An Internet Investigation of Mental Health Status of 1144 Different Status Identities in South China during Outbreak of COVID-19

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Abstract

Background At the end of 2019, the Coronavirus disease 2019 (COVID-19), with highly infectious, transmits rapidly. So it has caused people panic to a certain degree.

Methods This cross-sectional study performed via an online survey run from January 30 to March 30, 2020. 1144 people in South China (287 of level 1 population, 121 of level 2 population, 160 of level 3 population, 576 of level 4 population) were investigated. GAD-7 scale, PHQ-9 scale, and PSS-10 scale were used to evaluate the mental health status of different populations.

Results Among 1144 subjects, the average GAD-7 score was 4(1,8), the average PHQ-9 score was 4(1,9), and the average PSS-10 score was 16(11,19). There were statistically significant differences in the scores of GAD-7 ($H = 15.235$, $P < 0.01$), PHQ-9 ($H = 9.265$, $P = 0.026$), and PSS-10 ($H = 8.435$, $P = 0.049$) among different levels of population. In the score of GAD-7: The anxiety degree of the level 1 population is higher than that of the level 2 population and the level 4 population. The difference between the two pairs is statistically significant ($Z = -2.932, -4.012, -2.949$, $P < 0.005$). There are significant differences in items of "becoming easily annoyed or irritable", "seemingly terrible things will happen" ($Z = -3.399 \sim -2.055$, $P < 0.005$); Score of PHQ-9: The depression degree of the level 1 population and the level 2 population is higher than that of the level 4 population, and the difference between the two pairs is statistically significant ($Z = -3.38, -2.682$, $P < 0.005$). There are significant differences in items of "difficult to fall asleep or not awake", "feeling depressed" and other related items ($Z = -2.885 \sim -2.003$, $P < 0.005$); Score of PSS-10: The stress degree of the level 3 population is higher than that of the level 1 population and the level 4 population ($Z = -3.693 \sim -2.702$, $P < 0.005$). There are significant differences in items of "feel confident", "life are as expected", "the ability to control anger", "the things are all under control" and other related items ($Z = -4.782 \sim -2.102$, $P < 0.005$).

Conclusion There are differences in the effects of COVID-19 on the mental health of people with different identities. Appropriate psychological interventions should be provided for different populations in combination with their mental health status.

1. Background

Coronavirus Disease 2019 (COVID-19), named by the World Health Organization (WHO) on January 2020[1], soon afterwards has been declared an epidemic so as to increase the awareness of its severity globally[2]. At present, there are no specific medicine as well as treatments for COVID-19, only supportive care is provided to the patients[3]. In addition, COVID-19 is a highly infectious disease that can be transmitted person-to-person, people who was infected by COVID-19 can be asymptomatic[4]. As the disease still exists and complex elements continue puzzling us, human beings should face this crisis vigilantly and have a long way to go. To some extent, this horrible disease has aroused panic for the population[5].

Fighting against crucial challenges during COVID-19 outbreak, people have undergone an emergency, which may develop different psychological issues respectively. Accordingly, as for frontline health care workers in COVID-19 epidemic[6, 7], overwhelming workload, inadequate equipment and social support, as well as high risk of infection may lead to their urgent and long-term mental problems. What has been approved in the previous experience was that, health care workers in the Emergency Department from Hong Kong during SARS outbreak felt distress because of loss of control, fear of personal health and the spread of the virus[8]. In spite of distress, depression, anxiety, insomnia and other psychological problems would appear on medical staff when there is an epidemic outbreak. Confirmed patients, however, may experience fear and anxiety due to the severity of the disease, and the infectious symptoms of COVID-19 should be to blame because they may cause any other disturbances, like insomnia, distress and so on. Similarly, since the epidemic is still uncertain, and the quarantine environment is somehow scary[9], suspected patients and those who isolated would develop fear, stress, hypochondriasis and other mental issues. Of note, in order to successfully control the infection of COVID-19, strict measures like quarantine is of utmost significance. However, quarantine and home staying could bring out unexpected results. During staying home, the individuals would adopt psychological distress, frustration and boredom due to long duration of quarantine, fear of being infected and having insufficient information as well as protective supplements[10]. As for the general public, correct and adequate information was needed, but they often searched for overwhelming information, and some of them received rumors, which may lead to anxiety and fear among the population[11, 12].

