

Impact of Family Function on Mental Health Problems of College Students in China During COVID-19 Pandemic and Moderating Role of Coping Style: A Longitudinal Study

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Research Article

Keywords: College students, COVID-19 pandemic, family function, coping styles, mental health problems, longitudinal study

Posted Date: October 4th, 2021

DOI: <https://doi.org/10.21203/rs.3.rs-878815/v1>

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Abstract

Background. During the COVID-19 pandemic, college students were required to stay at home and maintain social distancing the entire spring semester of 2020. There is little research on how family function influenced mental health problems and how coping styles moderated the relationship between family function and mental health problems among college students during their stay-at-home period.

Methods. We carried out four evaluations between February and October 2020 through an online survey. A total of 13,462 college students (age = 16–29 years) participated. Family function, coping styles, depression symptoms, and anxiety symptoms were studied. To evaluate the associations between variables, a generalized estimating equation was used.

Results. Findings indicate that the incidence rates of depression rose during stay-at-home period from 33.87% to 40.08% after schools reopened. The incidence rates of anxiety rose from 17.45% to 26.53% through the entire period. The two-way interaction of time × family function for depression and anxiety were significant ($\chi^2 = 52.97, p < 0.001$ and $\chi^2 = 51.25, p < 0.001$, respectively). The three-way interaction of time × family function × coping style were also significant for depression and anxiety ($\chi^2 = 862.09, p < 0.001$ and $\chi^2 = 583.29, p < 0.001$, respectively)

Conclusions. These findings shed light on how family function intersected with coping styles to influence the mental health problems of college students during and after the stay-at-home period of COVID-19.

1. Introduction

It is now clearly evident that COVID-19 pandemic has had psychological and social impact worldwide, and studies have indicated that mental health problems will soon become a big global issue [1]. Previous research studying the impact of COVID-19 on an individual's mental health mainly focused on the epidemiology of depression, anxiety, sleeping problems, suicidal ideation, and PTSD symptoms [2–4]. However, there is a lack of research on factors that affected mental health problems during COVID-19 pandemic.

To prevent the rapid spread of COVID-19, in February 2020 the Chinese government ordered a nationwide closure of all educational institutions and the Ministry of Education suggested “suspending classes without suspending learning.” Students across the country were required to stay at home and study online. University campus life and learning environment play a crucial role in students' psychological development, their peer relationship, and autonomy. The results of a nationwide survey in China show that COVID-19 pandemic has brought about a high degree of psychological stress to general population, especially younger generation [5–8].

Large-scale health disasters intensify not only the psychological stressors but also the basic human need to feel safe, connected, calm, useful, and hopeful [9]. Family is one of the most prominent factors that impact mental health, and impaired family environments contribute to the risk for mental health problems (MHP) among family members [10–12]. A nationwide strict lockdown during the pandemic meant long-term home isolation. The negative psychological effects of social isolation are obvious, and a lack of sufficient personal space in the family may contribute to frequent parent–child conflicts and a surge in family pressure or even family violence [13]. Family functioning is defined as the extent to which a family performs as a unit to cope with stressors [14]. Previous studies have shown that family function is negatively correlated to MHP [15–17].

Under the impact of both COVID-19 pandemic and family pressure, an individual's coping style plays a significant role between pressure and mental health [18, 19]. Coping style refers to the specific efforts, both behavioral and psychological, that people employ to master, tolerate, reduce, or minimize stressful events [20]. According to the integrated model of coping process proposed by N Ntoumanis, J Edmunds and JL Duda [21], coping strategies are the result of stress appraisals, which can be influenced by social context and psychological needs. This model combines two important theories: (1) cognitive motivational relational theory of coping [22] and (2) self-determination theory of motivation [23]. When an individual faces a

stressful situation, different appraisals occur depending upon the evaluation of the stressor. Lazarus and Folkman (1984) have identified different types of appraisals as harm–loss, threat, challenge, and benign. Harm–loss appraisal refers to a damage that has already been done and is more likely to induce an emotionally focused passive coping style. Threat appraisal refers to a potential for harm or loss, and because the damage is yet to come, an individual may have a strong response that tries all kinds of strategies to cope. Challenge appraisal refers to an opportunity for personal growth, which easily leads one to take a positive coping style and focus at problem itself. Benign appraisal refers to a situation when an individual believes there is no threat, takes no further appraisal, and gives a weak response [21]. Recent cross-sectional studies have indicated that maladaptive coping strategies have a negative correlation with MHP during the pandemic [19, 24].

