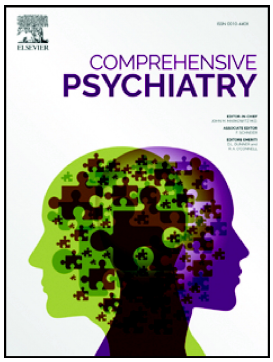

Public awareness and anxiety during COVID-19 epidemic in China: A cross-sectional study

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Public Awareness and Anxiety during COVID-19 Epidemic in China: A Cross-sectional Study

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Abstract

Objective: The study aims to investigate public awareness of coronavirus disease 2019 (COVID-19) and measure levels of anxiety during the outbreak.

Method: A total of 2,115 subjects from 34 provinces in China were evaluated. A questionnaire was designed, which covers demographic characteristics, knowledge of COVID-19, and factors that influenced anxiety during the outbreak to test public awareness and determine the impact of the outbreak on people's lives. In addition, a generalized anxiety disorder (GAD) scale was utilized to assess anxiety levels during the outbreak. Lastly, the chi-square test and multiple logistic regression analysis were used to identify factors associated with levels of public anxiety.

Results: A majority of respondents reported high levels of awareness of COVID-19. A total of 1,107 (52.3%), 707 (33.4%), 154 (7.3%), and 147 (7%) respondents exhibited no, mild, moderate, and severe levels of anxiety, respectively. Results of the chi-square test

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and multiple logistic regression analysis demonstrated that respondents (a) with no college education, (b) are unaware of neighbors who may have been infected, (c) who spent considerable time collecting information and browsing negative information related to the virus, (d) are unhealthy, and (e) displayed low levels of awareness of the transmission routes were highly likely to be anxious.

Conclusion: During the outbreak, the majority of people exhibited high levels of awareness and knowledge regarding preventive measures from COVID-19. The absence of psychological anxiety was observed in more than half of the respondents. Adaptive responses to anxiety and high levels of awareness about COVID-19 may have protected the public during the outbreak.

Keywords: COVID-19, outbreak, public, awareness, anxiety

Introduction

On December 30, 2019, four pneumonia cases of unknown etiology emerged in Wuhan, China [1]. After epidemic investigation and genetic sequencing, the Chinese Center of Disease Control and Prevention confirmed on January 7, 2020 that the virus is a novel coronavirus [2]. By January 23, 2020, a total of 835 cases were reported in China (549 cases from Hubei Province and 286 from 31 other provinces, municipalities, or special administrative regions) [1]. The government closed off Wuhan and declared a public health emergency from 10:00 on January 23, 2020. By 24:00 on February 14, 2020, the number of confirmed and suspected cases reached 66,576 and 8,969, respectively,

whereas mortality and recovery hit 1,524 and 8,216 nationwide, respectively [3]. Subsequently, infection cases have been reported in other countries, such as Japan, Thailand, and the United States [4,5]. The infection continued to spread worldwide[6]. On February 11, 2020, the World Health Organization named the novel coronavirus COVID-19 and issued a call to the international community to work together to respond to the public health emergency[7].

The COVID-19 outbreak posed an unprecedented threat to the community and presented a great challenge for the government [8]. As such, the government was required to improve public awareness of COVID-19. Previous studies demonstrated that the public may develop psychological problems due to the lack of knowledge about the public health emergency. Wang [9] found that 53.8% of respondents rated the psychological impact of the outbreak as moderate or severe, whereas, 16.5%, 28.8%, and 8.1% reported moderate-to-severe depressive symptoms, moderate-to-severe anxiety symptoms, and moderate-to-severe stress levels, respectively. A longitudinal study on mental health included 1,738 respondents from 190 cities in China and noted moderate-to-severe levels of stress, anxiety, and depression in 8.1%, 28.8%, and 16.5% of the respondents, respectively, without significant longitudinal changes [10]. A study on immediate mental health status and psycho-neuroimmunity prevention measures of a Chinese workforce deduced that 10.8% of respondents met the criteria for post-traumatic stress disorder after returning to work. The respondents reported a low prevalence of anxiety (3.8%), depression (3.7%), stress (1.5%), and insomnia (2.3%) [11]. Moreover, a case–control

study with service and research implications for immunopsychiatry included 76 patients and 109 healthy control subjects. The study found that serious worries about physical health, anger and impulsivity, and intense suicidal ideation were significantly higher in patients under psychiatric treatment compared with healthy individuals [12]. A multinational, multicenter study on psychological outcomes and physical symptoms associated with the COVID-19 outbreak among 906 healthcare workers found that 48 (5.3%), 79 (8.7%), 20 (2.2%), and 34 (3.8%) screened positive for moderate-to-very severe depression, moderate-to-extremely severe anxiety, moderate-to-extremely severe stress, and moderate-to-severe psychological distress, respectively [13]. The literature indicates that the public requires prompt psychiatric intervention when exposed to major disasters with widespread injuries and loss of lives.

