

# The Influence of Family Function on State and Trait Anxiety of Chinese College Students During the Epidemic of COVID-19

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## Research Article

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# Abstract

**BACKGROUND:** COVID-19 has a terrible impact worldwide, and more than 0.8 million people had died of it before September 2020. Many countries had taken many measures to against it, and one of the most effective methods was "stay-at-home" order. But staying at home for a long time is not good for human beings with social features, and that may lead to the occurrence of psychological diseases. Because of COVID-19, many people were forced to stay at home and spend more time with family members. As a special group of population, Chinese college student are more dependent on families, and their psychology, such as anxiety, may be more affected by family during the outbreak of COVID-19.

**METHODS:** This cross-sectional study was conducted online from March 14, 2020 to March 21, 2020. The State-Trait Anxiety Inventory (ST-AI) and Chinese Family Function Scale (FAD-18) were used in this study. ANOVA was used in basic information. Path analysis was used to estimate the relationship among family function, state anxiety and trait anxiety.

**RESULTS:** A total of 1039 respondents (695 females and 344 males) were included in the study. Their state anxiety scores were 39.28 and 36.84, respectively. The trait anxiety scores were 40.66 and 38.36, respectively. There were significant differences ( $p < 0.01$ ). But compared with the healthy norm, there was no significant difference. Except gender, there were significant differences ( $p < 0.01$ ) in state anxiety and trait anxiety between college students of medicine and art majors. In path analysis, the standard direct effect of family function on trait anxiety was 0.434 ( $p < 0.001$ ) in male group, 0.271 ( $p < 0.001$ ) in female group. While the standard direct and indirect effect of family function on state anxiety were not significant.

**CONCLUSIONS:** This study found that during the outbreak of COVID-19, the state anxiety and trait anxiety of Chinese college students were related to gender and major. What's more, family function had a great influence on anxiety. It is very important to pay attention to health function of family and psychological counseling for different genders and majors.

## Introduction

Coronavirus disease 2019 (COVID-19) is an acute respiratory infectious disease caused by 2019 Coronavirus, which is mainly manifested by fever, dry cough and fatigue. A few patients are accompanied by nasal obstruction, nasal discharge, diarrhea and other upper respiratory tract and gastrointestinal symptoms<sup>[1]</sup>. Most of the severe cases developed dyspnea one week later. The severe cases developed rapidly into acute respiratory distress syndrome, septic shock, metabolic acidosis, coagulation dysfunction and multiple organ failure, ect.<sup>[2]</sup> As we all know, COVID-19, is such a dreadful disease which is "raging" on earth from November 2019 to now<sup>[3]</sup>.

As of September 7, 2020, the epidemic of COVID-19 has spread to more than 210 countries<sup>[4]</sup> around the world. The cumulative confirmed cases of global COVID-19 have exceeded 27 million<sup>[5]</sup>, what's worse,

there were 900,000 people have died because of COVID-19. Considering the strong infectivity, long incubation period and high mortality of it, many countries have adopted various methods to prevent more people from being infected. The first outbreak of COVID-19 in Wuhan, China, which has experience in fighting against SARS, thus Chinese government has taken many effective measures in the early stage, such as “lockdown” the city, the order to “stay at home”<sup>[6]</sup>. But as social creatures, staying at home for a long time may cause many health problems<sup>[7]</sup>. Studies have shown<sup>[8]</sup> that if people stay at home for a long time, they may cause some psychosomatic diseases. Due to the sudden change of life schedule and routines, Chinese college students spend more time at home, and most of them are full-time students, as they are more dependent on their families. Therefore, family function may have a greater impact on the state and trait anxiety of Chinese college students who have to stay at home due to the government's requirements during the epidemic of COVID-19.