Although previous studies have used retrospective designs with respect to possible risk factors [25], little research has been done to understand the effect of interaction between family function and coping style on the mental health of college students during the quarantine period. This paper presents the results of a longitudinal study to comprehensively describe changes in the mental health states of college students with different family function and different coping styles from the beginning until the end of the quarantine period. We hypothesis a moderator model, family function would be negatively associated with MHP (hypothesis 1), and the influence will be weakened after schools reopened (hypothesis 2). Different coping styles would moderate the relation between family function and MHP during different times (hypothesis 3). The objective of this study was to assess how the main social context (family) and self-determined variable (coping style) together influence the mental health problems of college students during and after the stay-at-home period.

2. Methods

2.1 Study design and participants

This longitudinal prospective observational study was conducted on a large sample of college students from 22 colleges and universities in the Guangdong Province of China. The study was carried out in four survey periods: February 3–10, 2020 (T1); March 24 to April 3, 2020 (T2); June 1–15, 2020 (T3); and September 10 to October 17, 2020 (T4).

During the first three surveys, students had vacations and the colleges were still closed and therefore most students were staying at home with their families. The fourth survey was conducted at each college, using the same means as for the first three surveys, but after students had returned to their colleges.

A total of 164,101 students (valid questionnaire: 88.3%) completed the initial survey (T1) at the first outbreak phase of the pandemic, 148,343 students (valid questionnaire: 95.4%) completed the second-wave survey (T2) at the COVID-19 remission stage (for epidemiologic assessment of the first two surveys, see Y Li, J Zhao, Z Ma, LS McReynolds, D Lin, Z Chen, T Wang, D Wang, Y Zhang, J Zhang, et al. [3]), 159,187 students (valid questionnaire: 95.7%) completed the third-wave survey (T3) at normalization prevention stage, and 120,190 students (valid questionnaire: 97.5%) completed the fourth-wave survey (T4) after returning to schools. Of the total participants, 13,462 students participated in all the four surveys.

This study was approved by the appropriate institutional research and ethics committee of Southern Medical University. Electronic informed consents were obtained online. All participants were informed that they could withdraw from the study at any point of time.

2.2 Procedures

We prepared one common normative notice for all the 22 colleges, which mentioned the purpose, significance, deadline, and mode of participation in the online survey for all the four time periods. All students in the target universities were regarded as potential participants and were asked to voluntarily participate in the survey through the network platform (http://www.togx.cn/step_50.html). (For more details, see prior study Y Li, J Zhao, Z Ma, LS McReynolds, D Lin, Z Chen, T Wang, D Wang, Y Zhang, J Zhang, et al. [3]).

2.3 Measurements

2.3.1. Demographic information

The demographic information of the participants included age, gender (male or female), and college year (freshman, sophomore, junior, senior, and graduate).

2.3.2 Family function

The family function of the participants was assessed by Family APGAR [26] for T2–T4. The scale is rated on a 3-point Likert scale and consists of five items, with each item scored from 0 (*never or rarely*) to 2 (*most or all of the time*). The total score ranges from 0 to 10, and a score of 7–10 indicates a highly functional (HF) family, a score of 4–6 indicates a moderately dysfunctional family (MdF), and a score of 0–3 indicates a severely dysfunctional (SdF) family. The Cronbach α was 0.89 at T2, 0.91 at T3, and 0.90 at T4 in this study.

2.3.3 Coping style

The coping style of the participants was assessed using Simplified Coping Style Questionnaire (SCSQ) [27] at T1. The SCSQ is rated on a 4-point Likert scale and consists of 20 items, with each item scored from 0 (*never*) to 3 (*very often*). It consists of two dimensions: the active coping and the passive coping. The SCSQ score reflects the coping style preferences of participants, with a higher score indicating a higher possibility that the participant would adopt the relevant coping style. To differentiate from the coping styles theorized by N Ntoumanis, J Edmunds and JL Duda [21], in this study we used the standard score of active/passive coping to distinguish the participants into four groups. The standard score was achieved by Z-transformation of the mean and standard deviation of the positive and negative coping styles of the entire sample of T1. If the Z score of active coping > 0 and the Z score of passive coping ≤ 0 , it indicated that the individual generally adopted a positive coping style. If the Z score of active coping ≤ 0 and the Z score of passive coping > 0 , it indicated that the individual generally adopted a passive coping style. If the Z scores of both active and passive coping > 0 , it indicated that the individual generally adopted a strong response coping style. If the Z scores of both active and passive coping ≤ 0 , it indicated that the individual generally adopted a weak response coping style. The SCSQ is commonly used in China, and the Cronbach α coefficients for the two dimensions were 0.90 and 0.77, respectively, in this study.

