at the relationship of two out of the three (attachment style-mental health, mental health-sleeping disorder, attachment style-sleeping disorder). The studies focusing on the interrelationship between attachment style and sleeping quality were insufficient. In addition, there is a lack of research on the influence of attachment style on mental health or sleeping quality in China.

During the epidemic, college students have always been faced with uncertainty, such as the sudden small-scale cluster outbreaks, the adjustment of the model of teaching and learning, the possibility of closing school and so on. The deep uncertainty or the enormous changes may play a negative role in keeping their mental health and sleeping quality, which may lead to poor academic performance and attention difficulties. Moreover, the epidemic has brought great difficulties to social connection and the reunion of relatives and friends. The mood of the students with different attachment styles may be influenced at different levels. As a result, the COVID-19 epidemic has an inestimable influence to the mental health (stress, anxiety and depression included) and sleeping quality of college students, which the attachment style may have a mediation effect on it.

By using questionnaires, the study aims to assess the situation of mental health and the quality of sleep among university students under regular epidemic prevention measures during Covid-19. The study also explores the relationship between the two factors and the mediation effects of different attachment styles. Understanding how these factors interact may be helpful in developing measures to reduce the level of sub-healthy mental state among college students and thereby raise the well-being of the students in this special period.

2. Methods

This online cross-sectional survey was conducted in September 2022 among undergraduate students studying at prestigious universities in Shanghai and Nanjing.

The study used Wenjuanxing, a professional online questionnaire platform in China, to make a questionnaire and collect data. All subjects were informed of the research contents and methods before the questionnaire was distributed and assured that their personal information will not be disclosed. Overall, 70 students were approached and 68 of the responses were valid.

Basic personal information including gender, age, grade and current address was collected. The Depression Anxiety Stress Scale-21(DASS-21) questionnaire, which was updated by Xiang Xu et al. (2010) in accordance with the questionnaire created by Lovibond et al. in 1995, was used to assess the mental health state of the students. There are three subscales of depression, anxiety, and stress each including seven items in the DASS-21, which has 21 total items. All of the items use the 4-level scoring from "0" to "3" (0 - never applied to me; 1 - applied to me occasionally; 2 - sometimes applied to me; 3 - always applied to me). The scores for each item were calculated by adding up the specific questions' scores and then multiplied by 2. The severity of the distress feelings increased with scores. The scores of the 3 sub-scales respectively indicated the 5 different levels of three mental health statuses.

The recent sleeping patterns of the subjects were evaluated by using the Pittsburgh Sleep Quality Index (PSQI). It was created by Dr. Buysse et al. (1989) to assess the quality of sleep of patients with sleep problems and mental illnesses, but it can also be used to assess the sleep of healthy individuals. Nineteen individual items generate seven "component" scores: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. The seven component scores are added together to produce the overall score. When identifying excellent and bad sleepers, a total score > 7 had a diagnostic sensitivity of 98.3% and a specificity of 90.2% (kappa = 0.89, p 0.01) [15].

The moderator of attachment type was assessed by the Experiences in Close Relationships Inventory (ECR), which was based on the existing adult attachment scale through analysis and actual measurement completed by Brenman et al (1998). This scale includes two sub-scales: avoidance (uncomfortable with being close to and dependent on others) and anxiety (fear of rejection and abandonment). The final scores of the 4 types of attachment (Secure attachment, fearful attachment, preoccupied attachment and dismissing attachment) were calculated according to the score of the two sub-scales and the Fisher linear discriminant formula. The type with the highest score is the final result.

R-studio version 4.1.2 software, SPSS version 23.0 software, and Microsoft Excel were used to conduct all statistical analyses. Continuous data are shown as means and standard deviations, whereas categorical variables are shown as frequencies and percentages. The study used Student's t-test to test the difference between the continuous variables within categorical variable groupings and Spearman's chi-square test to explore the relationship between the ordered variables. Unary linear regression was used to examine the slope of two variables and two-factor analysis of variance was used to check the moderation effect.

3. Results

3.1 Characteristics of the subjects involved

In total, there were 69 questionnaires that were finally satisfactory to the requirement being considered for final analysis. The individuals were aged between 17 and 23, with an average age of 19.09 (SD=1.442) years old. More than three-quarters of the subjects (75.4%) are aged below 20 years old and there are 5.8% of them are minors (below 18). Furthermore, the number of female subjects is exactly twice that of male subjects. Most of the participants are undergraduates (92.8%) and the proportion of freshmen (40.6%) is the highest.

