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Research paper

Depressive symptoms in the front-line non-medical workers during the COVID-19 outbreak in Wuhan

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ABSTRACT

Background: The outbreak of Coronavirus Disease 2019 (COVID-19) has been raising global anxiety and fear to the real or perceived health threat from the virus. This study aimed to investigate the psychological impacts and depression in the front-line non-medical workers in Wuhan, the first and the worst hit place by COVID-19.

Methods: A total of 191 front-line non-medical workers in Wuhan were recruited by online survey. The Positive and Negative Affect Schedule (PANAS), the Stress Reaction Questionnaire (SRQ) and the Patient Health Questionnaire-9 (PHQ) were used.

Results: The results showed that 50.3% (96) participants reported the clinically significant symptoms of depression. Among them, 33.0% (63) participants were with mild depression, 10.5% (20) participants with moderate depression, 5.8% (11) with moderately severe depression, and 1.0% (2) with severe depression. Participants with depression tend to be post-90 s (the generation born after 1990s), females, with increased levels of stress reactions, increased negative affects, but lower positive affects compared to these without depression. The stepwise logistic regression analysis revealed that post-90 s ($\beta = 0.908$, $P = 0.016$), the emotional reaction ($\beta = 0.122$, $P = 0.005$) and physical reaction ($\beta = 0.124$, $P = 0.020$) in SQR were significant independent responsible for the development of depression.

Conclusion: The findings of the present study suggest the targeted psychological intervention measures should be developed to improve the mental health of non-medical workers on the front-line of COVID-19 epidemic, especially the females and younger individuals.

1. Introduction

Since the end of December 2019, a novel pneumonia caused by Coronavirus Disease 2019 (COVID-2019) emerged in Wuhan, Hubei Province, and spread domestically and internationally rapidly (Li et al., 2020). This virus has been named severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and could be transmitted from person to person (Rothan and Byrareddy, 2020). The World Health Organization held an emergency meeting and declared the global COVID-19 outbreak a public health emergency of international concern on January 30, 2020. According to the data released from the official website of the National Health Commission of China, the number of confirmed cases in China has increased to 83,005 as of April 6, 2020, and confirmed cases have been reported in more than 1.1 million in abroad (http://www.nhc.gov.cn, 2020). This massive, infectious, public health event, imposed enormous pressure on the national government, medical and healthcare providers, infected patients and the general public (Contini et al., 2020; Wang et al., 2020a).

The epidemic brought not only the risk of death from the viral infection but also unbearable psychological pressure to people in China and the rest of the world (Cao et al., 2020). Since February, medical workers from other provinces have volunteered to sign up to go to

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Hubei to help treat the rising number of infected patients. As the epidemic continues to spread, overwhelming workload, depletion of personal protection equipment, unknown development of the outbreak, the mental health of the front-line medical and nursing workers has been greatly challenged during the fighting the epidemics (Huang et al., 2020; Lai et al., 2020). Hence, the Chinese government quickly sends psychological intervention teams established by professional mental health workers to Hubei, so as to provide psychological services and to relieve psychological problems of the front-line medical workers and infected patients.

In addition to the medical workers, there are many non-medical volunteers working on the front-line of the outbreak and directing exposure to high-risk individuals, such as security guards, nursing assistants, transport staff, cooks, etc., providing services for medical workers and patients. It is important to note that most of the volunteers involved in this outbreak were born after 1990 (post-90 s), who were just children when the last major public health event SARS occurred in 2003. Because of the lack of understanding of the epidemic and professional epidemic prevention skills, they are at greater risk of infection. Thus, it triggered a wide variety of psychological problems, such as panic disorder, anxiety and depression. However, their emotional and psychological states are not given enough attention, and evidence-based evaluations and mental health survey targeting front-line non-medical workers are relatively scarce.

In the present study, we aimed to provide information about the mental health outcomes in non-medical volunteers who worked in Wuhan for fighting the COVID-19, especially to understand the psychological status of post-90 s volunteers. And to explore the potential risk factors associated with the development of depressive symptoms. Therefore, to promote the formulation and implementation of relevant mental health intervention policies for the front-line non-medical workers.