2.3.4 Mental health problems

Mental health issues reported by participants included depression and anxiety. Depression symptoms were assessed using Patient Health Questionnaire (PHQ-9) [28] on a 4-point scale ranging from 0 to 3, and a summed score of 7 indicates probable clinical depression [29]. The Cronbach α was 0.87 at T1, 0.90 at T2, 0.91 at T3, and 0.92 at T4.

Anxiety symptoms were measured using the Chinese version of Generalized Anxiety Disorder Scale (GAD-7) [30], which consists of 7 items rated on a 4-point scale from 0 to 3. As validated in a Chinese population, a cutoff total score of 7 indicates clinical levels of anxiety [31]. The Cronbach α was 0.91 at T1, 0.92 at T2, 0.94 at T3, and 0.94 at T4.

2.4 Covariates

To control the association between family function and MHP for confounding, the following variables were adjusted: age group (< 18 , 18–19, 20–21, 22–23, ≥ 24 years), self-reported gender (male/female), self-reported mental health status before the outbreak, including self-reported prior mental health problems (yes/no), and self-reported psychological counseling experience (yes/no). The school type was initially coded as medical university, normal university, multi-faculty university, three-year normal college, and three-year vocational college, but was recoded to binary (university and three-year college) in order to reduce the parameters in the statistical models to meet convergence criteria.

2.5 Statistical analysis

The relation between the repeated measures of family function (during T2–T4), MHP (during T1–T4), and coping style (during T1) were tested for statistical significance by fitting logistic regression models to the data for each MHP outcome by using a generalized estimating equation (GEE) approach [32, 33].

MHP were transformed into dichotomic variable by cutoffs, family function were classified into three categories, and coping styles were classified into four categories (see Measurements for details). All analyses were performed using Statistical Package for Social Sciences (SPSS) version 25.0.

3 Results

3.1 Descriptive characteristics

Of the 13,462 participants included in this analysis, 74.8% were female participants of ages 16–29 years ($M = 19.68$, $SD = 1.38$). Table 1 shows detailed sample characteristics, including gender, age, college year, university, and college type, ever received counseling for MHP from a professional, and prior MHP.

Table 1
Sample characteristics (N= 13462)

Variable	No. of students (%)
Gender	
Male	3387 (25.2)
Female	10075 (74.8)
Age (years)	
< 18	918 (6.82)
18–19	7539 (56.00)
20–21	4426 (32.88)
22–23	405 (3.01)
≥ 24	174 (1.29)
University/college type	
Medical university	704 (5.23)
Normal university	3421 (25.41)
Multifaculty university	2571 (19.10)
Three-year normal college	2087 (15.50)
Three-year vocational college	4679 (34.76)
College year	
Freshman	6924 (51.43)
Sophomore	4483 (33.30)
Junior	1912 (14.20)
Senior	143 (1.07)
Psychological counseling experience	
Never	12957 (96.25)
Yes	505 (3.75)
Prior mental health problems	
No	13381 (99.40)
Yes	81 (0.60)

Table 2 shows sample sizes and percentage of each subgroup categorized by three independent variables: time, family function, and coping style. All subgroups had more than 100 participants. SdF was the smallest group (118 participants) with active coping style at T1 and T2, and HF was the largest group (2085 participants) with active coping style at T1 and T2. Most of the HF and MdF subgroups had around 1000 participants (795–2085 participants), whereas SdF subgroups had around 200 participants (118–400 participants). The sample sizes were enough to take next step in statistics.

Table 2
Sample Sizes of Subgroups

	T1		T2		T3		T4					
	N	%*	N	%*	N	%	N	%				
HF	6493	48.23	6493	48.23	5474	40.66	6219	46.20				
Active coping	2085	15.49	(32.11)	2085	15.49	(32.11)	1797	13.35	(32.83)	1949	14.48	(31.34)
Passive coping	795	5.91	(12.24)	795	5.91	(12.24)	629	4.67	(11.49)	782	5.81	(12.57)
Strong response coping	1998	14.84	(30.77)	1998	14.84	(30.77)	1714	12.73	(31.31)	1951	14.49	(31.37)
Weak response coping	1615	12.00	(24.87)	1615	12.00	(24.87)	1334	9.91	(24.37)	1537	11.42	(24.71)
MdF	5911	43.91		5911	43.91		6674	49.58		6096	45.28	
Active coping	1021	7.58	(17.27)	1021	7.58	(17.27)	1255	9.32	(18.80)	1128	8.38	(18.50)
Passive coping	1220	9.06	(20.64)	1220	9.06	(20.64)	1352	10.04	(20.26)	1242	9.23	(20.37)
Strong response coping	1419	10.54	(24.01)	1419	10.54	(24.01)	1625	12.07	(24.35)	1439	10.69	(23.61)
Weak response coping	2251	16.72	(38.08)	2251	16.72	(38.08)	2442	18.14	(36.59)	2287	16.99	(37.52)
SdF	1058	7.86		1058	7.86		1314	9.76		1147	8.52	
Active coping	118	0.88	(11.15)	118	0.88	(11.15)	172	1.28	(13.09)	147	1.09	(12.82)
Passive coping	327	2.43	(30.91)	327	2.43	(30.91)	361	2.68	(27.47)	318	2.36	(27.72)
Strong response coping	211	1.57	(19.94)	211	1.57	(19.94)	289	2.15	(21.99)	238	1.77	(20.75)
Weak response coping	402	2.99	(38.00)	402	2.99	(38.00)	492	3.65	(37.44)	444	3.30	(38.71)

