Original Paper

Mental Health Disorders and Associated Risk Factors in Quarantined Adults During the COVID-19 Outbreak in China: Cross-Sectional Study

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Abstract

Background: People undergoing mass home- and community-based quarantine are vulnerable to mental health disorders during outbreaks of coronavirus disease (COVID-19), but few studies have evaluated the associated psychosocial factors.

Objective: This study aimed to estimate the prevalence of anxiety and depressive symptoms and identify associated demographic and psychosocial factors in the general Chinese population during the COVID-19 pandemic quarantine period.

Methods: Participants aged 18 years or above were recruited in a cross-sectional online survey using snowball sampling from February 26-29, 2020. The survey included questions on demographics, family relationships, chronic diseases, quarantine conditions, lifestyle, COVID-19 infection, and anxiety and depressive symptoms. Logistic regression analyses were conducted to identify factors associated with elevated anxiety or depressive symptoms.

Results: Out of 2331 participants, 762 (32.7%) experienced elevated anxiety or depressive symptoms. Nine risk factors associated with anxiety or depressive symptoms included younger age, reduced income, having cancer or other chronic diseases, having family members living with cancer, concerns related to COVID-19 infection for themselves or family members, living alone, having family conflicts, having <3 or >8 hours of sedentary time per day, and worsened sleep quality.

Conclusions: The findings highlight an urgent need for psychological support for populations at high risk for elevated anxiety or depressive symptoms during the COVID-19 pandemic.

Introduction

Pandemics and other public health crises such as severe acute respiratory syndrome (SARS), Ebola, and the current coronavirus disease (COVID-19) pandemic often result in elevated rates of mental health problems [1-3]. Anxiety, depressive symptoms, and posttraumatic stress disorder (PTSD) are the most common mental health problems during pandemics [4]. To fight against the COVID-19 pandemic, quarantine strategies have been implemented in many countries including China [5,6]. However, large-scale and long-term quarantine may have negative impacts on people's mental health. A recent

study found that the prevalence of depressive symptoms was 20.1% in the Chinese population during the first month of widely implemented quarantine due to COVID-19 [7], which is much higher than previous reports of the lifetime rate of depressive symptoms in this population (6.8%), based on a representative sample [8]. However, empirical evidence regarding psychological disorders and related risk factors among people undergoing mass home- and community-based quarantine are still lacking.

Although several studies have reported on factors associated with mental health disorders during the COVID-19 pandemic, some factors particularly characteristic of the pandemic and corresponding quarantine strategy remain understudied. In the existing literature, factors such as demographic characteristics, lifestyle, and concerns about COVID-19 infection have been examined during the pandemic [7,9,10]. Specifically, reduced income, increased sedentary time, poor sleep quality, and concerns for COVID-19 infection were reported as risk factors for elevated anxiety or depressive symptoms [7,9,10]. Yet little attention has been paid to social factors such as an individual's household composition (living alone or with others) and family relationships, all of which may reflect people's social connectedness and affect their psychological well-being especially under social distancing or quarantine policies. During the COVID-19 quarantine period, a strict movement restriction was widely implemented in China [6]. People either spent more time with family members at home or experienced isolation during quarantine. The former scenario could lead to increased family conflicts during this hardship, and the latter may result in social isolation [11]. However, the potential risk factors for mental health symptoms arising from the COVID-19 pandemic have rarely been studied during the quarantine.

In addition, previous studies have shown mixed findings about the effects of some factors such as age on anxiety or depressive symptoms during the COVID-19 pandemic. One study reported that individuals between 18 and 30 years or above 60 years had the highest rates of psychological distress during the COVID-19 outbreaks [12], while another study found only younger people presented higher levels of stress and anxiety [13]. Two other studies found no association between age and mental health problems during the COVID-19 outbreaks [10,14].

Some populations such as people living with cancer or other chronic diseases may be at increased risk for developing mental health problems during a pandemic due to their tenuous physical health, barriers to accessing medical treatment, higher risks of COVID-19 infection, and higher probability of severe illness if infected [15-19]. During the COVID-19 quarantine period, patients with cancer or other chronic diseases may experience increased challenges related to receiving routine medical care due to mobility restrictions and the potential shortages of medical workers and essential medicines [20]. One study found that the likelihood of COVID-19 infection in cancer patients was twice as high as that in the general population [17]. In addition, the World Health Organization (WHO) reported that patients with pre-existing noncommunicable diseases, including cardiovascular disease, chronic respiratory disease, diabetes, and cancer, are at increased risk of severe illness from COVID-19 [21]. Therefore, the WHO has urged the global

medical community to pay additional attention to mental health in this vulnerable population, especially during the pandemic [21]. Yet, studies on mental health problems in cancer patients or other chronic diseases are scarce.