Table 1 presents the details of the subjects.

Table 1. Details of the subjects involved

	Total	Stress			Anxiety			Depress			Sleeping		
		Norm al	Abnorm al	P- valu e	Norm al	Abnorm al	P- valu e	Norm al	Abnorm al	P- valu e	Norma l	Abnorm al	P- valu e
	n(%)	n(%)	n(%)		n(%)	n(%)		n(%)	n(%)		n(%)	n(%)	
Gend er				0.44 7			0.35 0			0.05 5			< 0.01
Male	23 (33.3)	6 (26.1)	17 (73.9)		3 (13.0)	20 (87.0)		6 (26.1)	17 (73.9)		18(78. 3)	5(21.7)	
Fema le	46(66. 7)	14 (30.4)	32 (69.6)		8 (17.4)	38 (82.6)		17 (37.0)	29 (63.0)		26(56. 5)	20(43.5)	
Age group (year)				0.57 5			0.19 4			0.64 3			0.04 0
>20	8(11.6)	2 (25.0)	6 (75.0)		2 (25.0)	6 (75.0)		3 (37.5)	5 (62.5)		5(62.5)	3(37.5)	
≤20	61(88. 4)	18 (29.5)	43 (70.5)		9 (14.8)	52 (85.2)		20 (32.8)	41 (67.2)		39(63. 9)	22(36.1)	

3.2 Components of mental health

The score for mental health was composed of three sub-scales: stress, anxiety and depression. The difference in mental health (stress p-value = 0.438, anxiety p-value = 0.642, depress p-value = 0.068) between males and females was not significant in a statistical sense. The influence of the age (over or below 20) was insignificant in both attachment style and the level of mental health. However, the DASS-21 score rose with increased age. To be more specific, the stress level was from 17.00 points (SD = 10.797) in participants aged > 20 years old to 12.62 points (SD = 9.155) in the participants age ≤ 20 years old (p-value = 0.283). The anxiety level was from 14.00 points (SD = 11.856) in

participants aged > 20 years old to 9.84 points (SD = 8.857) in the participants age ≤ 20 years old (p-value = 0.072). The depression level was from 14.50 points (SD = 12.773) in participants aged > 20 years old to 9.54 points (SD = 8.782) in the participants age ≤ 20 years old (p-value = 0.036). There are 31.9% of the students suffering very severe stress, 37.7% bearing very severe anxiety, and 24.6% withstanding very severe depression.

Table 2 presents the results in detail on mental health.

Table 2. Details of mental health

Mental health Components	Total	Gender		p-value	Age grouped (years)		
		Male	Female		>20	≤20	p-value
Stress, n (%)				0.438			0.838
Healthy	20 (29.0)	6 (30.0)	14 (70.0)		2 (10.0)	18 (90.0)	
Mild	8 (11.6)	3 (37.5)	5 (62.5)		0 (0.0)	8 (100.0)	
Moderate	11 (16.0)	5 (45.5)	6 (54.5)		2 (18.2)	9 (81.8)	
Severe	8 (11.6)	2 (25.0)	6 (75.0)		0 (0.0)	8 (100.0)	
Very severe	22 (31.9)	7 (31.8)	15 (68.2)		4 (18.2)	18 (81.8)	
Anxiety, n (%)				0.642			0.256
Healthy	11 (15.9)	3 (27.3)	8 (72.7)		2 (18.2)	9 (81.8)	
Mild	13 (18.8)	4 (30.8)	9 (69.2)		1 (7.7)	12 (92.3)	
Moderate	11 (15.9)	4 (36.4)	7 (63.6)		0 (0.0)	11 (100.0)	
Severe	8 (11.6)	3 (37.5)	5 (62.5)		1 (12.5)	7 (87.5)	
Very severe	26 (37.7)	9 (34.6)	17 (65.4)		4 (15.4)	22 (84.6)	
Depress, n (%)				0.068			0.270
Healthy	23 (33.3)	6 (26.1)	17 (73.9)		3 (13.0)	20 (87.0)	
Mild	10 (14.5)	3 (30.0)	7 (70.0)		0 (0.0)	10 (100.0)	
Moderate	17 (24.6)	9 (52.9)	8 (47.1)		1 (5.9)	16 (94.1)	
Severe	2 (2.9)	1 (50.0)	1 (50.0)		1 (50.0)	1 (50.0)	
Very severe	17 (24.6)	4 (23.5)	13 (76.5)		3 (17.6)	14 (82.4)	

3.3 The details of sleeping quality

The individuals' average bedtime was 7.25 ± 1.10 h, and their average sleep time was 6.04 ± 0.67 hours. The subjects' average sleep efficiency was 84%. Although there were 27.5% of the participants complained about their poor sleeping quality, only 6.0% of them once report to use drugs to help themselves sleep.