To provide mental services to the individuals specifically, populations are categorized into 4 levels[11, 13], according to the degree to which the population is affected by COVID-19: Level 1 population consists of confirmed patients with COVID-19, frontline health care workers, etc.; Level 2 population includes isolated mild-symptoms patients with COVID-19 or suspected COVID-19 patients; Level 3 population contains people related to the Level 1 or Level 2 population, including relatives, friends etc.; and Level 4 population mainly involves the susceptible and the general public.

If preventive measures were not taken immediately, mental issues may lead to serious psychological disorders[14, 15]. Therefore, agencies from different fields spared no efforts in carrying out various forms of prompt interventions all over China. First of all, government authorities, especially health authorities like the NHC, have adopted some psychological intervention and mental service guidelines so as to make it more regularized[11]. According to the Principle, social power, 24-hour psychological assistance hotlines, clinical psychological assistance teams as well as psychological expert teams should be organized and coordinated by the government[16]. The Principle has called for every qualified mental health associations and academic agencies take the responsibilities to set up professional expert teams, provide mental services, establish psychological assistance hotline and conduct guidelines and instructions[13]. During the COVID-19 outbreak, it is reported that there were at least 29 guidelines and instructions established to direct mental health services nationwide between January 26th and February 20th[11]. Compared with the SARS outbreak in 2003, online mental health services are more convenient and accessible for population recently due to the promulgation of internet services and smart phones. Online mental health surveys related to COVID-19, for example, were conducted to collect information about public mental issues so as to understand the latest situation of people with various identities[17]. Moreover, online mental health education for the general public as well as online mental consulting for those who were in need have been released to provide targeted services. Nevertheless, online services play a significance role to solve public psychological issues during COVID-19[17].

Though telephone-, internet- and application-based as well as offline psychological health services have been conducted throughout China during COVID-19 epidemic, evidence-based assessments were limited[18], most of which were mostly targeting health care workers[19] and vulnerable populations such as older adults[20], mental illness[21] and Chinese students studying overseas[22].

The current study would represent mental health status and psychological health survey to people in different four levels in China firstly. Researches about mental health status and mental health interventions related to COVID-19 for population with different identities are deficient. To address the gap, participants were selected from 4 different levels illustrated above in the current study. The magnitude of anxiety, depression and stress symptoms were evaluated to examine the mental health status of populations, which would be helpful to provide evidence to draw up constructive and specific measurements to promoting the mental well-being for each defined group facing the challenge in the epidemic.

2 Method

2.1 Participants

This study is a cross-sectional, survey-based research, in which snowball sampling was employed to recruit participants with different identities in South China. An online survey was publicized to the individuals and they were advocated sending it to other people. 911 individuals associated with COVID-19 could be searched for via the WeChat official account of the hospital, WeChat and the hospital website. Online questionnaire are addressed based on Questionnaire Star. Among the questionnaires, 1144 of which are valid, and the sampling efficiency is 92.4%. Enrollment criteria: participants should (1) finish the questionnaire independently with relevant educational attainments as well as physical and mental health; and (2) take part in this research voluntarily. Exclusion criteria: individuals who were (1) patients with schizophrenia, bipolar disorder, and other severe mental illnesses or personality disorder; or (2) patients with cognitive dysfunction or severe physical illnesses that can not complete the survey were excluded. This project has been approved by the Ethics Committee of Affiliated Brain Hospital of Guangzhou Medical University.

2.2 Measures

Online questionnaire was issued with purposes, explanations and informed consent, participants were requested to confirm informed consent and then finished the survey independently with the assistance of questionnaire instruction. In our study, anxiety, depression and stress symptoms were targeted, with access to the Chinese versions of validated scales. The measurement tools include: (1) Demographic data designed by the authors: this part consists of sex, age, geographic location, mental disorders or severe physical disease information, relatives' information, occupation, marital status and so on; (2) The Chinese versions of the 7-item Generalized Anxiety Disorder scale (GAD-7)[23, 24] was used to assess the severity of symptoms of anxiety. This scale was with a total of 7 items and marked with 4 points. The results of GAD-7 are as follows: normal (0–5), mild (5–9), moderate (10–14), and severe (15–21) anxiety. This scale has good reliability and validity, of which the sensitivity and specificity are over 85%; (3) The Chinese versions of the 9-item Patient Health Questionnaire (PHQ-9)[25, 26] was applied to assess the severity of symptoms of depression. This scale was with a total of 9 items and marked with 4 points. The results of PHQ-9 are as follows: normal (0–5), mild (5–9), moderate (10–14), moderately severe (15–19) and severe (20–27) depression; (4) The Chinese versions of the 10-item Perceived Stress Scale (PSS-10)[27] was used to assess the severity of symptoms of stress. This scale was with a total of 10 items and marked with 5 points, among which items 4, 5, 7 and 8 were reversely scored. The results of PSS-10 are as follows: mild (0–14), moderate (15–25), moderately severe (26–31) and severe (32–40) stress. In order to filter severe cases, the cutoff scores for GAD-7, PHQ-9 and PSS-10 were 5, 5 and 15 respectively, which predicts detecting symptoms of anxiety, depression and stress if scores were higher than this criteria.