Psychological assistance is an indispensable measure during the COVID-19 outbreak. Thus, the current study designed a questionnaire to investigate public awareness of COVID-19 and its relationship with anxiety. High levels of awareness of COVID-19 can prevent the public from suffering psychological morbidity [14,15]. COVID-19 is a novel coronavirus. As such, the unknown surroundings may cause anxiety, especially among individuals in regions where the outbreak is severe. The study aims to investigate public awareness of COVID-19, measure the level of anxiety during the outbreak among public, and provide a reference for psychological assistance measures during public health emergencies.

Materials and methods

Sample

All samples are derived from 34 provinces in China. The provinces were divided into two regions, namely, severely and mildly infected regions. The top 10 provinces with cumulative confirmed cases are located in the severe outbreak region, whereas the rest of the provinces belong to the mildly infected region. By 24:00 on February 14, 2020, the provinces belonging to the severely infected region were Hubei (34,406 positive cases), Guangdong (1,294), Henan (1,212), Zhejiang (1,162), Hunan (1,001), Anhui (950), JiangXi (913), Jiangsu (604), Chongqing (537), and Shangdong (532). Given that the majority of cities have restricted travel in China during the outbreak, thus, including the researchers in the restriction, the snowball sampling technique was used to recruit respondents via social media platforms, such as WeChat and QQ. The sampling method introduces significant bias compared with probabilistic sampling. As such, limiting the survey to a group of people with similar thinking could lead to serious bias [16]. However, snowball sampling is the only viable option in the unavailability of other probabilistic sampling methods. The questionnaire was sent to the respondents via email. They were invited to complete the questionnaire and recruit other people. Each email contained the questionnaire and an introductory letter that guaranteed anonymity during the survey. A total of 3,000 questionnaires were sent to respondents from 34 provinces, out of which 2,177 were returned before February 14, 2020. The response rate was 72.5%.

Development of the questionnaire

The questionnaire consisted of four parts. Part 1 involved collection of data on general demographics, such as gender, age, education, and location. Age was divided into four groups, namely, “less than 20 years,” “21–30 years,” “31–40 years,” and “more than 40 years.” Education was divided into three groups, namely, “no college education,” “undergraduate,” and “postgraduate.” Lastly, location was divided into two groups, namely, “severely infected region” and “mildly infected region.”

Part 2 covered general awareness of COVID-19. Three items, namely, clinical symptoms, transmission routes, and protective measures of COVID-19 were designed. The participants who chose the correct options were considered to have high-level awareness of COVID-19. Each item had multiple options. The options for clinical symptoms were “fever,” “dry cough,” “myalgia or fatigue,” “runny nose,” “dyspnea,” and “worsened conditions” [17]. The researchers assumed that if the participants chose “fever,” “dry cough,” and “general fatigue,” then they have high-level awareness of clinical features. Transmission routes consisted of four correct (“talking to a positive case face-to-face,” “eating with a positive case,” “taking a bus with a positive case,” and “eating wild animals”) and two wrong (“touching books from Wuhan” and “using high-quality surgical masks from Wuhan”) options [18]. The participants who chose any two right options and did not choose any of the two wrong options were considered to have high-level awareness of transmission routes. Protective measures consisted of five options [19], namely, “staying at home,” “going out with masks,” “washing hands frequently,” “eating cooked food,” and “not eating wild animals.” The researchers assumed that if the participants selected

"staying at home," "going out with masks," and "washing hands frequently," then they have high-level awareness of protective measures.

Part 3 collected data on the factors that influenced the respondents' anxiety during the outbreak, including the COVID-19 status of the people around them, physical status, proportion of browsed negative information, and time spent on reading information related to the virus [14]. The COVID-19 status of people around the respondents was categorized as follows: "someone confirmed," "someone suspected," "no one confirmed and suspected," and "unclear." The variable for physical status in the past 14 days included fever, myalgia, cough, dyspnea, coryza, sore throat, and other chronic medical conditions. The respondents were asked to rate their physical health status using three options, namely, "healthy," "sub-healthy," and "unhealthy." Browsed negative information was considered distressing information regardless of accuracy. The respondents were asked to rate the proportion of browsed negative information using three options, namely, "over 80%," "approximately 50%," and "under 20%." Time spent on information related to the virus every day was rated as follows: "hardly any time," "less than 30 min," "30 min to 1 h," "1 to 2 h," and "more than 2 h."

Part 4 used a generalized anxiety disorder (GAD-7) questionnaire to determine the degree of anxiety of the respondents [20]. GAD-7 is a widely validated test for measuring the anxiety level of people in China [21,22]. The GAD-7 questionnaire consisted of seven items, where each item is scored from 0 to 3. The GAD-7 scale score ranges from 0 to 21.