*Values within parentheses indicate within-group percentage.

3.2 Longitudinal effect of family function on MHP

Table 3 shows the main effects of time and family function for the incidence rates of MHP. All main effects are significant at $p < 0.001$ level, which means time and family function are associated with MHP. For the four-time survey periods, the highest incidence rate of depression is 43.53% (95% CI, 39.08–48.08) at T3 (i.e., when the students were at home quarantine), whereas the highest incidence rate of anxiety is 26.53% (95% CI, 22.64–30.82) at T4 (i.e., after students returned to schools). The incidence rates of MHP were lowest at T1, with 33.87% (95% CI, 29.88–38.10) for depression and 17.45% (95% CI, 14.59–20.73) for anxiety. Among the family function groups, the SdF group had the highest incidence rate of both MHP, with depression at 53.80% (95% CI, 48.98–58.55) and anxiety at 30.20% (95% CI, 25.79–35.00).

Table 3
Main Effect of Time and Family Function with Marginal Incidence Rates of MHP

Subgroup	Depression % (95% Wald CI)	Anxiety % (95% Wald CI)
Time		
T1	33.87 (29.88, 38.10)	17.45 (14.59, 20.73)
T2	39.21 (34.92, 43.67)	20.09 (16.94, 23.67)
T3	43.53 (39.08, 48.08)	22.50 (19.05, 26.37)
T4	40.08 (35.76, 44.55)	26.53 (22.64, 30.82)
Main effect of time Wald χ^2	193.68***	195.74***
Family function		
HF	22.46 (19.43, 25.81)	11.20 (9.26, 13.48)
MdF	44.01 (39.62, 48.50)	27.21 (23.29, 31.52)
SdF	53.80 (48.98, 58.55)	30.20 (25.79, 35.00)
Main effect of family function Wald χ^2	1509.21***	985.57***

The pairwise comparisons of time (see Supplementary Table S1 available online) show that the incidence rates of depression rose during T1–T3 (all significant at $P < 0.05$ level) and that the incidence rate at T4 is significantly lower than at T3 ($P < 0.05$) but not higher than at T2 ($P > 0.05$). As shown in Table 3, the incidence rates of anxiety rose during T1–T4. The pairwise comparison of family function shows that the incidence rates of the HF group were lowest and of the SdF group were highest for all MHP (all differences are significant at $P < 0.05$ level).

Table 4 shows the estimated marginal incidence rates of each MHP of each subgroup divide by time and family function. The table also includes interaction effect and simple effect of different MHP associated with time. Interaction effects are significant at $p < 0.001$ level for both depression and anxiety, which means that the MHP of the participants with different family functions changed differently over time.

Table 4
Interaction Effects and Simple Effect of Time and Marginal Incidence Rates of MHP

	Family Function			Time × Family Function Wald χ^2
	HF	MdF	SdF	
Depression % (95 Wald CI)				
T1	20.17 (17.27, 23.41)	36.04 (31.88, 40.43)	48.56 (43.20, 53.95)	52.97***
T2	21.19 (18.18, 24.54)	42.74 (38.28, 47.31)	57.21 (51.88, 62.37)	
T3	26.19 (22.68, 30.03)	50.15 (45.56, 54.73)	56.20 (51.01, 61.26)	
T4	22.61 (19.45, 26.11)	47.44 (42.88, 52.04)	53.16 (47.86, 58.39)	
Simple effect of time Wald χ^2	31.65***	315.37***	53.68***	
Anxiety % (95 Wald CI)				
T1	9.86 (8.00, 12.01)	19.43 (16.26, 23.05)	26.45 (21.84, 31.64)	51.25***
T2	10.02 (8.17, 12.24)	24.93 (21.15, 29.12)	30.06 (25.20, 35.43)	
T3	10.99 (8.97, 13.40)	31.13 (26.79, 35.82)	30.48 (25.67, 35.75)	
T4	14.44 (11.92, 17.39)	35.05 (30.41, 39.99)	34.06 (28.88, 39.66)	
Simple effect of time Wald χ^2	14.43**	220.22***	43.96***	

The pairwise comparisons of the incidence rates of MHP for each family function group with significant simple effect at different time points (see Supplementary Table S2 available online) show (high and low means significant at $P < 0.05$ level) that for the HF group the incidence rates of depression do not rise until T3, which is higher than other time, and that T4 is lower than T3 and higher than T1 but not T2. The incidence rates of anxiety rise only at T4, and there is no statistically significant difference between T1 and T3.