2.3 Quality Control

Online questionnaire was adopted in this research. To guarantee the efficiency of the data, participant in the same IP address can only accomplish the survey once, and questionnaires from IP addresses outside South China were removed. Only completed questionnaires can be submitted, and real-time backstage monitoring is operated.

2.4 Statistical Analysis

Data collection, storage and export were all run by the Questionnaire Star System. Data analysis was performed using SPSS 24.0. Count data and grade data are described by frequency and percentage [n (%)], and the skew measurement data are described by the median interquartile range [M (P25, P75)]; At the same time, the Kruskal-Wallis H test was used to test the differences in the total scores of the three scales among the population groups at different levels, and the groups were compared pairwise according to the Bonferroni method. Finally, the Wilcoxon rank sum test was utilized to further analyze the items between the scales. The significance level was set at $\alpha = 0.05$.

3 Result

3.1 Mental Health Status among People with Different Identities

A total of 1216 research subjects were surveyed, and 1144 valid questionnaires were obtained, with an effective response rate of 94.1%. All 1144 participants are from South China, including 4 provincial-level administrative regions, of which 402 were male (35.1%), 742 were female (64.9%). Of the participants, 344 were under 25 years old (30.1%), 741 were aged 26–50 (64.8%) and 59 were over 51 years old (5.2%). 229 participants were health care workers (20.0%), and 915 were not medical workers (80.0%). Most participants were from Level 4 population (50.3%, 576/1144), followed by Level 1 population (25.1%, 287/1144), Level 3 population (14.0%, 160/1144) and Level 2 population (10.6%, 121/1144). As the Table 1 has shown, 586 (51.2%) participants have reported different levels of anxiety, 567 (49.6%) participants have reported different levels of depression, and the remaining 159 (13.9%) participants have reported moderately severe stress. More specifically, participants from Level 1 population own the highest rate of anxiety (57.1%, 164/287), participants belong to Level 2

population own the highest rate of depression (57.0%, 69/121) and participants from Level 3 own the highest rate of moderately severe and severe stress (19.4%, 31/160).

Table 1 Mental Health Status among People with Different Identities[n = 1144, percent(%)]											
Status	Anxiety Symptoms				Depression Symptoms				Stress Symptoms		
Identity	Normal	Mild	Moderate	Severe	Normal	Mild	Moderate	Moderately severe	Severe	Mild	Moderate
Level 1 population	123(42.9)	89(31.0)	44(15.3)	31(10.8)	135(47.0)	72(25.1)	36(12.5)	29(10.1)	15(5.2)	101(35.2)	147(51.2)
Level 2 population	53(43.8)	36(29.8)	17(14.0)	15(12.4)	52(43.0)	34(28.1)	17(14.0)	13(10.7)	5(4.1)	52(43.0)	53(43.8)
Level 3 population	84(52.5)	44(27.5)	19(11.9)	13(8.1)	87(54.4)	37(23.1)	19(11.9)	12(7.5)	5(3.1)	52(32.5)	77(48.1)
Level 4 population	298(51.7)	160(27.8)	71(12.3)	47(8.2)	303(52.6)	140(24.3)	63(10.9)	48(8.3)	22(3.8)	207(35.9)	296(51.4)
Total	558(48.8)	329(28.8)	151(13.2)	106(9.3)	577(50.4)	283(24.7)	135(11.8)	102(8.9)	47(4.1)	412(36)	573(50.1)
7-item Generalized Anxiety Disorder scale (GAD-7) was used to assess the severity of symptoms of anxiety. The results of GAD-7 are as follows: normal (0-5), severe (15-21) anxiety; 9-item Patient Health Questionnaire (PHQ-9) was applied to assess the severity of symptoms of depression. The results of PHQ-9 are moderate (10-14), moderately severe (15-19) and severe (20-27) depression; 10-item Perceived Stress Scale (PSS-10) was used to assess the severity of stress. 10 are as follows: mild (0-14), moderate (15-25), moderately severe (26-31) and severe (32-40) stress.											