The scores were grouped into four, namely, 0–4 for minimal anxiety, 5–9 for mild anxiety, 10–13 for moderate anxiety, and 14–21 for severe anxiety [23]. In addition, a question was added in this part and respondents were told to choose the "3" option and accordingly provide their responses, otherwise, the questionnaire was considered as invalid. After all the questionnaires were returned, the reliability of all variables, awareness of COVID-19, and anxiety scale were tested [24].

Statistical analysis

Data were analyzed using the Statistical Package for the Social Sciences 22.0. A topic in the questionnaire was set, and the respondents were asked to choose the only correct option. Otherwise, the questionnaire was classified as invalid. The chi-square test was used to examine differences in demographic characteristics, knowledge about COVID-19, and factors that influenced the respondents among the anxiety level groups [21]. Variables with significant differences were included in the multiple logistic regression model as independent variables. The multiple logistic regression model was used to identify factors associated with levels of public anxiety [21]. The dependent variable was public anxiety status; this collective term can be classified into the categories of "minimal," "mild," "moderate," and "severe" levels of anxiety. Results with *p*-values of less than 0.05 were interpreted as statistically significant. For the reliability testing of the questionnaire, Cronbach's α coefficient was used to measure internal consistency. Cronbach's α values over 0.7 indicated reliability [25].

Results

General demographic characteristics

After eliminating the invalid questionnaires, a total of 2,115 valid questionnaires were obtained with a passing rate of 97.1%. The number of invalid questionnaires was less than 5% of the total. Cronbach's α values for awareness of COVID-19 and anxiety were 0.73 and 0.938, respectively. The benchmark for substantial reliability was reached for two cases. Table 1 displays the characteristics of the sample (female: 59.1%; male: 40.9%). The age groups were distributed as follows: 63.8% (21–30 years), 12.6% (less than 20 years), 10.8% (31–40 years), and 12.8% (more than 40 years). In terms of education, 60.4%, 13.9%, and 25.7% of the respondents are undergraduates, without college education, and postgraduates, respectively. A total of 51.1% of the respondents lived in provinces belonging to the severely infected region, whereas 48.9% lived in provinces under the mildly infected region.

Table 1 Demographics of the respondents

Variable	NO.	proportion (%)
Gender		
Male	865	40.9
Female	1250	59.1
Age group		
Less than 20 years	267	12.6
21-30 years	1350	63.8
31-40 years	228	10.8
More than 40 years	270	12.8
Education		
No college education	294	13.9

Undergraduate	1277	60.4
Postgraduate	744	25.7
Location		
Mildly infected region	1035	48.9
Severely infected region	1080	51.1

General awareness of COVID-19

Table 2 displays the level of awareness of the respondents. For the mildly and severely infected regions, the rates for the high-level awareness of (a) clinical symptoms, (b) transmission routes, and (c) protective measures reached (a) 84.2% and 81.6% ($\chi2$ = 2.306, p = 0.129), (b) 57% and 56.7% ($\chi2$ = 0.025, p = 0.875), and (c) 89.5% and 92.5% ($\chi2$ = 5.94, p = 0.015), respectively. No significant difference in statistics was observed for the levels of awareness of clinical features and transmission routes, whereas a significant difference was noted for the cognitive degree of protective measures.

Table 2 Public awareness of COVID-19 (n [%])

Variable	Slight outbreak region	Severe outbreak region	Total	χ^2	P
Clinical symptoms	871 (84.2%)	882 (81.6%)	1,753 (82.8%)	2.306	0.129
Transmission route	590 (57%)	612 (56.7%)	1,202 (56.8%)	0.025	0.875
Protective measure	926 (89.5%)	999 (92.5%)	1,925 (91%)	5.94	0.015

Factors that influenced respondents' anxiety during the outbreak

In terms of people surrounding the respondents, 23 (1.1%), 52 (2.5%), 1,870 (88.4%), and 170 (8.0%) were identified as "someone confirmed," "someone suspected," "no one confirmed and suspected," and "unclear" (8.0%), respectively, during the COVID-19 outbreak. In terms of rating their physical status, 1,305 (61.7%), 731 (34.6%), and 79 (3.7)

rated themselves as “healthy,” “sub-healthy,” and “unhealthy,” respectively. Moreover, 501 (23.7%), 692 (32.7%), and 922 (43.6%) of the respondents browsed negative information in the following proportions: “over 80%,” “approximately 50%,” and “under 20%,” respectively. Regarding time spent on reading information related to the virus every day, 964 (45.6%), 662 (31.3%), 268 (12.7%), 204 (9.6%), and 17 (0.8%) reported durations of “1 to 2 h,” “30 min to 1 h,” “less than 30 min,” “more than 2 h,” and “hardly any time,” respectively.