In the MdF group, the incidence rates of depression have significant difference between each time, meaning that the growth tendency stops at T4, but is still higher than at T2. The incidence rates of anxiety also have significant difference between each time, meaning it keeps growing from T2 to T4.

In the SdF group, the incidence rates of depression are higher at T2 and T3 than at T1 and other differences are not significant. The incidence rates of anxiety are higher at T2–T4 than at T1, and T4 is higher than T2.

To demonstrate the odds ratio of different subgroups and the change in pattern through time, we carried out an adjusted multivariate logistic regression analysis by EEG, using T1-HF group as reference group, covariates mentioned in Sect. 2.4 were controlled in the analyses. Figure 1 shows the forest plot of adjusted odds ratio (AOR) and 95% CI of each subgroup at the two MHP.

3.3 Longitudinal moderating effect of coping style to family function on MHP

The three-way interaction between time, family function and coping style on depression and anxiety incident rate are calculated, Wald χ^2 and are 862.09, $p < 0.001$ and 583.29, $p < 0.001$, respectively. The simple effects of time were also calculated (see Table 5 for simple effect of time by each subgroup). Except HF group with passive coping style on anxiety, SdF group with passive and weak response coping on both MPH do not have significant simple effect of time, other subgroups' MHP are associated with time significantly.

Table 5
Interaction Effect and Simple Effect of Time (Wald χ^2)

Family Function		<i>HF</i>		<i>MdF</i>		<i>SdF</i>	
MHP		Depression	Anxiety	Depression	Anxiety	Depression	Anxiety
Coping Style	Active	44.92***	17.8***	91.22***	70.88***	39.5***	13.21***
	Passive	11.2*	7.8	37.42***	64.48***	4.59	5.14
	Strong response	10.04*	15.71***	98.39***	116.83***	16.18***	8.39*
	Weak response	18.8***	20.27***	132.24***	99.15***	5.01	1.82

To demonstrate the odds ratio of different subgroups and the change in pattern through time, an adjusted multivariate logistic regression analysis by EEG was carried out using T1-HF group with active coping style as reference. Figure 2 shows the forest plot of AOR and 95% CI of each subgroup at the two MHP.

To present the significant result clearly, in this paper we only describe the differences between T1 and T3 and between T3 and T4 because these two survey pairs show the differences of the 4-month home quarantine and before and after schools reopened (rise and down means significant at $P < 0.05$ level level). For the HF group, the incidence rates for depression rise between T3 and T1, except for passive coping subgroup. However, at T3, the AOR of the HF group is 8.21, of the active coping subgroup is 2.19, of the strong response coping subgroup is 4.39, and of the weak response coping subgroup is 3.49; also note that the risk of passive coping subgroup is high throughout the quarantine period. After schools resumed, the incidence rates of MHP of all subgroups were low, except for weak response subgroup, and the incidence rates of the passive coping subgroup were down by 7.86% and its AOR went down to 5.89. The incidence rates for anxiety rise between T3 and T1 for active and weak response coping subgroups. At T3, the AORs of active and weak response coping subgroups were 1.44 and 2.86, respectively, whereas the AOR of passive coping subgroup was 5.68. After students returned to school, the incidence rates of all subgroups were higher, and the incidence rate of passive coping subgroup rose to 5.57% and AOR was 7.96.

For the MdF group, all four MHP incidence rates rose during T1–T3. For active, passive, strong response, and weak response subgroups, the incidence rates of depression rise 17.49%, 10.18%, 15.74%, and 14.40%, respectively, and the AORs rise from 2.36 to 5.94, 11.38 to 17.24, 7.00 to 13.24, and 4.95 to 9.14, respectively. For passive and strong response coping style subgroups, the incidence rates fall at T3–T4 by 4.34% and 3.90%, respectively, and the AORs rise to 14.4 and 11.32, respectively. For active, passive, strong response, and weak response subgroups, the incidence rates of anxiety rise 8.79%, 10.76%, 16.65%, and 10.13%, respectively, and the AORs rise from 2.35 to 5.3, 10.57 to 17.04, 6.30 to 14.62, and 5.17 to 9.40, respectively. MHP incidence rise up at T3 to T4 for active and weak response coping style group.