To fill these gaps in the literature, the current study aimed to estimate the prevalence of anxiety or depressive symptoms and identify associated demographic and psychosocial factors in the general Chinese population during the COVID-19 pandemic quarantine in China in February 2020. Specifically, we examined the effects of associated factors including demographics, family relationships, chronic disease status, quarantine conditions, lifestyle, and COVID-19 infection. Special attention was paid to characteristics particularly relevant to the COVID-19 pandemic quarantine such as household composition, family conflict, and chronic disease status.

Methods

Participants aged 18 years or above were recruited through a snowball sampling process via WeChat from February 26-29, 2020 during the community- or home-based quarantine in China. WeChat is the most widely used social media platform in China with over 1 billion active users [22]. We developed an online questionnaire using Questionnaire Star, the link to which could be shared via WeChat. Clicking the survey link in WeChat took participants directly to the online questionnaire. The online survey link was initially and purposely sent to 10 participants who were chosen to ensure a broad representation of age, gender, educational level, and chronic diseases status (eg, with or without chronic diseases). We asked these participants to send the survey link to friends on their WeChat contact list whom they considered suitable for this survey, and their friends were also encouraged to send the link to their own WeChat contact networks. The snowball sampling process continued until a sufficient sample size was reached. To recruit cancer patients and their family members, oncologists sent the survey link to patient groups in WeChat and encouraged them to participate in the study. Participants anonymously completed the self-administered electronic questionnaire for about 15 minutes with no financial incentive. Participants were allowed to reaccess the survey link but doing so erased their previous data. Although the probability of repeated completion by the same participants cannot be ruled out, such instances were rare as they were asked to complete it once and there was no incentive for repeat submissions.

Data on demographics (eg, age, gender, marital status, educational status, household composition, individual income), family relationships (eg, family conflict), chronic diseases (eg, cancer, hypertension, diabetes, asthma, cerebrovascular or cardiovascular diseases), quarantine conditions (eg, quarantine duration, frequency of going out during the quarantine), lifestyle (eg, physical activity, sedentary behavior, sleep quality), COVID-19 infection (eg, confirmed or suspected cases among family members, friends, colleagues, or in the community), and anxiety and depressive symptoms were collected.

Anxiety and depressive symptoms were assessed by the 14-item Hospital Anxiety and Depression Scale (HADS) that comprises two 7-item subscales; participants with an Anxiety subscale

(HADS-A) score ≥8 or a Depression subscale (HADS-D) score ≥8 were classified as having elevated anxiety or depressive symptoms [23]. We chose HADS because not only does it measure anxiety and depressive symptoms simultaneously with good reliability and validity [24], but it is also easy to understand and brief, requiring minimal time to complete. In comparison, other tools such as the Center for Epidemiologic Studies Depression Scale (CESD) and the Patient Health Questionnaire-9 (PHQ-9) measure only depressive symptoms. In addition, the 20-item CESD is too long to complete, whereas PHQ-9 has one item that is particularly sensitive and unsuitable for the general population during the stressful time of the pandemic (ie, "Thoughts that you would be better off dead, or thoughts of hurting yourself in some way") [24]. Therefore, based on the feedback from the pilot study prior to the large-scale survey deployment, we chose to use HADS.

The sample size was calculated based on the estimated rate of anxiety or depressive symptoms in the general population. A pre–COVID-19 epidemiological study reported the lifetime prevalence of anxiety and depressive symptoms in the Chinese population as 7.6% and 6.8%, respectively [8]. Considering the likelihood of increased rates of anxiety and depressive symptoms during pandemics, we hypothesized a rate of 18% for anxiety or depressive symptoms in the general population. With a significance level set at .05, an absolute error of 1.8%, and allowing for up to 10% invalid questionnaires, we estimated a minimum sample size of 2004 for the current study.

Logistic regression models were employed to identify factors associated with elevated anxiety or depressive symptoms. All variables were categorized and described by frequencies and percentages. Univariate logistic regression models were used to analyze the distribution of anxiety or depressive symptoms among different categories for each variable and select risk factors for multivariate analysis. For example, to identify whether chronic disease status was a potential risk factor for anxiety or depressive symptoms, we compared the rate of anxiety or depressive symptoms among participants with chronic diseases to that of participants without. Variables with $P<.10$ in univariate analysis were included in the multivariate logistic regression model and those with $P<.05$ were retained in the final model. R software version 3.5.1 (R foundation for Statistical Computing) was used for data analyses.