In addition, the difference between men and women in PSQI scores was statistically significant (p-value < 0.01). To be more specific, almost half of the female subjects (43.5%) were suffering sleeping problems while only 21.7% of the male participants were bearing sleeping problems. Furthermore, the overall PSQI score and age had a favorable relationship, from 6.95 points (SD = 2.895) among individuals under the age of 20 compared to 7.13 points (SD = 4.224) in participants beyond the age of 20 (p-value = 0.040). In addition, 36.2% of the students had sleeping problems.

Table 3 presents the results in detail on sleeping quality.

Table 3. Details of sleeping quality

Sleeping quality Components	Total	Gender		p-value	Age grouped (years)		
		Male	Female		>20	≤20	p-value
Subjective sleeping quality (Mean + SD)	1.13 ± 0.68	1.04 ± 0.77	1.17 ± 0.64	1.000	1.38 ± 0.52	1.1 ± 0.70	0.830
Sleep latency, n (%)				0.170			0.846
≤15min	25 (36.2)	8 (32.0)	17 (68.0)		2 (8.0)	23 (92.0)	
16-30 min	29 (42.0)	8 (27.6)	21 (72.4)		5 (17.2)	24 (82.8)	
>30 min	15 (21.7)	7 (46.7)	8 (53.3)		1 (6.7)	14 (93.3)	
Sleep duration, n (%)				0.112			0.806
>7 h	17 (24.6)	10 (58.8)	7 (41.2)		3 (17.6)	14 (72.4)	
6-7 h	38 (55.1)	10 (26.3)	28 (73.7)		4 (10.5)	34 (89.5)	
<6 h	14 (20.3)	3 (21.4)	11 (78.6)		1 (7.1)	13 (92.9)	
Habitual sleep efficiency, n (%)				0.145			0.008
>85%	46 (66.7)	13 (28.3)	33 (71.7)		7 (15.2)	39 (84.8)	
75-84%	18 (26.1)	8 (44.4)	10 (55.6)		1 (5.6)	17 (94.4)	
<75%	5 (7.2)	2 (40.0)	3 (60.0)		0 (0.0)	5 (100.0)	
Any sleep disturbance, n (%)				<0.001			0.003
No	10 (14.5)	8 (80.0)	2 (20.0)		0 (0.0)	10 (100.0)	
Yes	59 (85.5)	15 (25.4)	44 (74.6)		8 (13.6)	51 (86.4)	
Use of sleep medication, n (%)				0.002			<0.001
No	65 (94.2)	23 (35.4)	42 (64.6)		6 (9.2)	59 (90.8)	
Yes	4 (5.8)	0 (0.0)	4 (100.0)		2 (50.0)	2 (50.0)	
Daytime dysfunction, n (%)				0.320			0.001
No	2 (2.9)	1 (50.0)	1 (50.0)		1 (50.0)	1 (50.0)	
Yes	67 (97.1)	22 (32.8)	45 (67.2)		7 (10.4)	60 (89.6)	

3.4 Attachment styles

The account of the secure attachment style was 18.8%, and the fearful attachment was 44.9%. The preoccupied attachment style accounts for 31.8% and the dismissing attachment for 4.3%. The difference between males and females in the specific attachment style was not found to be statistically significant ($p = 0.3177$), while the difference between secure and insecure types was significant in the statistic sense ($p\text{-value} = 0.01$).

Table 4 presents the results in detail on attachment style.