Risk factors associated with high levels of anxiety during the COVID-19 outbreak

Single-factor analysis. Single-factor analysis. The average anxiety score for all respondents during the outbreak was 4.95. In terms of anxiety levels, 1,107 (52.3%), 707 (33.4%), 154 (7.3%), and 147 (7) respondents displayed no anxiety, mild, moderate, and severe levels of anxiety, respectively. The chi-square test was used to determine differences in anxiety levels among variables. Table 3 showcases the results. No significant difference was found between anxiety levels and the respondents according to gender, age, location, and awareness levels of clinical features and preventive measures. Meanwhile, statistical significance was found among anxiety levels, educational background, surrounding positive cases, physical status, proportion of browsed negative information, time spent on reading information related to the virus, and awareness level of transmission. Differences with *p*-values of <0.05 were considered statistically significant.

Table 3 Differences in anxiety status according to variables

Variable	Minimal	Mild anxiety	Moderate anxiety	Severe anxiety	Total	χ^2	P
Gender							
Male	455 (52.6%)	276 (31.9%)	64 (7.4%)	70 (8.1%)	865	3.806	0.283
Female	652 (52.2%)	431 (34.5%)	90 (7.2%)	77 (6.2%)	1250		
Age group							
<20	150 (56.2%)	82 (30.7%)	13 (4.9%)	22 (8.2%)	267	12.071	0.209
21～30	709 (52.5%)	446 (33%)	105 (7.8%)	90 (6.7%)	1350		
31～40	106 (46.5%)	82 (36%)	23 (10.1%)	17 (7.5%)	228		
>40	142 (52.6%)	97 (35.9%)	13 (4.8%)	18 (6.7%)	270		
Education							
No college education	128 (43.5%)	114 (38.8%)	20 (6.8%)	32 (10.9%)	294	16.131	0.013
Undergraduate	693 (54.3%)	411 (32.2%)	93 (7.3%)	80 (6.3%)	1277		
Postgraduate	286 (52.6%)	182 (33.5%)	41 (7.5%)	35 (6.4%)	544		
Location							
Mildly infected region	546 (52.8%)	328 (31.7%)	87 (8.4%)	74 (7.1%)	1035	5.531	0.137
Severely infected region	561 (51.9%)	379 (35.1%)	67 (6.2%)	73 (6.8%)	1080		
Awareness of clinical symptoms							
Low	201 (55.5%)	104 (28.7%)	33 (9.1%)	24 (6.6%)	362	5.814	0.121
High	906 (51.7%)	603 (34.4%)	121 (6.9%)	123 (7%)	1753		
Awareness of transmission route							
Low	451 (49.4%)	319 (34.9%)	61 (6.7%)	82 (9%)	913	14.086	0.003
High	656 (54.6%)	388 (32.3%)	93 (7.7%)	65 (5.4%)	1202		
Awareness of preventive measures							
Low	104 (54.7%)	61 (32.1%)	10 (5.3%)	15 (7.9%)	190	1.774	0.621
High	1003 (52.1%)	646 (33.6%)	144 (7.5%)	132 (6.9%)	1925		
Surrounding positive cases							
Someone confirmed	11 (47.8%)	5 (21.7%)	3 (13%)	4 (17.4%)	23	37.941	<0.001
Someone suspected	23 (44.2%)	16 (30.8%)	7 (13.5%)	6 (11.5%)	52		
No one infected	1014 (54.2%)	613 (32.8%)	127 (6.8%)	116 (6.2%)	1870		

unclear	59 (34.7%)	73 (42.9%)	17 (10%)	21 (12.4%)	170		
Physical status							
Healthy	746 (57.2%)	390 (29.9%)	85 (6.5%)	84 (6.4%)	1305		
Sub-healthy	338 (46.2%)	282 (38.6%)	62 (8.5%)	49 (6.7%)	731	49.161	<0.001
Non-healthy	23 (29.1%)	35 (44.3%)	7 (8.9%)	14 (17.7%)	79		
Time							
No time	7 (41.2%)	4 (23.5%)	2 (11.8%)	4 (23.5%)	17		
<0.5h	154 (57.5%)	83 (31%)	12 (4.5%)	19 (7.1%)	268		
0.5h～1h	393 (59.4%)	198 (29.9%)	37 (5.6%)	34 (5.1%)	662	68.439	<0.001
1h～2h	450 (46.7%)	374 (38.8%)	77 (8%)	63 (6.5%)	964		
>2h	103 (50.5%)	48 (23.5%)	26 (12.7%)	27 (13.2%)	207		
The proportion of negative information							
Over 80%	191 (38.1%)	179 (35.7%)	61 (12.2%)	70 (14%)	501		
Around 50%	353 (51%)	254 (36.7%)	51 (7.4%)	34 (4.9%)	692	112.301	<0.001
Under 20%	563 (61.1%)	274 (29.7%)	42 (4.6%)	43 (4.7%)	922		