This study was approved by the institutional review board of the School of Public Health, Sun Yat-sen University, and all participants provided informed consent.

Results

Out of 2441 questionnaires collected, 2331 (95.5%) were deemed valid using a quality-control question, which stated that its purpose was to screen out invalid questionnaires and requested participants to check a specific option. Questionnaires that checked the correct option were considered valid. The mean age of participants was 34.4 (SD 11.1) years, 56.1% (n=1307) were female, 60.0% (n=1398) were married, 73.7% (n=1718) had a bachelor's degree or above, 11.5% (n=269) had a chronic disease, 41.6%(n=970) had family members with a chronic disease, 44.7% (n=1041) had been quarantined for over 3 weeks, and 54.5% (n=1271) went out no more than once a week. In total, 32.7% (n=762) of participants experienced elevated anxiety or depressive symptoms. Specifically, 25.4% (n=592) experienced anxiety, 21.3% (n=496) experienced depressive symptoms, and 13.9% (n=326) experienced both anxiety and depressive symptoms.

Rates of elevated anxiety or depressive symptoms among people without chronic diseases, with cancer, and with other chronic diseases were 31.5% (n=649), 34.8% (n=32), and 45.8% (n=81), respectively. Rates of elevated anxiety or depressive symptoms among people whose family members had no chronic diseases, cancer, and other chronic diseases were 31.7% (n=431), 45.0% (n=36), and 33.1% (n=295), respectively.

As shown in Table 1, nine variables were retained in the multivariate logistic regression model, and the odds ratio (OR) of each variable was adjusted by the remaining eight variables in the model. Risk factors associated with elevated anxiety or depressive symptoms included younger age (<40 years) (41-55 years: OR 0.666, 95% CI 0.494-0.899; ≥56 years: OR 0.507, 95% CI 0.304-0.847), reduced income during quarantine (OR 1.441, 95% CI 1.179-1.760), having cancer (OR 1.900, 95% CI 1.146-3.149) or other chronic diseases (OR 2.222, 95% CI 0.304-0.847), having family members living with cancer (OR 1.821, 95% CI 1.119-2.964), concerns for COVID-19 infection for themselves or family members (moderate concern: OR 1.603, 95% CI 1.216-2.115; severe concern: OR 2.315, 95% CI 1.705-3.142), living alone (living with family or others: OR 0.595, 95% CI 0.422-0.839), having family conflicts during the COVID-19 outbreak (OR 1.707, 95% CI 1.267-2.299), having <3 (OR 1.702, 95% CI 1.407-2.059) or >8 (OR 1.458, 95% CI 1.193-1.783) hours of sedentary time per day, and worsened sleep quality (OR 2.917, 95% CI 2.319-3.670) during the quarantine.

Table 1. Logistic regression of associated factors for elevated anxiety or depressive symptoms during the quarantine (N=2331).