Table 4. Details of attachment styles

	Total	Secure attachment	Fearful attachment	Preoccupied attachment	Dismissing attachment	P-value
	n (%)	n (%)	n (%)	n (%)	n (%)	
Gender						0.497
Male	23 (33.3)	2 (8.7)	12 (52.2)	8 (34.8)	1 (4.3)	

Female	46(66.7)	11 (23.9)	19 (41.3)	14 (30.4)	2 (4.3)	0.338
Age group (year)						
>20	8(11.6)	2 (25.0)	4 (50.0)	2 (25.0)	0 (0.0)	
≤20	61(88.4)	11 (18.0)	27 (44.3)	20 (32.8)	3 (4.9)	

3.5 The relationship between mental health and sleeping quality

We use the Spearman correlation to test the relationship between the score of mental health and sleeping quality. The higher the score of the stress sub scale of DASS-21, the higher the score of PSQI (p-value < 0.01), which means that the subjects with a higher level of stress may be more possible to suffer sleeping problems. Moreover, the link between the degree of depression and PSQI (p-value < 0.01) and the relationship between the level of anxiety and sleeping issue (p-value < 0.01) are same.

Table 5 presents the results in detail on the relationship between mental health and sleeping quality.

Table 5. Relationship between mental health and sleeping quality

	Total	Good sleeper	Poor sleeper	P-value
Stress, n (%)				0.005
Healthy	20 (29.0)	17 (85.0)	3 (15.0)	
Mild	8 (11.6)	5 (62.5)	3(37.5)	
Moderate	11 (16.0)	7 (63.6)	4(36.4)	
Severe	8 (11.6)	6 (75.0)	2 (25.0)	
Very severe	22 (31.9)	9 (40.9)	13 (59.1)	
Anxiety, n (%)				0.016
Healthy	11 (15.9)	10 (90.9)	1 (9.1)	
Mild	13 (18.8)	9 (69.2)	4 (30.8)	
Moderate	11 (15.9)	6 (54.5)	5 (45.5)	
Severe	8 (11.6)	7 (87.5)	1 (12.5)	
Very severe	26 (37.7)	12 (46.2)	14(53.8)	
Depress, n (%)				0.002
Healthy	23 (33.3)	17 (73.9)	6 (26.1)	
Mild	10 (14.5)	9 (90.0)	1 (10.0)	
Moderate	17 (24.6)	12 (70.6)	5 (29.4)	
Severe	2 (2.9)	2 (100.0)	0 (0.0)	
Very severe	17 (24.6)	4 (23.5)	13 (76.5)	

3.6 The moderating role of the attachment style

We classify the fearful attachment, the preoccupied attachment, and the dismissing attachment as the unsafe attachment to test the mediation effect of attachment style. The independent sample t-test was utilized by the researcher, and she discovered a significant difference between the stress levels of those with secure attachments and those with insecure attachments (p-value < 0.01). The same situation also happened on the anxiety (p-value < 0.01) and depression (p-value < 0.01) scores. However, the participants with various attachment types had similar PSQI scores, with no discernible variation between them.

Because of the limit on the number of samples, the interaction between the attachment style and the level of mental health status was not significant. The researcher cannot find a moderation effect on attachment style when using the level of mental health to forecast sleeping quality.

However, the subjects with dismissing attachment owns a much smoother slope of the anxiety score and the PSQI score than the subjects with other attachment style and the fearful attachment followed. It is noteworthy that the two styles of attachment are all avoidant attachments. The same situation also happened on the slope of the depression score and the PSQI score, whereas the slope of the stress score and sleeping quality was roughly the same.

The results are presented in Table 6. The scatter plot were shown in Figure 1-3.