Note: Time = time spent on information related to the virus

Multiple logistic regression analysis. The results of the chi-square test of statistically significant variables were used for multiple logistic regression analysis. Table 4 presents the variable assignment for multiple logistic regression analysis. The dependent variable was anxiety level, whereas the independent variables were educational background, time spent on reading information related to the virus, surrounding positive cases, proportion of browsed negative information, physical status, and awareness of transmission routes. The normal level of anxiety was used as the reference level. Table 5 provides the results of multiple logistic regression analysis. For mild and severe anxiety groups, the respondents with no college education were more likely to be anxious. In the severe

anxiety group, respondents with knowledge about an individual as a confirmed case of COVID-19 are associated with significantly increased likelihood of anxiety. Being unclear about the COVID-19 status of the surrounding people was associated with significantly increased likelihood for all anxiety categories. In the moderate and severe anxiety groups, respondents who spent less than 1 h on information related to the virus were less likely to be anxious. Spending 1 to 2 h on information related to the virus was associated with significantly reduced odds of severe anxiety but increased odds of mild anxiety. Respondents under the severe anxiety group with low awareness of transmission routes were more likely to be anxious. In the mild and severe anxiety groups, respondents with unhealthy physical status were more likely to be anxious. In all anxiety groups, the respondents who browsed less than 20% negative information every day were less likely to be anxious. Differences with *p*-values of <0.05 were considered statistically significant.

Table 4 Variable assignment for multiple logistic regression analysis

Variable	Assignment
Anxiety levels	1=Normal, 2=Mild anxiety, 3=Moderate anxiety, 4=Severe anxiety
Education	1=No college education, 2=Undergraduate, 3=Postgraduate
Surrounding positive cases	1= Someone confirmed, 2= Someone suspected, 3=Unclear, 4=No one confirmed and suspected
Time	1=NO time, 2="<0.5h"，3="0.5h～1h", 4="1h～2h", 5=">2h"
Awareness of transmission route	0=Low, 1=High
Physical status	1= Healthy, 2= Sub-healthy, 3= Non-healthy
The proportion of negative information	1= Over 80%, 2= Around 50%, 3= Under 20%

Note: Time = time spent on information related to the virus

Table 5 Results of multiple logistic regression analysis

Variable	Anxiety level								
	Mild anxiety			Moderate anxiety			Severe anxiety		
	OR	95%CI	P	OR	95%CI	P	OR	95%CI	P

Education									
No college education	1.457	1.051～2.020	0.024	1.252	0.692～2.266	0.457	1.992	1.144～3.469	0.015
Undergraduate	0.988	0.785～1.242	0.915	1.006	0.673～1.506	0.975	0.963	0.622～1.490	0.866
Postgraduate	1	-	-	1	-	-	1	-	-
Surrounding positive cases									
Someone confirmed	0.787	0.268～2.305	0.662	2.290	0.612～8.573	0.219	3.469	1.052～11.447	0.041
Someone suspected	1.009	0.522～1.951	0.979	2.186	0.893～5.349	0.087	1.883	0.702～5.055	0.205
Unclear	1.747	1.206～2.530	0.003	1.912	1.057～3.459	0.032	2.558	1.449～4.514	0.001
No one infected	1	-	-						
Time									
No time	1.162	0.318～4.252	0.820	0.866	[illegible]160～4.676	0.867	1.300	0.316～5.350	0.716
<0.5h	1.043	0.670～1.623	0.853	0.268	0.[illegible]28～0.564	0.001	0.373	0.192～0.728	0.004
0.5h～1h	0.988	0.669～1.460	0.953	0.[illegible]18	0.181～0.559	<0.001	0.289	0.162～0.515	<0.001
1h～2h	1.660	1.141～2.414	0.008	0.608	0.366～1.009	0.054	0.472	0.472～0.281	0.005
>2h	1	-	-	1	-	-	1	-	-
Awareness of transmission route									
Low	1.215	0.998～1.4[illegible]	0.053	1.024	0.718～1.460	0.897	1.848	1.285～2.658	0.001
High	1	-	-	1	-	-	1	-	-
Physical status									
Healthy	0.384	[illegible]221～0.667	0.001	0.416	0.170～1.019	0.055	0.238	0.113～0.502	<0.001
Sub-healthy	0.607	0.347～1.063	0.081	0.700	0.282～1.734	0.440	0.313	0.145～0.673	0.003
Non-healthy	1	-	-	1	-	-	1	-	-
The proportion of negative information									
Over 80%	1.947	1.506～2.517	<0.001	4.301	2.784～6.645	<0.001	5.092	3.312～7.830	<0.001
Around 50%	1.578	1.262～1.974	<0.001	2.060	1.329～3.195	0.001	1.429	0.882～2.315	0.147
Under 20%	1	-	-	1	-	-	1	-	-

Note: OR = odds ratio, CI = confidence interval, Time = time spent on information related to the virus

Discussion

The study deduced that a majority of the individuals had a high-level of awareness of

COVID-19 due to multimedia publicity regarding the pandemic sponsored by governments and professionals. No significant difference was observed in the awareness of the symptom and transmission routes between respondents from the severely and mildly infected regions. Moreover, respondents in the severely infected region experienced increased awareness of prevention measures during the outbreak compared with those in the mildly infected region. In addition, the possibility of contacts with confirmed cases is greater. Thus, respondents should undertake more preventive measures. However, 43.2% of the respondents lacked sufficient awareness of transmission routes as evidenced by the response that touching products from Wuhan would increase the likelihood of being infected.