3.2 Differences in Total Scores of Anxiety, Depression and Stress among People with Different Identities

As the Table 2 has shown, the scores of three scales of 1144 participants were: anxiety 4(1,8), depression 4(1,9) and stress 16(11,19). Kruskal-Wallis H test showed that different levels of population' s scores of GAD-7 (H = 15.235, P < 0.01), PHQ-9 (H = 9.265, P = 0.026), PSS-10 (H = 8.435, P = 0.049) are statistically significant;

As what is shown in Table 3, the scores of anxiety: Level 1 population~Level 2 population~Level 4 population (Z=-4.012~-2.932, P = 0.005 or P<0. 001); the scores of depression: Level 1 and Level 2 population~Level 4 population (Z=-3.387~-2.682, P = 0.001 ~ 0.007); the scores of stress: Level 3 population~Level 1 population~Level 4 population (Z=-3.693~-2.702, P = 0.006 ~ 0.007 or P<0. 001). There is no evidence showing significant influence between anxiety and depression of Level 3 population and other groups.

Table 2 GAD-7, PHQ-9, PSS-10 scores of different levels of people (n = 1144, M (P25, P75))					
Status/Identity	Frequency	Percentage (%)	Anxiety	Depression	Stress
Level 1 population	287	25.09	6(3,10)	7(2,12)	16(11,19)
Level 2 population	121	10.58	5(1,7)	6(2,11)	15(8,21)
Level 3 population	160	13.99	4(1,8)	4(1,9)	16(11,20)
Level 4 population	576	50.34	4(1,7)	4(1,9)	15.5(9.5,20.5)
Total	1144	100	4(1,8)	4(1,9)	16(11,19)

Table 3 Pairwise Comparison among Anxiety, Depression and Stress among People with Different Identities							
Subgroup A	Subgroup B	Anxiety		Depression		Stress	
		Z value	P value	Z value	P value	Z value	P value
Level 1 population	Level 2 population	-2.932	0.005	-1.271	0.204	-0.221	0.825
Level 1 population	Level 3 population	-0.678	0.498	-1.994	0.046	-2.702	0.007
Level 1 population	Level 4 population	-4.012	< 0.001	-3.387	0.001	-2.735	0.006
Level 2 population	Level 3 population	-1.291	0.197	-1.956	0.050	-0.658	0.511
Level 2 population	Level 4 population	-2.949	0.005	-2.682	0.007	-0.144	0.885
Level 3 population	Level 4 population	-0.112	0.911	-0.897	0.370	-3.693	< 0.001
According to Bonferroni method, α = 0.05 / 6 = 0.008; All tests significance level was α = 0.05, and all tests were 2-tailed.							

3.3 Item Analysis of GAD-7, PHQ-9 and PSS-10

Item analysis was conducted to further investigate the effect of factors from GAD-7, PHQ-9 and PSS-10, exploring the various factors influencing anxiety, depression and stress among all levels. As shown in Table 4, there are 7 items in GAD-7, of which there was a statistically significant difference in items “Feeling nervous, anxious, or on edge”, “Not being able to stop or control worrying”, “Being so restless that it’s hard to sit still”, “Becoming easily annoyed or irritable”, “Feeling afraid as if something awful might happen” ($Z = -3.399 \sim -2.051$, $P = 0.001 \sim 0.040$).

Table 4
Item Analysis of Generalized Anxiety Disorder-7 (GAD-7)