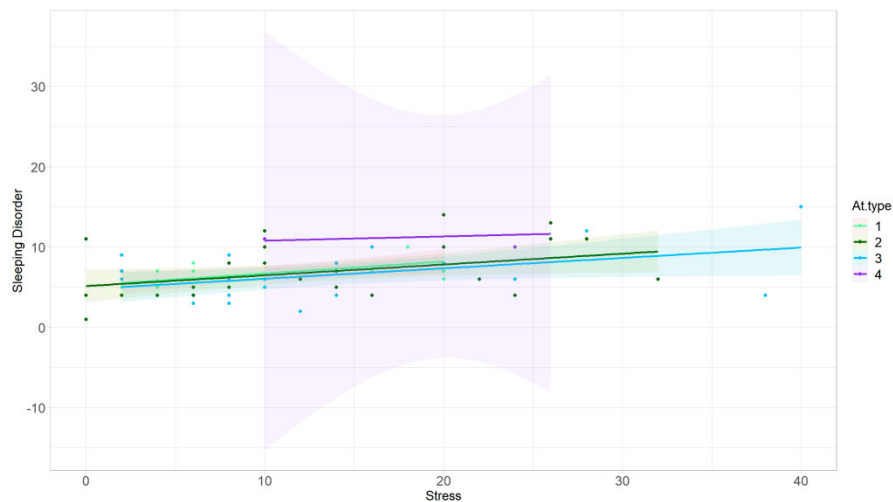


Fig. 1 Relationship between Stress and sleeping problems in COVID-19

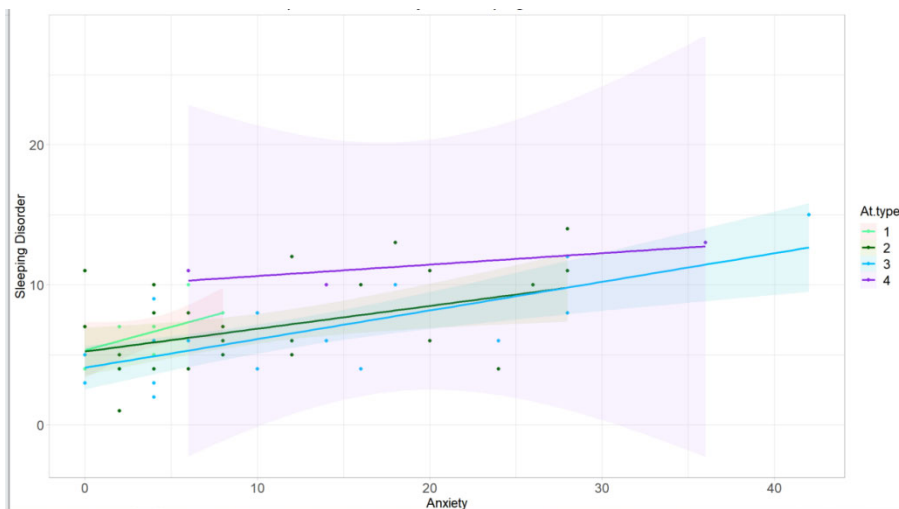


Fig 2. Relationship between Anxiety and sleeping problems in COVID-19

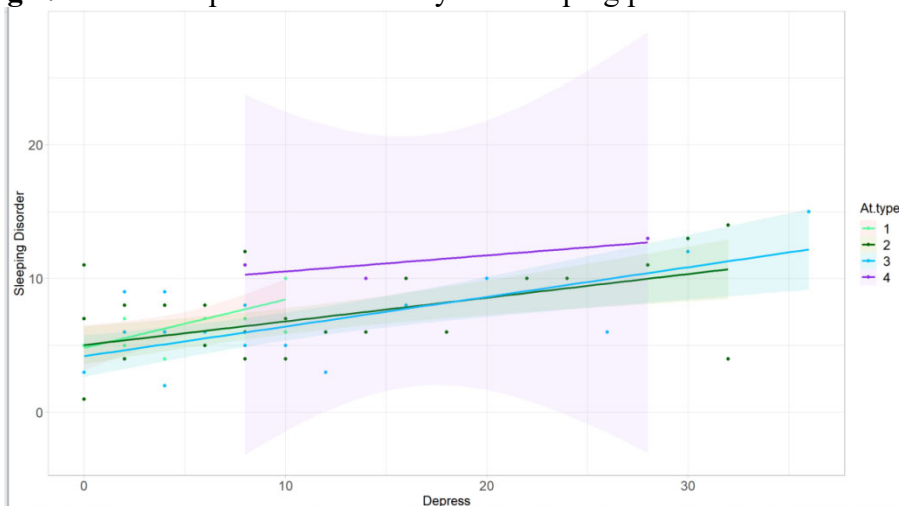


Fig 3. Relationship between Depress and sleeping problems in COVID-19

4. Discussion

The present research explored that more than 70% of the subjects were suffering stress of different levels: two-thirds of them were undergoing varying degrees of depression, and nearly 85% were bearing anxiety during the COVID-19 pandemic. According to SHENG HUI KIOH et al, there were approximately 36.1% of the undergraduate students in Klang Valley had depression, 40.9 % anxiety and 22.5% stress during the COVID-19 lockdown which was higher than those before the epidemic [16]. Consistent with the current research, Jungmin et al found that 87.61% of the students were at a moderate or severe stress level, and 91% of them reported that they felt stress and anxiety after the outbreak of the epidemic [8]. In an earlier study on college students, 23% of them presented significant symptoms of anxiety, 24% depression and 32.9% insomnia [7]. Different factors might influence the variation between different studies, including the variation in methods, various study sites, various sociocultural contexts, and various academic demands among various population groups.