For the SdF group, a result worth noticing is that the incidence rates of MHP did not change after students rejoined school. The incidence rates of depression rise 29.76% and 9.86% from T1 to T3 for active and strong response coping styles, and the AOR rise from 1.99 to 8.97 for active coping style and from 8.8 to 13.10 for strong response coping style. The AOR of depression for passive coping rise from 18.27 at T1 to 23.58 at T3, and the AOR for weak response coping style rise from 9.08 at T1 to 10.67 at T3. Incidence rate of depression has no significant change after students returned to school. For active

coping subgroup, the incidence rates of anxiety rise 13.43% from T1 to T3 and the AOR changes from 1.93 to 6.55. Other subgroups have no significant change from T1 to T3. The AOR of passive coping subgroup are 14.33 at T1 and 17.3 at T3. For all coping style subgroups, there was no significant change after students returned to school.

4 Discussion

In this longitudinal study, we analyzed the tangling interaction effect of family function and coping styles with MHP during and after the stay-at-home period of February to June 2020. The time when college students across China were required to stay at home for a semester and returned to school after the lockdown period ended was an opportunity to study the relationship between these variables.

We found that the incidence rates of depression rose from 33.87% (95% CI, 29.88%–38.10%) to 43.53% (95% CI, 39.08%–48.08%) during the stay-at-home period and dropped to 40.08% (95% CI, 35.76%–44.55%) after students returned to school. The incidence rates of anxiety rose from 17.45% (95% CI, 14.59%–20.73%) to 22.50% (95% CI, 16.94%–23.67%) during the stay-at-home period and kept rising to 26.53% (95% CI, 22.64%–30.82%) after students returned to school. Our results are in line with the recent studies of M Daly, AR Sutin and E Robinson [8], who state that pronounced and prolonged deterioration in mental health of people occurred during the COVID-19 crisis in UK, and C González-Sanguino, B Ausín, MA Castellanos, J Saiz and M Muñoz [7], who state that the pandemic has had a negative impact on the mental health of general population in Spain and the mental health of people still does not seem to be at pre-crisis levels even after the country returned to new normality.

The result of interaction effect of family function and time with MHP shows different family function group changes in varying pattern though time: the incidence rates of MHP rose during the stay-at-home period in all family groups, which indicates that none of the family function could not protect the mental health of students from the impact of the pandemic. After students returned to school at T4, the direct influence of family function lessened and interaction with friends and classmates became normal. This change partly explains the reduction in the incidence rates of depression at T4 in HF and MdF groups. However, there was no change in the incidence rates of depression in the SdF group, which indicates a prolonged negative affinity of dysfunctional family function to depression. According to [34], after most universities and colleges shifted to online study mode during March to June 2020, the academic-related concerns due to pandemic situation have increased, which explains why in our study the incidence rates of anxiety in the HF group increased during T3–T4.

After taking coping styles into consideration, the variance of each subgroup began to emerge. Interestingly, for the passive coping style with HF subgroup, unlike with other subgroups, the incidence rates of MHP tended to reduce during T1–T3 and rise during T3–T4, showing a stronger protective effect of family. However, for the active coping style with SdF subgroup, the incidence rates of MHP tended to rise during T1–T3 and reduce during T3–T4, showing a stronger protective effect of coping style. Additionally, passive coping style with dysfunctional family subgroup had the highest incidence rates of all MHP during T1–T4, indicating that the risk of having MHP was 10 times higher than active coping style with HF subgroup. These results corroborate the findings of previous studies in this field [19, 24].

There are very few studies that consider the relationship between MHP and strong response or weak response coping style. Most of the previous studies using SCSQ have divided participants into only two categories and used the differential value between the standard score of active coping minus the standard score of passive coping to determine the tendency of individual coping styles. If the differential value was greater than 0, it indicated that the individual generally adopted a positive coping style and vice versa [19]. This grouping is arbitrary because the two scores may be very close and an individual may use many coping strategies to overcome difficulties, and therefore we used the method mentioned in Sect. 2.3.3 to differentiate among coping styles. This gave us a chance to investigate the changing pattern of those who reacted strongly to pull through the pandemic and those who reacted weakly. The result is interesting: both groups have lower incidence rates of MHP than the passive coping group, which can be explained by coping styles theorized by Lazarus and Folkman (1984). As explained by Ntoumanis et al. (2009) in their integrated model of stress, coping, and motivation, a strong response coping style is aroused by threat appraisals of the stressor, while a weak response coping style is aroused by benign appraisals of the

stressor. However, the change in pattern of these two group in different family function for depression and anxiety are alike and their AOR did not change as drastically as the that of passive coping style, which could be aroused from harm–loss appraisals. According to N Ntoumanis, J Edmunds and JL Duda [21], effective coping requires a fit between social context, situational appraisals, and choice of coping responses. When variations in actual coping behavior do not result in a “fit” between situational factors and actual coping efforts, one may increase their emotional arousal to a level exceeding that which they can tolerate [35], and this can explain why MHP show a more stable pattern in the active, strong/weak response coping style group compared with passive coping style.