State anxiety refers to the temporary restlessness caused by a specific situation<sup>[9]</sup>. Trait anxiety refers to a general personality characteristic or trait, which is manifested as a kind of more or less continuous worry and uneasiness<sup>[10]</sup>. ST-AI<sup>[11]</sup> has 40 questions that can well measure the state anxiety and trait anxiety. FAD-18<sup>[12]</sup> with 18 questions measures family function from the four dimensions of cohesion, behavior control, growth and adaptability, and is a mature scale designed for China. Path analysis is a widely used method to analyze the causal relationship between variables and proved to be a very effective analysis method<sup>[13]</sup>. Thus, this study used path analysis in structural equation model (SEM) to determine the relationship of family function, state anxiety and trait anxiety. ST-AI scale and FAD-18 scale are used to evaluate family functions, state anxiety and trait anxiety of Chinese college students.

## Methods

### Setting and participants

This study is a cross-sectional study to survey the influence of family function on state and trait anxiety of Chinese college students during the COVID-19 epidemic. We have to choose online survey because of the government's requirements for stay at home. The questionnaire was distributed via Wenjuanxing ([www.wjx.cn](http://www.wjx.cn)), which is an online survey platform, on WeChat (Tencent, Shenzhen, China) and other social platforms (QQ, Tencent, Shenzhen, China). The questionnaire was distributed from March 14 to March 21, 2020. The questionnaire link was first sent to the students' class group and collected by snowball sampling. Then the first respondent forwarded the questionnaire to others.

### Questionnaire content

The first part of the questionnaire collects relevant demographic information, including gender, age, education, region and major. The second part contains the questions that the researcher wants to know and related to the research content. For example, which you live with during the epidemic, whether someone around you is infected with COVID-19, the frequency of going out, and the longest time to stay at home. The third part contains two questionnaires: ST-AI and FAD-18, developed by Spielberger<sup>[11]</sup> and

ZHANG Manyan<sup>[12]</sup>, respectively. STAI is suitable for evaluating state and trait anxiety of College Students. The respondents with a higher score might have a higher anxiety degree. FAD-18 can effectively evaluate family function.

### Quality control method

We set strict restrictions on the respondents to fill in the questionnaire. The same Internet protocol address, the same WeChat ID or the same QQ number can only be filled in once and the questionnaire with obvious logical errors was eliminated. These questionnaires have been proved to be suitable for Chinese College Students<sup>[11, 12]</sup>. Thus, the questionnaire was very suitable for this study.

## Data analysis

Descriptive and correlation analysis of collected data was analyzed by SPSS26.0 Version (IBM SPSS Statistics, New York, United States). Path analysis in SEM used AMOS 24.0. Quantitative data were analyzed by t-test or ANOVA (analysis of variance). Tukey-Kramer Adjustment was used to compare the imbalance data among groups. The map of cumulative number of COVID-19 cases in different provinces of China and probability density curve and frequency distribution histogram of FAD-18 score was drawn in R 4.0.1(used with “maptools” package, “rgdal” package, “mapproj” package, “plyr” package and “ggplot2” package). Correlation analysis was used to analyze the relationship between factors. The results of STAI scale were also compared with the healthy norm<sup>[14]</sup> by Z-test.  $P < 0.05$  was considered statistically significant.

## Results

### Respondents' demographic characteristics and scale scores

The implementation of this survey was from March 14, 2020 to March 21, 2020. 1309 questionnaires were submitted. We had eliminated the questionnaires that did not meet the requirements and 1200 of them were valid. Among the 1200 questionnaires, 161 questionnaires were excluded due to errors. Finally, there were 1039 questionnaires left. Respondents' demographic characteristics are shown in Table 1. These respondents were from 30 provinces and province-level municipalities. They were distributed in different majors, grades and living environment. Thus, we are convinced of that these respondents can represent the Chinese college students. Our survey included 344 male(33.11%) and 695 female(66.89%). The age is between 16 and 47 years old, included 650 undergraduate(62.56%) and 389 postgraduate students(37.44%), most of them between 19 to 26 years old (92.69%). 594 medical college students(57.17%), 296 science and engineering(28.49%), and 149 other major(14.34%) such as arts, education, agronomy, had filled those scales. There were 109 respondents (10.49%) from severe epidemic provinces(> 1000 COVID-19 cases), 664(63.91%) from moderate epidemic provinces (500–1000 COVID-19 cases) and 266(25.60%) from mild epidemic provinces (< 500 COVID-19 cases). The distribution of the cumulative number of cases in each province is shown in Fig. 1. Also, there are some questions related to