More than half of the respondents displayed no psychological anxiety. The anxiety scores of all respondents were approximately the same as the normative value of 4.9 of people without anxiety [20]. The scores indicated that the COVID-19 outbreak did not cause psychological anxiety for the majority of people. However, 33.4%, 7.3%, and 7% of the respondents exhibited mild, moderate, and severe levels of anxiety, respectively. The results suggested that anxiety level is associated with educational background, surrounding positive cases, time spent on reading information related to the virus, physical status, proportion of browsed negative information, and awareness of transmission routes. Furthermore, the study found that respondents who spent considerable time and browsed excessive negative information related to the virus every day displayed an increased likelihood of anxiety during the pandemic. Paying less

attention to information about the pandemic may be associated with significantly reduced odds of anxiety. Therefore, governments and health authorities should provide accurate health information during the pandemic to reduce the impact of misleading information.

In addition to the two factors mentioned above, educational background, surrounding positive cases, physical status, and awareness of transmission routes are associated with anxiety. The results revealed that respondents with no college education had a greater likelihood of anxiety during the outbreak. In this regard, local agencies should provide information in simple languages to support those with no college education during the outbreak. The respondents who were not surrounded by positive cases were less likely to be anxious. The possibility of contact with positive cases was limited, which greatly reduced the risk of infection. Moreover, the study observed that respondents presenting with fever, myalgia, cough, dyspnea, coryza, sore throat, and other chronic medical conditions had a greater likelihood of anxiety during the outbreak. They may be required to be quarantined or be admitted in the hospital for further investigation after presentation with possible COVID-19 symptoms. In terms of awareness of transmission routes, respondents with low-level awareness had a greater likelihood of anxiety during the outbreak. Thus, providing appropriate and repeated, yet simple, health education via the Internet and media is important for increasing a positive awareness of transmission routes. In this manner, the acceptability of certain precautionary measures may increase.

Ensuring the dissemination accurate health information to the public is important for the

government. Tran [26] investigated the coverage of COVID-19 health information by different sources accessed by health workers and community workers in Vietnam. The finding revealed that the majority of participants displayed knowledge about the “clinical and pathogen characteristics of COVID-19” and consumed COVID-19 information via the “Internet, online newspapers, and social networks.” Thus, re-designing training programs and communication activities is urgent for the effective dissemination of information related to the COVID-19 pandemic. Le [27] aimed to provide insight into the current level of awareness of the public about the pandemic and to identify associated factors among participants in Vietnam to recommend necessary interventions. The results revealed that the most requested information was the latest updated news on the pandemic followed by information about disease symptoms, and updated news on the outbreak. Thus, identifying group-specific demands would be helpful in providing accurate information and fulfill the needs of every population group.

Many studies have suggested that a public health emergency will influence public psychology and behavior. Vijaya [14] investigated the behavior and anxiety of Singaporeans during the severe acute respiratory syndrome (SARS) outbreak and found that over half of the respondents were anxious about the outbreak. Respondents with neighbors being quarantined to prevent the spread of SARS to the community experienced high levels of anxiety. In response, they adopted more appropriate personal hygiene measures and healthy lifestyle habits for prevention. Tam and Maunder [28,29] investigated the psychological and occupational impacts of the 2003 SARS outbreak

among frontline healthcare workers. The authors found that the majority of healthcare workers experienced psychological morbidity during the outbreak. This observation was understandable due to the frequent physical contact of healthcare workers with patients. Tan [30] focused on the psychological impact of the COVID-19 pandemic on healthcare workers in Singapore and found that they were less likely to be anxious than those from previous disease outbreaks, such as SARS, as cited in the literature. As the pandemic continues, important clinical and policy strategies are required to support healthcare workers.

With the growing number of reports on the increasing mental health burden caused by the COVID-19 outbreak, efforts have been taken for developing preventive measures to enhance psychological intervention for the public. On January 27, 2020, the National Health Commission in Mainland China issued the first comprehensive guidelines on emergency psychological crisis intervention in individuals affected by COVID-19 [31]. In Singapore, Chee [32] suggested that prompt and continuous psychological intervention was necessary for medical staff during high-mortality infectious disease outbreaks. Psychological interventions include cognitive behavior therapy and mindfulness-based cognitive therapy to treat anxiety during the COVID-19 pandemic.