Variable	Total, N	Anxiety or depressive symptoms[a], n (%)	Unadjusted results		Adjusted results	
			Odds ratio (95% CI)	P value	Odds ratio (95% CI)	P value
Age (years)						
18-25	530	184 (34.7)	1 (ref[b])	N/A[c]	1 (ref)	N/A
26-40	1197	406 (33.9)	0.965 (0.778-1.197)	.75	0.836 (0.661-1.058)	.14
41-55	475	138 (29.1)	0.770 (0.590-1.006)	.06	0.666 (0.494-0.899)	.01
≥56	129	34 (26.4)	0.673 (0.438-1.035)	.07	0.507 (0.304-0.847)	.01
Change in income						
Unchanged	1571	467 (29.7)	1 (ref)	N/A	1 (ref)	N/A
Worse	737	290 (39.3)	1.534 (1.277-1.842)	<.001	1.441 (1.179-1.760)	<.001
Better	23	5 (21.7)	0.657 (0.242-1.779)	.41	0.558 (0.198-1.575)	.27
Has a chronic disease						
None	2062	649 (31.5)	1 (ref)	N/A	1 (ref)	N/A
Other chronic diseases	177	81 (45.8)	1.837 (1.347-2.505)	<.001	2.222 (1.556-3.172)	<.001
Cancer	92	32 (34.8)	1.161 (0.749-1.801)	.51	1.900 (1.146-3.149)	.01
Family members with chronic diseases[d]						
None	1361	431 (31.7)	1 (ref)	N/A	1 (ref)	N/A
Other chronic diseases	890	295 (33.1)	1.070 (0.893-1.281)	.46	0.983 (0.808-1.196)	.86
Cancer	80	36 (45.0)	1.765 (1.120-2.783)	.01	1.821 (1.119-2.964)	.02
Concerns about infection for themselves or family members						
Little	400	87 (21.8)	1 (ref)	N/A	1 (ref)	N/A
Moderate	1351	430 (31.8)	1.680 (1.290-2.187)	<.001	1.603 (1.216-2.115)	.001
Severe	580	245 (42.2)	2.631 (1.971-3.513)	<.001	2.315 (1.705-3.142)	<.001
Living situation						
Alone	168	71 (42.3)	1 (ref)	N/A	1 (ref)	N/A
With family or others	2163	691 (31.9)	0.641 (0.466-0.882)	.06	0.595 (0.422-0.839)	.003
Family conflict[e]						
No	1502	409 (27.2)	1 (ref)	N/A	1 (ref)	N/A
Yes	829	353 (42.6)	1.982 (1.658-2.369)	<.001	1.702 (1.407-2.059)	<.001
Sedentary behavior (hours/day)						
3-8	1150	313 (27.2)	1 (ref)	N/A	1 (ref)	N/A
<3	261	102 (39.1)	1.715 (1.296-2.271)	<.001	1.707 (1.267-2.299)	<.001
>8	920	347 (37.7)	1.619 (1.344-1.951)	<.001	1.458 (1.193-1.783)	<.001
Sleep quality during quarantine						
Unchanged	1448	384 (26.5)	1 (ref)	N/A	1 (ref)	N/A
Worse	451	249 (55.2)	3.416 (2.743-4.253)	<.001	2.917 (2.319-3.67)	<.001
Better	432	129 (29.9)	1.180 (0.931-1.495)	.17	1.043 (0.814-1.335)	.74
Region						
Other provinces	2134	677 (31.7)	1 (ref)	N/A	N/A	N/A
Hubei Province	197	85 (43.1)	1.633 (1.214-2.197)	.001	N/A	N/A

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Variable	Total, N	Anxiety or depressive symptoms[a], n (%)	Unadjusted results		Adjusted results	
			Odds ratio (95% CI)	P value	Odds ratio (95% CI)	P value
Infection cases[f]						
None	2285	736 (32.2)	1 (ref)	N/A	N/A	N/A
Yes	46	26 (56.5)	2.736 (1.517-4.933)	.001	N/A	N/A
Duration of quarantine						
≤3 weeks	1290	414 (32.1)	1 (ref)	N/A	N/A	N/A
>3 weeks	1041	348 (33.4)	1.063 (0.893-1.264)	.49	N/A	N/A
Frequency of going out						
Never	462	152 (19.9)	1 (ref)	N/A	N/A	N/A
≤1 time per week	809	256 (33.6)	0.944 (0.740-1.205)	.64	N/A	N/A
2-4 times per week	769	261 (34.3)	1.048 (0.820-1.339)	.71	N/A	N/A
≥5 times per week	261	93 (12.2)	0.958 (0.700-1.311)	.79	N/A	N/A

[a]Participants with an HADS-A score ≥8 or an HADS-D score ≥8 were classified as those with elevated anxiety or depressive symptoms.

[b]ref: reference.

[c]N/A: not applicable.

[d]Chronic diseases included the following options: cancer, hypertension, diabetes, cerebrovascular disease (eg, stroke, cerebral infarction, cerebral hemorrhage), ischemic heart disease, chronic hepatitis/cirrhosis, chronic bronchitis/emphysema, asthma, rheumatoid arthritis, psychological disorders, and others specified by the participants.

[e]Family conflict refers to family disputes over COVID-19–related preventive measures (eg, frequency of hand washing), concerns about mutual transmission of coronavirus among family members, and different opinions on information related to COVID-19 (eg, origins of the outbreak) were the three main triggers of family conflict.

[f]Infection cases: whether there were confirmed or suspected cases among family members, friends, colleagues, or in the community.