stay-at-home order. 87 respondents (8.37%) lived with less than 2 people (including themselves), 832(80.08%) lived with 3–5 people, and 120(11.55%) lived with more than 5 people. 111 respondents (10.68%) lived with single parents, 627(60.35%) lived with parents, 181(17.42%) lived with parents and grandparents, and 120(11.55%) lived alone or with others, such as roommates, collateral relatives. Most of respondents lived in city (640, 61.60%), and others lived in rural (399, 38.40%). More than half of respondents never went out(534, 51.40%), 219(21.08%) went out on average every three days, 154(14.82%) went out once a week, 132(12.70%) went out once more than half a month. There's 8 respondents (0.77%) can't remember the longest day they hadn't been out, 448(43.12%) less than 15 days, 367(35.32%) between 16 and 30 days, 122(11.74%) between 31 and 45 days, 94(9.05%) more than 45 days. Almost respondents (1020, 98.17%) had no COVID-19 cases around.

There was no significant difference between the respondents and the healthy norm. The results had been shown in Table 2. In this survey, the state anxiety and trait anxiety of female were 39.28(± 9.32) and 40.66(± 8.39), respectively, and those of male were 36.84(± 10.26) and 38.36(± 8.91), respectively. Similar to the healthy norm, the scores of female were higher than those of male in both state anxiety and trait anxiety, and the trait anxiety scores of both female and male were higher than state anxiety.

The distribution of family function score had shown in Fig. 2. The worse the family function, the higher the score. Nearly a quarter of the respondents (252, 24.25%) scored 3, which accounts for the highest proportion, and the vast majority of the respondents (981, 94.42%) scored below 10 in FAD-18. The results indicated that the family function of college students in China during the outbreak of COVID-19 is well.

#### Impact factors of respondents' state anxiety and trait anxiety

The results have been showed in Table 3. We adjusted gender during factor analysis by multiple linear regressions. For imbalanced group, we used Tukey-Kramer Adjustment after one-way ANOVA (Supplementary Figure S1). The results showed that male and female had significant difference in state anxiety score ( $p < 0.01$ ) and trait anxiety score ( $p < 0.01$ ). It could be easily found that both state anxiety score and trait anxiety score of male were lower than that of female. It showed that scores of state anxiety and trait anxiety were significant differences between medical respondents and other majors ( $P < 0.01$ ). The scores of state and trait anxiety in other majors were higher than those in medicine. Other factors had no difference.

#### Path analysis

Bivariate correlations grouped by gender among family function, state anxiety and trait anxiety are shown in Table 4. Because of the difference in STAI and FAD-18 scores between male and female, the simultaneous analysis of multiple groups by gender was used in this study. The results of the path analysis are shown in Fig. 3 and Supplementary Tables. In order to make the FAD-18 score normal distribution, square root transformation was used. It was shown by the fit indices that for the proposed model  $\chi^2(15) = 8.943$ ,  $p = 0.030$ ,  $\chi^2/df = 2.981$ , RMSEA = 0.044 ( $P\text{-Close} = 0.560$ ), CFI = 0.996 and TLI =

0.992. Although  $p < 0.05$ , the sample size was large enough in this study and other indicators suggested that the proposed pathway fit very well to the data. Table 5 summarizes the standardized direct, indirect, and total estimates of the reduced model's paths of each group. We found that except family function and state anxiety were not significant, others were significant in both groups. The results were in good agreement with our proposed model. The direct effect of family function on trait anxiety in male and female was 0.434 ( $p < 0.001$ ), 0.271 ( $p < 0.001$ ), respectively, that on state anxiety was 0.007 ( $p = 0.61$ ), -0.011 ( $p = 0.82$ ), respectively, and that of trait anxiety on state anxiety was 0.873 ( $p < 0.001$ ), 0.844 ( $p < 0.001$ ), respectively. The indirect effect of family function on state anxiety in male and female was 0.379 ( $p = 0.61$ ), 0.229 ( $p = 0.82$ ), respectively.