The limitations of the research are as follows. First, the questionnaires were completed via WeChat or QQ. Thus, individuals without mobile phones were excluded. However, according to the Ministry of Industry and Information Technology, the total number of

mobile phone users has reached 1.6 billion, and the penetration rate of mobile phone users has reached 114.4 per 100 people in China. Thus, the study overlooked individuals without mobile phones.[33] Second, the sample is not representative of China's demographic structure as 75% were under the age of 30 years, whereas 85% have a university education. People with no college education had little interest in participating in the survey, whereas older people in China may lack access to social media. Thus, the researchers were able to recruit only a few respondents with no college education and older people. Another limitation is snowball sampling method, which could only recruit a group of people with similar thinking, and thus, lead to serious bias [16]. Future studies should adopt various survey methods to increase the representativeness of the sample and reduce bias. Third, the current study referenced published literature from previous disease outbreaks to design the questionnaire and did not use a standard questionnaire, which can lead to subjective bias. Finally, the survey was limited to the COVID-19 outbreak and overlooked other potential variables, such as preexisting anxiety or personality issues prior to the outbreak. Despite these limitations, the research examined residents around China directly or indirectly affected by the COVID-19 outbreak and demonstrated the effect of anxiety caused by COVID-19 on psychological health.

Conclusion

The research is cross-sectional in design and reflected the psychological anxiety of the Chinese people during the early stage of the disease outbreak. The study has several strengths, including a large sample recruited from different regions in China. It examined

the relationship between anxiety and public knowledge about COVID-19 and other factors. More than half of the respondents did not report anxiety, whereas 33.4% indicated mild symptoms. Thus, the study infers that individuals are relatively resilient to the psychological impact of the virus and the measures employed by the Chinese government to contain the disease. Vijaya [14] demonstrated that timely public health education programs could alleviate anxiety, fear, stress, and other psychological symptoms to a certain extent. Moreover, people could successfully develop public confidence in the preventive measures undertaken by the government. The Chinese government has undertaken a series of powerful measures to control this outbreak. Specifically, the government strongly suggested that people should stay indoors as long as possible, wear surgical masks if going out, and adopt healthy lifestyles.

However, the study found that 47.7% of the respondents experienced anxiety. Such respondents frequently spent considerable time browsing negative information related to the virus every day, are unhealthy, or fear contact with people and products from Wuhan. Thus, the government should urge people not to pay excessive attention to information about the pandemic but provide timely psychological assistance to people who are considered unhealthy. In addition, the government should aim to alleviate discrimination against people residing in severely infected regions and among those in other areas. The outbreak is ongoing, and predicting its end is difficult. Thus, although anxiety is alleviated and public confidence is built, people should be reminded to remain vigilant and refrain from becoming complacent because the virus continues to spread.

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Supplemental Material

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1. This research was a cross-sectional study and recruited a large sample from different regions in China, including severely and mildly infected areas. It reflected the knowledge and psychological anxiety of the Chinese people in the early stage of the Covid-19 epidemic.

2. Most respondents had a high awareness of Covid-19 virus. More than half of people did not report anxiety, while 33.4% of people did report mild symptoms, 7.3% of people did report moderate symptoms, 7% of people did report severe symptoms.

3. Respondents who have no college education, are not aware of neighbours who may have been infected, spend considerable time gathering information and browsing negative information related to the virus, are unhealthy, and have a low awareness of the transmission route were highly likely to be anxious.

4. The finding may help governments of other countries that have been affected by the COVID-19 to take measures to avoid public anxiety.

Table 1 Demographic characteristics

Variable	NO.	proportion (%)
Gender		
Male	865	40.9
Female	1250	59.1
Age group		
Under 20 years	267	12.6
21-30 years	1350	63.8
31-40 years	228	10.8
Over 40 years	270	12.8
Education		
No college education	294	13.9
Undergraduate	1277	60.4
Postgraduate	544	25.7
Location		
Mildly infected region	1035	48.9
Severely infected region	1080	51.1

Table 2 Public awareness of COVID-19 [n (%)]

Variable	Slight outbreak region	Severe outbreak region	Total	χ^2	P
Clinical symptoms	871 (84.2%)	882 (81.6%)	1,753 (82.8%)	2.306	0.129
Transmission route	590 (57%)	612 (56.7%)	1,202 (56.8%)	0.025	0.875
Protective measure	926 (89.5%)	999 (92.5%)	1,925 (91%)	5.94	0.015

Table 3 Differences in anxiety status from different variables

Variable	Minimal	Mild anxiety	Moderate anxiety	Severe anxiety	Total	χ^2	P
Gender							
Male	455	276	64	70	865	3.806	0.283

Female	652	431	90	77	1250		
Age group							
<20	150	82	13	22	267		
21～30	709	446	105	90	1350	12.071	0.209
31～40	106	82	23	17	228		
>40	142	97	13	18	270		
Education							
No college education	128	114	20	32	294		
Undergraduate	693	411	93	80	1277	16.131	0.013
Postgraduate	286	182	41	35	544		
Location							
Mildly infected region	546	328	87	74	1035	5.531	0.137
Severely infected region	561	379	47	73	1080		
Awareness of clinical symptoms							
Low	201	104	33	24	362	5.814	0.121
High	906	603	121	123	1753		
Awareness of transmission route							
Low	451	319	61	82	913	14.086	0.003
High	656	388	93	65	1202		
Awareness of preventive measures							
Low	104	61	10	15	190	1.774	0.621
High	1003	646	144	132	1925		
Surrounding infected cases							
Someone confirmed	11	5	3	4	23		
Someone suspected	23	16	7	6	52		
No one confirmed and suspected	1014	613	127	116	1870	37.941	<0.001
unclear	59	73	17	21	170		
Physical status							