The causes of deterioration in mental health may be related to long-term isolation, lack of social relationships, fear of infection, lack of correct information and so on. The possible causal chain is shown in Figure 4 [17]. Moreover, people who usually do exercises were more likely to have better mental health [5].

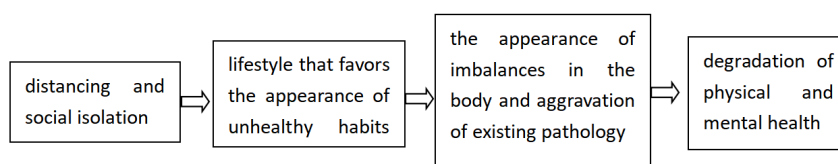


Fig 4 The possible causal chain long-term isolation and mental health

The researcher found that there were approximately 36.2% of college students suffering sleeping problems during the epidemic. In Li-yu Lin et al study, the prevalence of clinical insomnia was 20.05% while COVID-19 was in the air [6]. In an earlier study, there were 47.37% of the residents suffering moderate and severe insomnia at the outbreak of the epidemic in Nanjing [10]. In other research on Chinese university students, a higher proportion (42.47%) of them were found to have poor sleeping quality during COVID-19 which was poorer than before [11,18].

Daytime dysfunction was the most prevalent PSQI component for the participants in the current study (97.1%), followed by sleep disturbance (85.5%), longer sleep latency (21.7%), and shorter sleep duration (20.3%).

According to previous research on college students, online learning during the epidemic may increase the time spent working and learning in bed, which is inconsistent with the intervention measures that limit the time spent in bed, and may lead to prolonged sleep [11]. Furthermore, more and more college students may feel mood fluctuation when the pressure of entering a higher school or finding a good job increases, which seriously affects their sleep quality.

The researcher found that the higher the score of the stress sub-scale of DASS-21, the higher the score of PSQI, which means that the subjects with a lower level of mental health may be more possible to suffer sleeping problems. According to some previous studies, the two variables can predict the change trend of each other which was in accordance with the result in the present research [11,12]. In addition, psychological resilience and ruminant play a mediating role between stress and college students' sleep quality according to a previous study [12]. Moreover, depression symptoms and sleeping quality were related before and during the epidemic when controlling the epidemic exposure factors, but the relationship between anxiety and sleeping quality were not found without the epidemic, which means the epidemic caused the correlation between anxiety symptoms and sleep quality [11].

The mediating effect of attachment styles was not found. Nonetheless, the researcher explored that the subjects with dismissing attachment own a much smoother slope of the anxiety score and the PSQI score than the subjects with other attachment styles and the fearful attachment followed, which means attachment style may play a more or less role in mediating the influences that mental health status places on students' sleeping quality. Additionally, the attachment style plays an important role in regulating both mental health and sleeping quality according to other studies. To be specific, subjects with the insecure attachment style are more likely to suffer sleeping problems and have a greater risk of mental illness [13-14].

There were some noteworthy limitations in this research. Firstly, the present study was aimed at college students from prestigious universities in Shanghai and Nanjing, so the results might not apply to other students in different levels of universities or different cities. Secondly, the scale of subjects with dismissing attachment styles was too small which led to big problems in the analysis on the mediation of attachment style. Thirdly, due to the use of the cross-sectional study design, there was no baseline data collected before the epidemic for the researcher to establish a causal relationship between mental health and poor sleeping quality. Fourthly, there was one possibility of recall bias because of the self-rating measurements, which may lead to outcome bias.

To sum up, mental health problems and sleeping problems during COVID-19 both become more serious for undergraduate students, which must be attached to more attention immediately. Using different interventions for people with different attachment styles may be a practice worthy of adoption.

5. Conclusion

During the epidemic, many college students were suffering different levels of mental problems and sleeping problems. Stress, anxiety and depression index were all in direct proportion to the level of sleeping problems, which can predict the changing trend of each other. The moderating effect of attachment style was not found to be significant. But it may play a more or less role in moderating the direct proportion. The research explored the relationship between mental health and sleeping quality and the moderating effect of attachment style which may be helpful in choosing appropriate interventions to try to solve the mental and sleep problems for people with different attachment styles. Future research can increase the number of subjects to investigate whether the moderating effect exists and the possible predictive effect of the attachment style.

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