Discussion

China's large-scale quarantine was implemented in late January 2020, resulting in weeks of social isolation. In our sampled population, 32.7% experienced elevated anxiety or depressive symptoms during the quarantine, with 25.4% and 21.3% experiencing anxiety and depressive symptoms, respectively. This is more than triple the rates of lifetime anxiety and depressive symptoms previously reported for the Chinese population (7.6% and 6.8%, respectively) [8]. In our survey, the rates of elevated anxiety or depressive symptoms among participants with cancer or chronic diseases were found to be 34.8% and 45.8%, respectively, which are higher than the rate of 31.5% identified among participants without chronic diseases during the COVID-19 quarantine.

Consistent with the existing literature, this study also found that financial loss, infection concerns, sedentary behavior, poor sleep quality, living with cancer or other chronic diseases, or having family members with cancer were associated with elevated anxiety or depressive symptoms [11,25-27]. Previous studies reported inconsistent results regarding the impact of age on anxiety or depressive symptoms during the COVID-19 outbreak. One study revealed a greater negative psychological impact for both young adults and the elderly [12], while another study found that only younger age was associated with increased stress [13]. In our study, we found that younger people were more

likely to experience elevated anxiety or depressive symptoms than those above 40 years. A possible explanation for this result is that younger people might have heavier financial burdens and more access to information about the COVID-19 epidemic through social media, both of which could lead to increased stress [28]. Some studies have indicated that increased sedentary behavior was associated with anxiety and depressive symptoms during the COVID-19 pandemic [29]. Interestingly, our study found associations between both increased (>8 hours per day) and decreased sedentary time (<3 hours per day) and mental health symptoms. This could be explained by people who were working or taking care of sick family members suffering from intensified stress due to the likelihood of exposure to COVID-19. However, this finding needs further exploration.

This study found some unique risk factors associated with elevated anxiety or depressive symptoms in the Chinese population during the COVID-19 outbreak. We found that people who lived alone had an increased risk of anxiety or depressive symptoms, which might be due to diminished social interactions during the quarantine. Conversely, we also found that family conflict related to COVID-19 might be a source of stress contributing to mental health problems. In our survey, the rate of family conflict during the COVID-19 quarantine was found to be 36%, and most family conflict was related to COVID-19, such as disagreements over how family members should protect themselves from the pandemic and different opinions about information related to COVID-19. These results

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provide important empirical evidence for policy making; tailored strategies are advisable for different populations at high risk of increased psychological distress and problems. Social connectedness and support should be promoted and provided, especially to those who live alone as an effort to protect them from social isolation. Information on COVID-19 and health promotion could be delivered more effectively through multiple channels to minimize family conflict and cultivate better mental health.

There are some limitations in this study. Our sample was more educated than the general Chinese adult population and may not be representative due to limitations of the sampling method used. However, since random sampling is difficult to achieve in a situation like the COVID-19 pandemic, social media–based sampling is a preferred alternative [30]. Though we oversampled cancer patients and their family members through the WeChat contact networks of doctors, the numbers were still small. Findings should be interpreted with caution. Future studies exploring interactions between or among risk factors may be helpful in providing guidance for vulnerable populations.

The results of this study highlight an urgent need for psychological support and counseling for populations at high risk for elevated anxiety or depressive symptoms during the current pandemic or any quarantine implementation. The WHO needs to urge the global medical community to provide screening for mental health problems and psychological services to vulnerable populations such as patients with cancer or other chronic diseases.

Acknowledgments

Authors' Contributions

YG and CC have full access to all of the data of this study and take responsibility for the integrity of the data and the accuracy of the data analysis. YG and CC were responsible for study concept and design; YZ, WY, MZ, YL, HX, XL, JL, and SW contributed to data acquisition, analysis, or interpretation of data. YG and CC drafted the manuscript. YG, CC, YZ, WY, YL, MZ, and AM-W critically revised the manuscript for important intellectual content. YZ, YL, and MZ conducted the statistical analysis. YG, CC, YZ, YL, MZ, and WY offered administrative, technical, or material support. YG and CC supervised the study.

Conflicts of Interest

None declared.

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Abbreviations

CESD: Center for Epidemiologic Studies Depression Scale
COVID-19: coronavirus disease
HADS: Hospital Anxiety and Depression Scale

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HADS-A: Anxiety subscale of Hospital Anxiety and Depression Scale
HADS-D: Depression subscale of Hospital Anxiety and Depression Scale
PHQ-9: Patient Health Questionnaire-9
PTSD: posttraumatic stress disorder
SARS: severe acute respiratory syndrome
WHO: World Health Organization

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