Status/Identity	Frequency	1. Feeling nervous, anxious, or on edge	2. Not being able to stop or control worrying	3. Worrying too much about different things	4. Trouble relaxing	5. Being so restless that it's hard to sit still	6. Becoming easily annoyed or irritable	7. Feeling afraid as if something awful might happen
Level 1 population	287	1(1,2)	1(0,1)	1(0,1)	1(0,1)	1(0,1)	1(1,2)	1(0,1)
Level 2 population	121	1(0,1)	1(0.5,1.5)	1(0,1.5)	1(0,1.5)	1(0,1.5)	1(0,1)	1(0,1.5)
Level 3 population	160	1(0,2)	1(0,1)	1(0,1)	1(0,1)	0(0,1)	1(0,1)	1(0,1)
Level 4 population	576	1(0,1)	1(0,1)	1(0,1)	1(0,1)	0(0,1)	1(0,1)	1(0,1)
Z value ^a	-	-2.185	-1.486	-0.322	-0.557	-2.407	-2.129	-2.932
P value ^a	-	0.029	0.137	0.747	0.577	0.016	0.033	0.005
Z value ^b	-	-1.282	-0.885	-0.450	-0.152	-2.051	-2.055	-2.526
P value ^b	-	0.200	0.376	0.652	0.879	0.040	0.040	0.014
Z value ^c	-	-1.770	-3.399	-1.769	-1.510	-1.014	-2.155	-2.398
P value ^c	-	0.077	0.001	0.077	0.131	0.311	0.031	0.017
a) Item analysis between Level 1 and Level 2 population; b) Item analysis between Level 1 and Level 4 population; c) Item analysis between Level 2 and Level 4 population.								

According to Table 5, there are 9 items in PHQ-9, of which there was a statistically significant difference in items “Little interest or pleasure in doing things”, “Feeling down, depressed, or hopeless”, “Trouble falling or staying asleep, or sleeping too much”, “Trouble concentrating on things, such as reading the newspaper or watching television”, “Thoughts that you would be better off dead or of hurting yourself in some way” ($Z = -2.736 \sim -2.003$, $P = 0.004 \sim 0.048$).

Table 5
Item Analysis of Patient Health Questionnaire-9 (PHQ-9)

Status/Identity	Frequency	1. Little interest or pleasure in doing things	2. Feeling down, depressed, or hopeless	3. Trouble falling or staying asleep, or sleeping too much	4. Feeling tired or having little energy	5. Poor appetite or overeating	6. Feeling bad about yourself - or that you are a failure or have let yourself or your family down	7. Trouble concentrating on things, such as reading the newspaper or watching television	8. Moving or speaking so slowly that other people could have noticed? Or the opposite - being so fidgety or restless that you have been moving around a lot more than usual	9. Thoughts that you would be better off dead or of hurting yourself in some way
Level 1 population	287	1(0,1)	1(0.5,1.5)	1(0,2)	1(0,2)	1(0,1)	1(0.5,1.5)	0(0,1)	0(0,1)	1(0.5,1.5)
Level 2 population	121	1(0.5,1.5)	1(0.5,1)	1(1,1.5)	1(0,1)	0.5(0,1)	1(0,2)	0.5(0,1)	0.5(0,2)	0.5(0,1)
Level 3 population	160	0(0,1)	0(0,1)	0(0,1)	1(0,1)	0(0,1)	0(0,0.5)	0(0,1)	0(0,0)	0(0,0)
Level 4 population	576	1(0,1)	1(0,1)	1(0,2)	1(0,1)	0(0,1)	0(0,1)	0(0,1)	0(0,0)	0(0,0)
Z value ^a	-	-2.401	-2.736	-2.708	-0.644	-0.291	-2.885	-2.053	-0.002	-0.342
P value ^a	-	0.014	0.006	0.007	0.519	0.771	0.004	0.040	0.999	0.732
Z value ^b	-	-0.685	-2.125	-2.219	-0.277	-2.003	-1.212	-0.148	-1.959	-2.116
P value ^b	-	0.493	0.035	0.025	0.782	0.048	0.226	0.882	0.050	0.034
a) Item analysis between Level 1 and Level 4 population; b) Item analysis between Level 2 and Level 4 population;										

From Table 6, there are 10 items in PSS-10. There was a statistically significant difference in “Feeling unable to control the important things in life”, “Feeling confident about your ability to handle personal problems”, “Feeling things were going on your way”, “Finding you couldn’t cope with all the things you have to do”, “Being able to control irritations in life”, “Feeling you were on the top of things”, “Being angered because of things that were outside of control”, “Feeling difficulties were piling up so high that couldn’t overcome” ($Z = -4.782 \sim -2.087$, $P = 0.001 \sim 0.037$ or $P \leq 0.001$).