## Discussion

In this study, the basic information collected was analyzed by descriptive analysis and difference analysis. Then we used path analysis to explore relationships of family function, state anxiety and trait anxiety. We found in Table 1 that there were no COVID-19 cases around most respondents (1020, 98.17%) and a considerable part of the respondents came from provinces with severe and moderate epidemic (773, 74.4%). In the implementation of the "stay-at-home" order, more than half of the respondents (534, 51.4%) which never go out. It showed the fact that prophylactic measures implemented by China were effective. And it was not hard to find that most of the respondents (627, 60.35%) lived with their parents. The study of Carolina González et al<sup>[15]</sup> may explain that the respondents with better family function have lower anxiety level. Since considering the basic characteristics of the respondents, their anxiety may in the normal range compared with the healthy norm.

The results in Table 2 showed that during the stay-at-home order, although respondents' state anxiety average scores and trait anxiety average scores were higher than the healthy norm, there was no significant difference between them. The result of Xi Liu<sup>[16]</sup> was the same as ours. Due to the implementation of the "stay-at-home" order, college students may be exposed to social media for a longer time, thus receiving more information about COVID-19. Some studies<sup>[17]</sup> showed that in the case of such social events, ordinary people may produce vicarious traumatization (VT). It is a kind of psychological abnormality indirectly caused by witnessing a large number of cruel and destructive scenes, and the degree of damage exceeds the psychological and emotional tolerance limit of some people<sup>[18]</sup>. However, considering that it has been nearly 4 months since the outbreak of the COVID-19 to this survey, the respondents may have developed compassion fatigue<sup>[19]</sup>, a psychological self-protection mechanism of human body. Therefore, we thought that it may be due to such reason that there was little difference between the respondents and the healthy norm.

Some meaningful information had been given in Table 3 and Fig. 3. Whether it was state anxiety or trait anxiety, the score of male was lower than that of female, and it was significant. This may indicate that female may more anxious and vulnerable to social events, which was similar to the results of Bao-Liang Zhong et al<sup>[20-22]</sup>. Different majors also showed different state anxiety and trait anxiety scores. The state

anxiety and trait anxiety scores of medical college students are lower than those of other majors. Studies showed that <sup>[23]</sup>medical respondent have a nice professional foundation and a better understanding of COVID-19, while other majors were mostly arts, which were suffered more anxiety. Although other factors were not significant, we also found some notable points. College students which live with alone or others had highest scores of state and trait anxiety. The second was lived with single parent. The third was lived with parents, and the last was lived with parents and grandparents. This showed that the more lineal relatives around, the less anxiety. For “Frequency of going out”, the average score of state anxiety of respondents who went out frequently is the highest. This suggested that those respondents may still be anxious about the COVID-19. For “The longest days at home”, except those who did not remember the days, those who did not go out for the longest 45 days scored the highest in state anxiety. This may be due to a long period of not going out of the house. For “Is anyone around you infected with COVID-2019”, there was also a big gap between the average state and trait score of patients with and without cases around them. Our results were similar to those of others.<sup>[24–29]</sup>

The results of path analysis showed that family function has a significant impact on trait anxiety, and the path coefficient is 0.434 in male and 0.271 in female. Because the better the family function is, the lower the FAD-18 score is, and the higher the anxiety degree is, the higher the ST-AI score is. They may have a negative relationship, that is to say, the better the family function, the lower the trait anxiety degree. We discovered that the path coefficient on family function and trait anxiety of male group is higher than that of female. It may suggested that during the outbreak of COVID-19, the impact of family function on trait anxiety of female was less than that of male, which suggested that female were vulnerable to social events<sup>[30]</sup>. The relationship between family function and state anxiety is not significant, which may require more research to explain it.

## Conclusion

In this study, path analysis was used to analyze family function, state anxiety and trait anxiety. It is a relatively objective analysis method and a good model was obtained. Some significant factors related to this study were also found. We found that among Chinese college students, female were more likely to be affected by social events and aggravated their anxiety degree and we also found that medical college students were less anxious about pandemic infectious diseases than other majors. Those of which had a better family function had less anxious. Family function had a significant impact on trait anxiety, which has a great impact on state anxiety. In the case of social events, family function may also affect state anxiety. In addition, P value for trend was used in this study in the factors with trend variation. However, this study also had limitations. Firstly, there was a large difference in the number of people in some factor groups in this study, which may have an impact on the analysis results. Secondly, there may be some factors that had not been observed and not been included in the study, which will affect the final results. Generally, the significance of this study is profound.