This study has several advantages: we prospectively followed up a large sample of college students in multiple waves from the first month of the COVID-19 pandemic until the reopening of schools. COVID-19–related MHP depressive symptoms and anxiety were repeatedly assessed with well-established scales. Moreover, the coping style of participants were divided into four categories to get more detailed result. However, our study is not without limitations. First, our sample was collected via convenience sampling methods and may not be fully representative of the general population of college students in China. For example, females constituted a relatively large proportion of the sample, which might limit the generalizability of our results. Second, current mental health disorders were collected by single self-reported items, but no structured or standardized clinical diagnostic interview was used to validate the diagnoses according to DSM or ICD criteria. Third, the coping style was measured at T1 and family function was measured from T2 because the development of the epidemic was not clear in the initial few months. Although SCSQ has high test–retest reliability (0.89) [27], a lack of repeated measurements could lead to bias in estimates.

5. Conclusion

he COVID-19 pandemic has had prolonged negative effects on the mental health of college students in China. Even students with HF or active coping style had a deterioration in the mental health. The negative influence of dysfunctional family function does not cease affecting the mental health of students even after schools restarted. MHP show a more stable pattern for the active, strong/weak response coping style group compared with passive coping style. These findings contribute to a greater understanding of the interaction of family function and coping style with mental health of college students during the COVID-19 pandemic. It is now a well-established fact that pandemic-induced mental health issues will soon become a big global issue. It is thus the need of the hour that greater attention be paid to students with dysfunctional family function and help them cultivate active coping styles such as seeking help and change cognitive strategies.

Declarations

Ethics approval and consent to participate

This study was approved by the appropriate institutional research and ethics committee of Southern Medical University. Electronic informed consents were obtained online. All participants were informed that they could withdraw from the study at any point of time. This study was conducted in accordance with the Declaration of Helsinki.

Consent for publication

Not applicable

Availability of data and materials

The datasets used and/or analysed during the current study available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests

Funding

None

Authors' contributions

L.L.: data analysis, wrote the main manuscript text. J.C. and S.L.: reviewing and editing. W.W, X.P. and C.C.: revising the manuscript. A.H. and X.W: data analysis. J.Z: Supervision, reviewing and editing. All authors read and approved the final manuscript.

Acknowledgements

Not applicable

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Figures

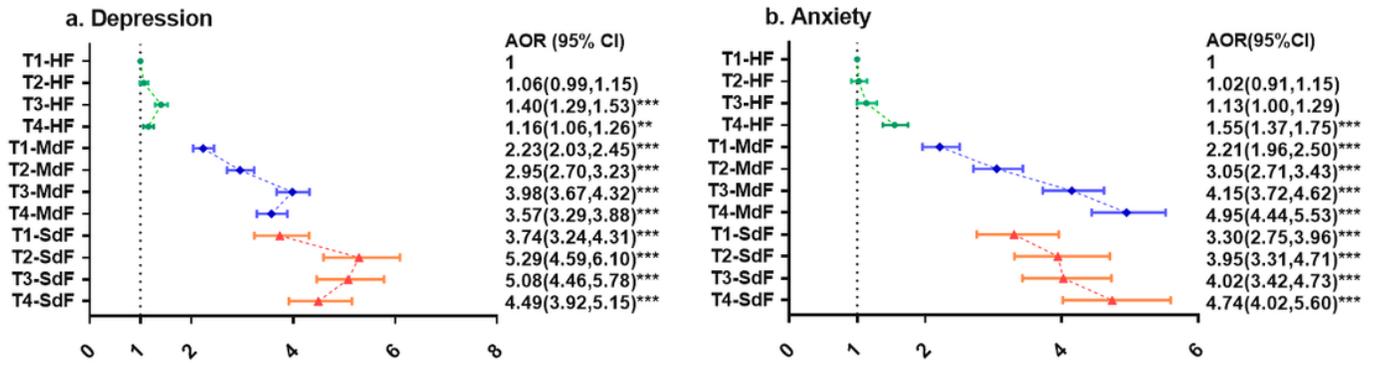


Figure 1

Forest plot showing adjusted multivariate logistic regression analysis: time × family function. HF, highly functional family; MdF, moderately dysfunctional family; SdF, severely dysfunctional family; AOR, adjusted odds ratio; **p < 0.01; ***p < 0.001. AOR was adjusted for age, gender, mental health status before the outbreak of the pandemic, and school type.