Healthy	746	390	85	84	1305		
Sub-healthy	338	282	62	49	731	49.161	<0.001
Non-healthy	23	35	7	14	79		
Time							
No time	7	4	2	4	17		
<0.5h	154	83	12	19	268		
0.5h～1h	393	198	37	34	662	68.439	<0.001
1h～2h	450	374	77	63	964		
>2h	103	48	26	27	207		
The proportion of negative information							
Over 80%	191	179	61	70	501		
Around 50%	353	254	71	34	692	112.301	<0.001
Under 20%	563	274	42	43	922		

Note: Time = time spent on information related to the virus

Table 4 Variable assignment of multiple logistic regression analysis

Variable	Assignment
Anxiety levels	1=Normal, 2=Mild anxiety, 3=Moderate anxiety, 4=Severe anxiety
Education	1=No college education, 2=Undergraduate, 3=Postgraduate
Surrounding infected cases	1= Someone confirmed, 2= Someone suspected, 3=Unclear, 4=No one confirmed and suspected
Time	1=NO time, 2="<0.5h"，3="0.5h～1h", 4="1h～2h", 5=">2h"
Awareness of transmission route	0=Low, 1=High
Physical status	1= Healthy, 2= Sub-healthy, 3= Non-healthy
The proportion of negative information	1= Over 80%, 2= Around 50%, 3= Under 20%

Note: Time = time spent on information related to the virus

Table 5 Multiple logistic regression analysis results

Variable	Anxiety level								
	Mild anxiety			Moderate anxiety			Severe anxiety		
	OR	95%CI	P	OR	95%CI	P	OR	95%CI	P

Education									
No college education	1.457	1.051 ~ 2.020	0.024	1.252	0.692 ~ 2.266	0.457	1.992	1.144 ~ 3.469	0.015
Undergraduate	0.988	0.785 ~ 1.242	0.915	1.006	0.673 ~ 1.506	0.975	0.963	0.622 ~ 1.490	0.866
Postgraduate	1	-	-	1	-	-	1	-	-
Surrounding infected cases									
Someone confirmed	0.787	0.268 ~ 2.305	0.662	2.290	0.612 ~ 8.573	0.219	3.469	1.052 ~ 11.447	0.041
Someone suspected	1.009	0.522 ~ 1.951	0.979	2.186	0.893 ~ 5.349	0.087	1.883	0.702 ~ 5.055	0.205
Unclear	1.747	1.206 ~ 2.530	0.003	1.912	1.057 ~ 3.459	0.032	2.558	1.449 ~ 4.514	0.001
No one confirmed and suspected	1	-	-						
Time									
No time	1.162	0.318 ~ 4.252	0.820	0.866	[illegible]160 ~ 4.676	0.867	1.300	0.316 ~ 5.350	0.716
<0.5h	1.043	0.670 ~ 1.623	0.853	0.268	0.[illegible]28 ~ 0.564	0.001	0.373	0.192 ~ 0.728	0.004
0.5h ~ 1h	0.988	0.669 ~ 1.460	0.953	0.[illegible]18	0.181 ~ 0.559	<0.001	0.289	0.162 ~ 0.515	<0.001
1h ~ 2h	1.660	1.141 ~ 2.414	0.008	0.608	0.366 ~ 1.009	0.054	0.472	0.472 ~ 0.281	0.005
>2h	1	-	-	1	-	-	1	-	-
Awareness of transmission route									
Low	1.215	0.998 ~ 1.4[illegible]	0.053	1.024	0.718 ~ 1.460	0.897	1.848	1.285 ~ 2.658	0.001
High	1	-	-	1	-	-	1	-	-
Physical status									
Healthy	0.384	[illegible]221 ~ 0.667	0.001	0.416	0.170 ~ 1.019	0.055	0.238	0.113 ~ 0.502	<0.001
Sub-healthy	0.607	0.347 ~ 1.063	0.081	0.700	0.282 ~ 1.734	0.440	0.313	0.145 ~ 0.673	0.003
Non-healthy	1	-	-	1	-	-	1	-	-
The proportion of negative information									
Over 80%	1.947	1.506 ~ 2.517	<0.001	4.301	2.784 ~ 6.645	<0.001	5.092	3.312 ~ 7.830	<0.001
Around 50%	1.578	1.262 ~ 1.974	<0.001	2.060	1.329 ~ 3.195	0.001	1.429	0.882 ~ 2.315	0.147
Under 20%	1	-	-	1	-	-	1	-	-

Note: OR = odds ratio, CI = confidence interval, Time = time spent on information related to the virus