## Declarations

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## Author's contributions

B.P. conceived the idea and supervised the work. L.Y. performed the research and wrote the scripts. L.Y., M.W. and Y.W. prepared and analyzed the data. B.P. and L.Y. wrote the manuscript. All authors reviewed and approved the manuscript.

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## Availability of data and materials

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

## Ethics approval and consent to participate

After consultation, the online survey did not require the approval of the local ethics committee. All participants agreed to participate in the study.

## Consent for publication

Not applicable.

## Competing interests

The authors declare no competing interests.

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## Tables

**Table 1 The demographic characteristics of the respondents**

Variable		Number	Proportion (%)
		(Total, n = 1039)	
<b>Gender</b>			
	Male	344	33.11
	Female	695	66.89
<b>Age(years)</b>			
	Below 22	547	52.65
	Above23	492	47.35
<b>Region</b>			
	Severe epidemic city	109	10.49
	Moderate epidemic city	664	63.91
	Mild epidemic city	266	25.6
<b>Major</b>			
	Medicine	594	57.17
	Science and Engineering	296	28.49
	Others	149	14.34
<b>Education</b>			
	Undergraduate	650	62.56
	Postgraduate	389	37.44
<b>Number of people living together during the epidemic</b>			
	Below 2	87	8.37
	3-5	832	80.08
	Above 6	120	11.55
<b>Live with</b>			
	Single parent	111	10.68
	Parents	627	60.35
	Parents and grandparents	181	17.42
	Alone or others	120	11.55
<b>Residential area</b>			
	Rural	399	38.4
	City	640	61.6
<b>Frequency of going out</b>			
	Never	534	51.4
	Below three days	219	21.08
	Once a week	154	14.82
	Once more than half a month	132	12.7
<b>The longest days at home</b>			
	Below 15	448	43.12
	16-30	367	35.32
	31-45	122	11.74
	Above 45	94	9.05
	Can't remember	8	0.77
<b>Is anyone around you infected with COVID-2019?</b>			
	Yes	1020	98.17
	No	19	1.83

**Table 2** The score of gender was compared with ST-AI scale healthy norm

Variable	Gender	Score		P value
		Norm	Survey	
		(Mean ± SD)	(Mean ± SD)	
State anxiety	Male	36.47±10.02	36.84±10.26	0.49
	Female	38.76±11.95	39.28±9.32	0.39
Trait anxiety	Male	38.30±9.18	38.36±8.91	0.93
	Female	40.40±10.15	40.66±8.39	0.62

Note: Z-test used to compared the sample with the healthy healthy norm. In order to facilitate the comparison, the z-value had been converted to the p-value.

**Table 3** Anxiety of the public under the epidemic of COVID-19 in China

Variable	State anxiety				Trait a	
	Mean(95%CI)				Mean(95%CI)	
	Unadjusted	P value	Adjusted†	P value	Unadjusted	P value
<b>Gender</b>						
Male	36.84 (35.75, 37.93)	<0.01	—	—	39.28 (38.29, 40.27)	<0.01
Female	38.36 (37.69, 39.02)		—		40.66 (40.04, 41.29)	
<b>Age(years)</b>						
Below 22	38.09 (37.32, 38.86)	0.4	37.67 (36.81, 38.52)	0.77	40.52 (38.80, 41.24)	0.23
Above 23	37.6 (36.74, 38.45)		37.48 (36.62,38.35)		39.86 (39.07, 40.65)	
<b>Region</b>						
Severe epidemic city	38.55 (37.12, 39.98)	0.44 <sup>a</sup>	37.86 (36.00, 39.72)	0.69 <sup>a</sup>	41.19 (39.84, 42.53)	0.35 <sup>a</sup>
Moderate epidemic city	37.66 (36.92, 38.40)		37.4 (36.65, 38.16)		40 (39.31, 40.69)	
Mild epidemic city	37.82 (36.64, 39.00)		38 (36.78, 39.22)		39.98 (38.91, 41.05)	
<b>Major</b>						

†Adjusted for gender by multiple linear regressions. Tukey-Kramer Adjustment was used to compare the imbalance data among groups.