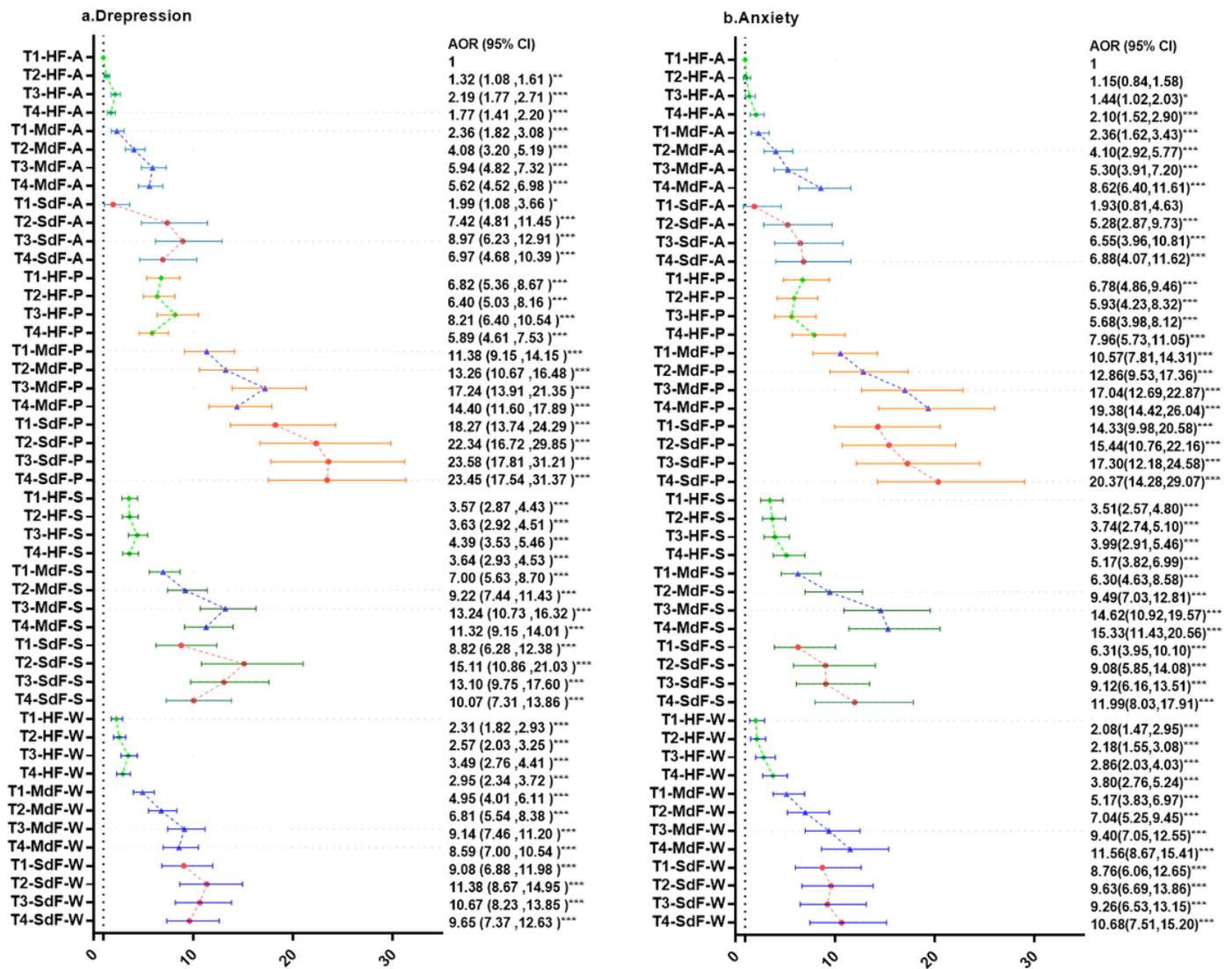


Figure 2

Forest plot showing adjusted multivariate logistic regression analysis: time × family function. HF, highly functional family; MdF, moderately dysfunctional family; SdF, severely dysfunctional family; A, active coping style; P, passive coping style; S, strong response coping style; W, weak response coping style; AOR, adjusted odds ratio; **p < 0.01; ***p < 0.001. AOR was adjusted for age, gender, mental health status before the outbreak of the pandemic, and school type.

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