Table 6
Item Analysis of Perceived Stress Scale-10 (PSS-10)

Status/Identity	Frequency	1. Feeling upset because of something happened unexpectedly	2. Feeling unable to control the important things in life	3. Feeling nervous and “stressed”	4. Feeling confident about your ability to handle personal problems	5. Feeling things were going on your way	6. Finding you couldn’t cope with all the things you have to do	7. Being able to control irritations in life	8. Feeling you were on the top of things	9. Being angered because of things that were outside of control	10. Feeling difficult were piling up so high that couldn’t overcome
Level 1 population	287	1(1,2)	1.5(0,2)	0.5(0,2.5)	2(1.5,3)	2(1,3)	1(1,2)	2(1,3)	2(2,3)	1.5(1,2)	1(0,2)
Level 2 population	121	1(1,1.5)	1(0,2)	1(0,1)	1(1,3)	1(1,2)	1(0,2)	2(1.5,2.5)	2(1,3)	1(0,2)	1(0.5,1.5)
Level 3 population	160	1(0,2)	1(0,2)	1(0,1.5)	3(1.5,3)	3(1.5,3)	1(0,2)	3(2,3)	3(2,3)	1(0.5,1.5)	1(0,1.5)
Level 4 population	576	1(1,2)	1(1,2)	1(0,2)	2(1,3)	1.5(1,2.5)	1(0,2)	2(1,3)	2(1,3)	1(1,2)	1(0,2)
Z value ^a	-	-0.646	-0.311	-0.344	-3.98	-4.614	-0.668	-3.682	-4.105	-0.249	-0.202
P value ^a	-	0.518	0.756	0.731	< 0.001	< 0.001	0.504	< 0.001	< 0.001	0.803	0.840
Z value ^b		-1.944	-3.069	-1.739	-3.289	-4.782	-2.867	-2.326	-2.102	-2.294	-2.087
P value ^b		0.052	0.002	0.082	0.001	< 0.001	0.004	0.020	0.036	0.022	0.037
Z value ^c		-0.365	-1.354	-0.617	-2.618	-2.543	-0.891	-2.697	-3.364	-1.685	-1.063
P value ^c		0.715	0.176	0.537	0.009	0.011	0.373	0.007	0.001	0.092	0.288
a) Item analysis between Level 1 and Level 3 population; b) Item analysis between Level 1 and Level 4 population; c) Item analysis between Level 3 and Level 4 population.											

4 Discussion

4.1 Mental Health Status among People with Different Identities during COVID-19 Outbreak

1144 participants from South China were enrolled in this cross-sectional, survey-based investigations. In the current study, it was revealed that relatively great prevalence of mental health symptoms among people at all levels. According to the result, prevalence of anxiety symptoms range from 47.5–57.2%, while 45.8%–57.1% participants were depressed. A relevant research was adopted by scholars in Guangzhou involved 1563 health care workers. Among the 1563 participants, 44.7% were anxious and 50.7% were depressed[17]. COVID-19 as an uncertain and severe public health crisis, would crush individuals physically and psychologically. Scholars has approved that effective mental interventions may reduce one’s anxiety and depression symptoms during disasters[28]. Consequently, interventions such as psychological counseling should be carried out to promote mental health condition during the epidemic.

4.1.1 Anxiety Symptoms among People with Different Identities

Anxiety symptom of Level 1, Level 2 and Level 4 population present a descending gradient array. As for Level 3 population, there is a big difference on anxiety symptom and depression symptom from other groups, some of which are approximately the same with that of Level 1 and Level 2 population, while some of which are quite similar to that of Level 4 population, suggesting that anxiety and depression symptom of Level 3 population is indistinguishable from other levels. Of note, this sort order is consistent with ripple effect[29]. In terms of ripple effect, the degree of anxiety will move from the center to the layer of risk event, people in the center report highest anxiety scores. For example, mainly consisting of confirmed patients and frontline health care workers, Level 1 population is exposed to the high risk environment, whose mental well-being can be ruined because of material shortages and infection. Thus, they reported saliently high rate of anxiety, inferring that living environment may account for the result of such effect. As for Level 2 population, the quarantined individuals or suspected patients would be likely to worry about their physical and mental health. They would unnecessarily apply over-interpretation to their harmless symptoms, which arouse numerous anxious emotion. Compared with Level 1 and Level 2 population, health conditions of Level 4 population were better, as this group contained the general public and the susceptible. Though a lower degree of anxiety appeared among Level 4 population, limited daily activities, endless home quarantine and protective equipment shortages still affect their lives.

4.1.2 Depression Symptoms among People with Different Identities

Coincidentally, ripple effect can also explain the result of depression symptom in this study. No significance was found on depression between Level 1 and Level 2 population, but both scores are higher than that of Level 4 population. Members in both groups have a connection with the reservoir of infection directly or indirectly, that is to say, they take greater risks similarly than any other individuals. Facing with the novel and even unknown virus, both groups perform upset, negative and dragged emotion, which reflects higher scores of depression. Having isolated at home for a long time, Level 4 population produces depression symptoms as expected.