<sup>a</sup> P value for trend.

**Table 4** Bivariate correlations grouped by gender among variables

Factors	Covariance					
	(r)					
	State anxiety		Trait anxiety		Family function	
	Male	Female	Male	Female	Male	Female
State anxiety	105.29	79.45	.	.	.	.
	1.00	1.00	.	.	.	.
Trait anxiety	82.87	62.99	86.91	70.41	.	.
	0.87**	0.84**	1.00	1.00	.	.
Family function	2.38	1.57	2.53	1.84	0.48	0.59
	0.33**	0.23**	0.40**	0.28**	1.00	1.00

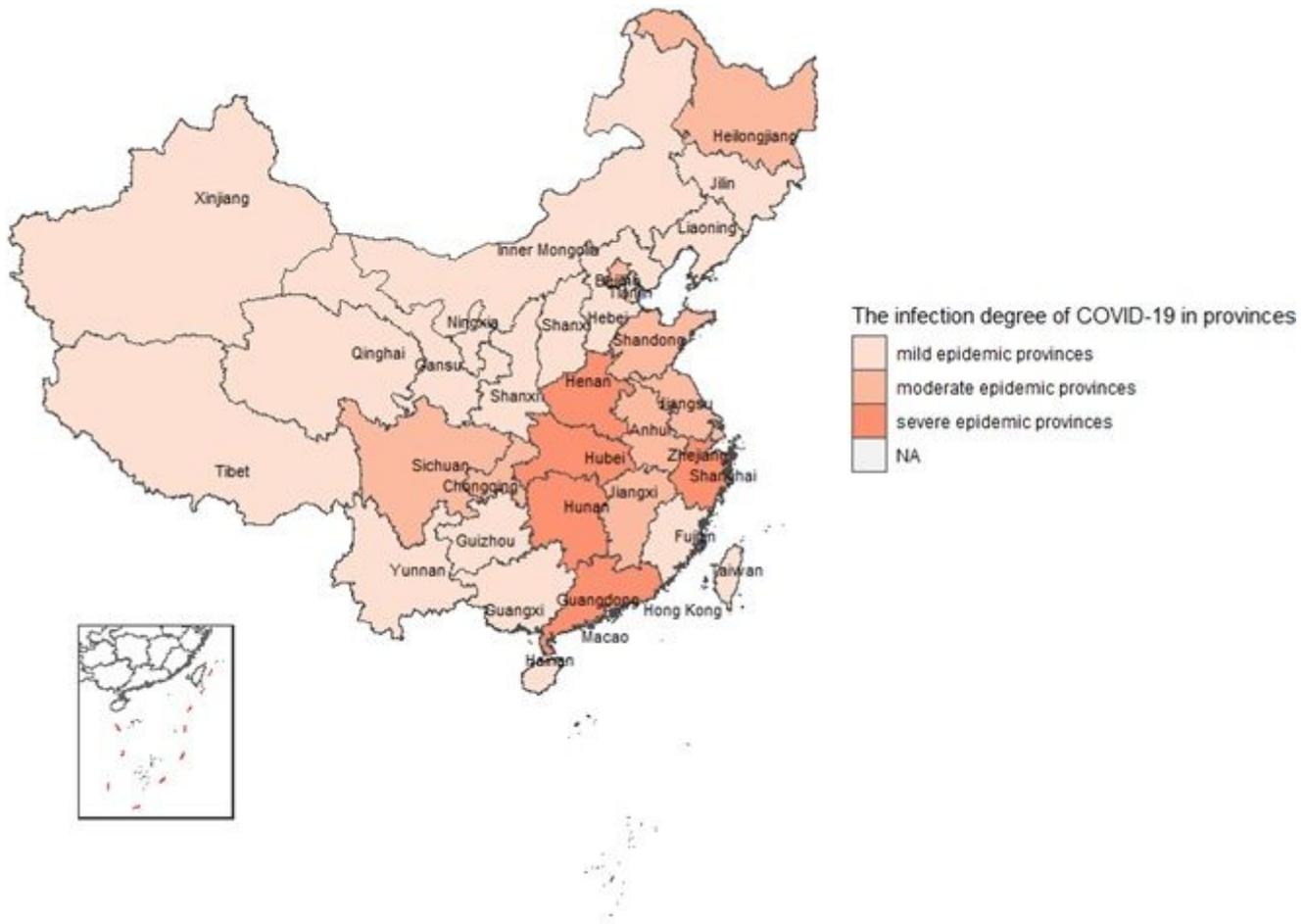
\*\* means that  $P < 0.01$ , and has significant correlation.

Table 5 The standard direct, indirect and total effects of path analysis by gender among family function, state anxiety and trait anxiety.

Endogenous Variables	Predicting Variables	Standardized direct effect $\beta$	
		Male	Female
Family Function	State Anxiety	-0.007	-0.011
	Trait Anxiety	0.434***	0.271***
Trait Anxiety	State Anxiety	0.873***	0.844***

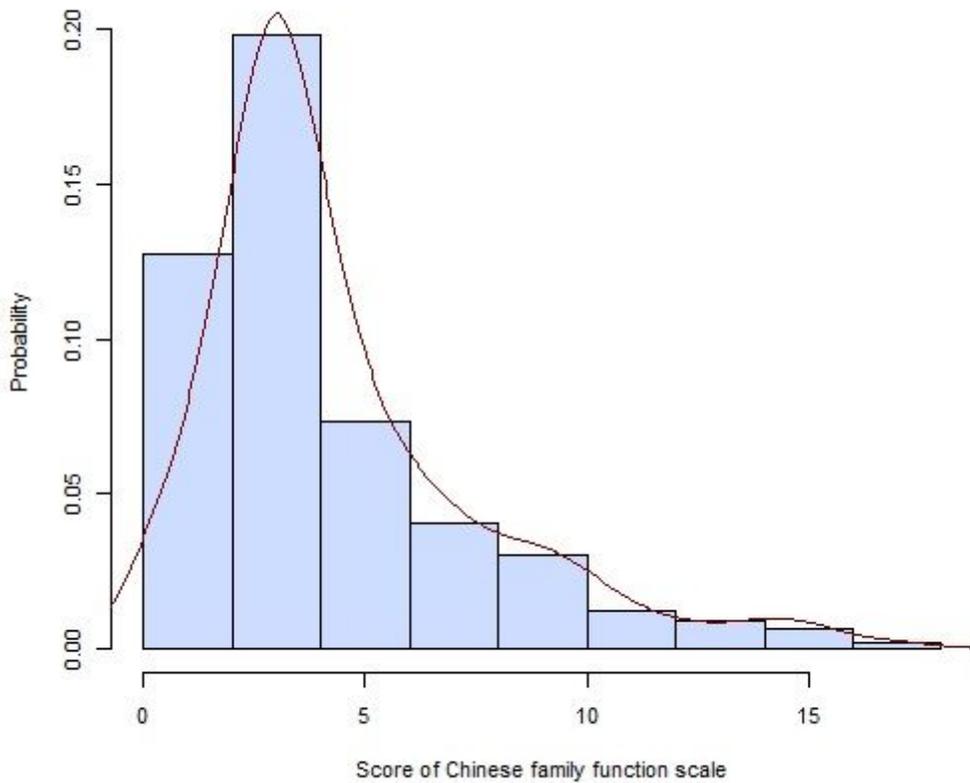
\*\*\* means that  $P < 0.001$ .