4.1.3 Stress Symptoms among People with Different Identities

Stress symptoms show a decline trapezoidal arrangement among Level 3, Level 1 and Level 4 population, which can be clarified by psychological typhoon eye effect. During the risk event, people who are at the core may show a lower degree of stress, while those who are away from the core present higher stress symptoms. An important finding in the current research was that, compared with Level 3 population, Level 1 population is closer to the risk event in relative distance. Due to the closer relative distance, members in Level 1 population show lower stress symptoms, which approves the result of a previous study. Though Level 1 population reports lower risk of stress, being exposed to the critical circumstance makes it possible for them to develop stress emotion. What should be focused on was that, there is an intimate relationship among people in Level 3 population and Level 1 or Level 2 population, the close relatives or friends would worry about the health status of their acquaintances as well as be afraid of being infected on the other hand. Stress symptom of the individuals belonged to Level 4 population is the lowest, because they will not be infected directly as long as they adopt appropriate and adequate protections.

4.1.4 Specific Mental Health Issues among People with Different Identities

Anxiety problems that becoming easily annoyed or irritable (items 6 in Table 4) and Feeling afraid as if something awful might happen (items 7 in Table 4) are more obvious on Level 1 and Level 2 population than Level 4 population. People may become anxious and irritable emotionally, and they will have negative predictions of the future, who may be afraid of the coming future. Another key discovery of the recent study is people from Level 1 and Level 2 population are more likely to suffer from the depression problems which Feeling down, depressed, or hopeless (items 2 in Table 5) and Trouble falling or staying asleep, or sleeping too much (items 3 in Table 5), compared with the individuals of Level 4 population. Similarly, stress problems of Level 4 population are less mild than that of Level 1 and Level 3 population. The latter reports more difficulties in establishing self-esteem, controlling or predicting personal affairs and controlling anger emotion. Having negative prediction of the future is quite common among those people, they lost faith in coping with personal problems, and they do not believe they have the ability to control their life and emotion.

4.2 Mental Intervention Strategies during COVID-19 Outbreak

4.2.1 Intervention Strategies of Mental Health for Social Agencies during COVID-19

As the epidemic continues to threaten the mental health of the public, the whole society should work together providing forceful measures during the epidemic[30]. Firstly, authorities or departments concerned should conduct epidemiological investigations frequently, mastering the exact information and dynamic changes of mental health status of all levels[31]. Of note, discerning high-risk population and providing timely psychological crisis interventions to prevent extreme personal and social incidents (e.g. Suicide and compulsion) are of utmost significance[32]. In addition, professional as well as systematic mental health services should be strengthened and integrated under the guidance of national authorities. A better mental health system is still developing, and this is also a challenge for us to face with[33]. Therefore, only when a superior system has built up, people can benefit it from greater mental health services.

Secondly, health agencies should adopt related mental health surveys to understand the psychological needs among the general public, which can be vital to arrange targeted interventions. Moreover, related psychological associations and academic societies should take the responsibilities for immediate and qualified services, such as mental assistance hotline, expert teams supporting high risk zones, psychological consulting and any other accessible means of services. Though COVID-19 has been eased effectively in China, there are still individuals stricken with serious mental disorders[33]. Individuals suffering from severe mental trauma have a high hazard to develop PTSD[34], but an earlier study showed that psychological interventions are beneficial to reduce anxiety and depression during disasters, and is good for them to develop personal strategies for coping with crisis[28].

Thirdly, basic living supplies and correct information should be equipped for the public by the government. According to a guideline conducted to help patients adjust to the mental effects of quarantine and isolation, insufficient supplies and inadequate information are main stressors during quarantine[10, 12]. In the beginning of the COVID-19 outbreak, the supply of facial masks, medical protective coveralls and other protective materials as well as some basic supplies fell short of demand, which lead to panic in the population. Later on, as production capability has gradually resumed, the supply recovery enables people to decrease psychological issues. Some scholars suggested that the receiving health information with higher satisfaction may lead to a decreased mental impact of the outbreak and decreased levels of stress, anxiety, and depression[35]. Therefore, government and health authorities should guarantee basic materials and protective equipment to every community, correct and timely epidemic information and qualified health care knowledge especially mental health education should be popularized.