## Figures



**Figure 1**

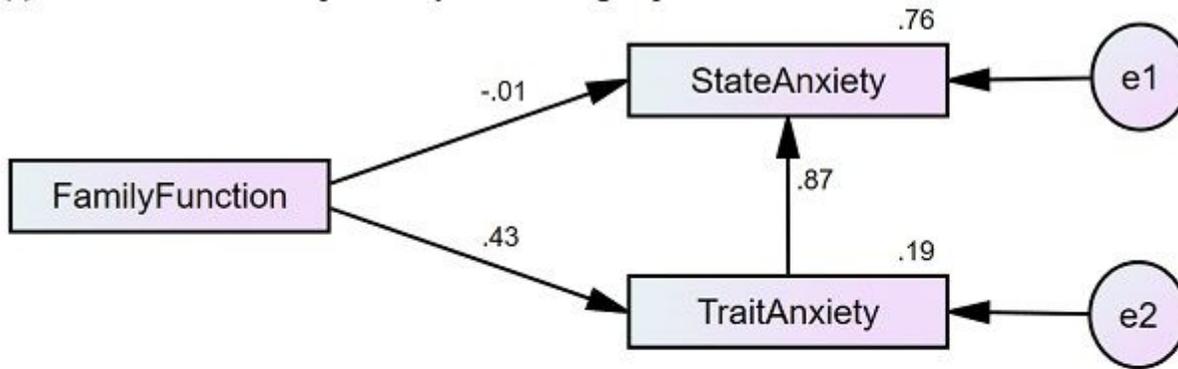
The cumulative number of COVID-19 cases in different provinces of China during the survey (Figure 1) reflected the cumulative number of COVID-19 infections in each province of China before the time of this survey. More than 1000 cases are severe epidemic provinces, 500-1000 cases are moderate epidemic provinces, and less than 500 cases are mild epidemic provinces. Note: The designations employed and the presentation of the material on this map do not imply the expression of any opinion whatsoever on the part of Research Square concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. This map has been provided by the authors.



**Figure 2**

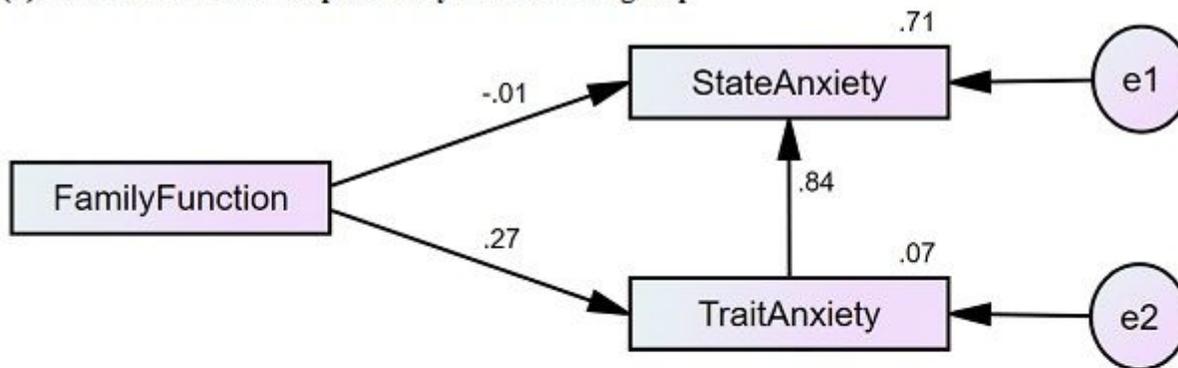
Probability density curve and frequency distribution histogram of FAD-18 score Figure 2 showed the probability density curve and frequency distribution histogram of family function score, with class interval of 2 and range of 18. It showed that family function score is a skew distribution data. Therefore, after square root transformation, the transformed distribution was approximately normal distribution and included in path analysis.

(a) Standardized model of path analysis for male group



Standardized estimates  
GROUP=Male  
Chisq=8.943;p=.030  
RMSEA=.044;GFI=\GFI

(b) Standardized model of path analysis for female group



Standardized estimates  
GROUP=Female  
Chisq=8.943;p=.030  
RMSEA=.044;GFI=\GFI

Figure 3

Standard path analysis of family function, state and trait anxiety for gender in invariant model. Figure 3 showed standard path analysis of family function, state and trait anxiety for gender in invariant model. Figure 3 (a) was male and figure3 (b) was female. The path coefficients and variances of two groups were the same. Abbr.: RMSEA: Root Mean Square Error of Approximation GFI: Goodness-of-fit Index

## Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [SupplementaryMaterialsylp01.doc](#)