4.2.2 Specific Interventions of Mental Health targeted People with Different Identities

Individuals were divided into four different class of population based on how they were affected by COVID-19[11, 13]. As anxiety and depression symptoms of Level 1 population are the most obvious among all groups, it is suggested that mental intervention should be applied to Level 1 population primarily[13]. Health education as well as mental intervention should be spread out over all levels gradually. What is of utmost significance for Level 1 population was that, they should be encouraged to have positive mental adjustment, including understanding and accepting their negative emotions, releasing emotional catharsis properly, having close online contact with relatives and friends as well as gaining emotional support[36]. Meanwhile, one who keeps on positive self-conversation as well as appreciating self-value and efforts will be able to improve one's self-efficacy[37]. Psychological expert teams should be arranged for

Level 1 population, because frontline health care workers[38] and confirmed patients are experiencing dramatic high risk exposure, and they may not enable to seek for psychological aid proactively. Meanwhile, some hospitals have set up a relaxing room for the medical staff to isolate themselves temporarily and adopted some ways to keep in touch with their relatives so as to maintain social support[38].

With regard to Level 2 population, daily life, work and outing activities are limited due to the long-term quarantine, which leads to the serious consequence of mental stress to the innocent residents. Obviously, to adjust this psychological imbalance, those whom isolated should guarantee a regular healthy life style[39], ameliorate sleep[40] and seek for social support[41] (e.g. Intimate relationships or professional psychological assistances) if necessary. Related agencies should identify people in this category, offering some basic and necessary mental assistance can be helpful. The psychological assistance hotline will be very accessible for those quarantined as they cannot go anywhere.

Besides, there were some intervention strategies for Level 3 population. As reported previously, people in this category are mainly concerned about the health condition of their risky relatives and friends, who may be in a seriously stressed state. To avoid the unexpectedly worse situation happening, they should grasp some credible scientific information about COVID-19, learn to aware and accept all the emotional and physical responses. They may be able to decrease stress with the assistance of taking relaxation exercise[42] (e.g. Music therapy and abdominal respiration) and professional mental aids.

Level 4 population, the general public and the susceptible, should stabilize emotion, keep a healthy lifestyle, promote interpersonal relationships and avoid information overload. Absorbing overwhelming information could sometimes make one anxious and even promote anger, as some messages are not real, and negatively influence our cognition. Additionally, mental health education cannot be ignored, which should be carried out by qualified institutions regularly.

4.3 Limitation

The current research is a cross-sectional study to assess mental health status of people from four different levels, which provides some evidence for the longitudinal study of personal mental health after the epidemic. But there are several limitations in this study. Firstly, the sample size of this study is limited. Secondly, anxiety, depression and stress symptoms on all levels were included in the current study, but new evolutions of COVID-19, how people grasp relevant information as well as sleep and eating problems of affected people were not included in our research. Lastly, because of the COVID-19 outbreak, people were informed to stay home and avoid crowded places, confirmed patients, suspected individuals and health care workers were isolated. Therefore, online survey was conducted, and snowball sampling took the place of simple random sampling in our research, which may lead to an unrepresentative sample. It is suggested that improving sampling methods and evaluation of mental impacts should be included in the further research.

5. Conclusion

Our study investigated the mental health status of 1144 different status identities in South China during Outbreak of COVID-19. In this investigation, participants reported experiencing psychological burden. There are differences in the effects of COVID-19 on the mental health of people with different identities. Appropriate psychological interventions should be provided for different populations in combination with their mental health status.

Abbreviations

COVID-19

Coronavirus disease 2019; WHO:World Health Organization; NHC:National Health Commission of China; PHQ-9:the 9-item Patient Health Questionnaire; GAD-7:the 7-item Generalized Anxiety Disorder scale; PSS-10:the 10-item Perceived Stress Scale

Declarations

Ethics approval and consent to participate

Ethics approval and consent to participate was given by: Ethics Committee of Affiliated Brain Hospital of Guangzhou Medical University. Obtaining informed consent from participants was part of the screening process. Participants will attend an information session where they will be provided verbal and written information of the research project. If they agree to participate they will provide signed informed consent and be formally screened to assess in- and exclusion criteria.

Consent for publication

Not Applicable.

Availability of data and material

Data and materials will be available at the completion of this study.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

QL and HP designed the study and drafted the primary manuscript. SD, KW and WM supervised the recruitment and made statistical analyses. YN and HH and SZ took part in recruitment and data management. DW and HP made further revisions of the manuscript. All the authors had read and approved the final manuscript.

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