2. Methods

2.1. Participants

Front-line non-medical workers in Wuhan were recruited to participants in this survey from February, 20, 2020 to March 20, 2020. We collected the data through Wenjuanxing (www.wjx.cn) with an anonymous, self-rated questionnaire. Only subjects who meet the following criteria and choose yes were taken to the questionnaire page: (1) age $>$ 20 years, (2) no dyslexia, (3) As a front-line non-medical volunteer in Wuhan, (4) in good health of the physical condition as no heart, liver, kidney and other physical diseases, not take any medicine for nearly 1 month, (5) never been diagnosed with a mental disorder, (6) worked on the front-line of COVID-19 outbreak for more than 15 days, (7) Willing to participate in this survey. The exclusion criterion was that the answer time for all questions was more than 30 min or less than 2 min. Electronic informed consent was obtained from each participant before the commencement of this survey and subjects could quit the process at any time. All procedures for this study were reviewed and approved by the Institutional Review Boards of the Shanghai Mental Health Center and the Affiliated Kangning Hospital of Wenzhou Medical University.

2.2. Questionnaire

The questionnaire consists of two parts: basic demographic data and mental health assessment. Basic demographic data including age, sex, education level, occupation. The age was divided into 2 groups: post-90 s and non-90 s. The occupation including: cadres of state organs, company staff, service personnel, biopharmaceutical related industries, workers, farmers, retired persons; individual practitioners, migrant workers in cities, science and education personnel, students and others.

For the mental health assessment, Firstly, three questions (overall risk, overall feeling, overall behavioral response) with ten-point answers were asked to evaluate the overall emotional state of all participants: How much risk do you feel about this novel coronavirus (from none to very big)? In general, how would you feel about the COVID-19 infection (from no tension to very panicked)? In general, what is your behavioral response to the COVID-19 infection (from helpless to totally normal)? Secondly, we used three scales to evaluate the mental health status of the participants. The Positive and Negative Affect Schedule (PANAS), the Stress Reaction Questionnaire (SRQ) and the Patient Health Questionnaire-9 were used to evaluate current positive and negative affect, perception of stress, depression, respectively.

The PANAS is a 20-item self-report measure of current positive and negative affect. Half of the items represent positive affects (i.e., interested, excited, and determined), whereas the other half are indicative of negative affects (i.e., hostile, scared, and ashamed). Items are scored on a 1 (very slightly or not at all) to 5 (extremely) scale, with higher scores representing higher affects. Scores range from 10 to 50, and positive and negative affects are summed independently of each other. The Chinese version of PANAS had been validated in residents from community, with Cronbach's alpha for positive and negative affect of 0.85 and 0.83, respectively (Jiang et al., 2019).

We adopted the 28-item Stress Reaction Questionnaire (SRQ) to measure the psychosomatic symptoms and degree of individual psychological stress response, which was developed by Professor Qianjing Jiang from the Department of Medical Psychology at Zhejiang University (Jiang et al., 2000). Respondents were asked to report their experienced stress level on a 5-point Likert scale from 1 (to a very large extent) to 5 (not at all). The SRQ consists of 3 subscales: emotional reaction (12 items: 3/5/6/9/10/14/18/21/24/25/27/28), physical reaction (8 items: 1/4/13/15/19/20/22/23), and behavior reaction (6 items: 7/8/11/12/17/26). The sum of scores for the 3 subscales plus items 2 and 16 was calculated to obtain a composite stress value for this study, with lower scores indicating greater perceived stress. The Cronbach alphas of the total scale and three subscales were 0.971, 0.955, 0.920, and 0.854, respectively (Wang and Wang, 2019).

The PHQ-9 is a 9-item, self-report questionnaire that evaluates the frequency and severity of symptoms of depression within the previous 2 weeks. Each of the 9 items is based on the Diagnostic and Statistical Manual of Mental Disorders (DSM-4) criteria for major depressive disorder and can be scored on a 0 (not at all) to 3 (nearly every day) scale. If a participant scores between 0 and 5, this indicates he or she does not experience symptoms of depression. Scores of 5 to 9, 10 to 14, 15 to 20, and $>$20 indicate mild, moderate, moderately severe, and severe depression, respectively. The PHQ has good validity and reliability in Chinese people and works well in evaluating depressive symptoms in general populations (Wang et al., 2014). In the present study, the participants were classified into two groups using PHQ cut-offs: $\leq$ 4 = not depressed (NDP) and $\geq$ 5 = depressed (DP).

2.3. Statistical analysis

The Statistical Package for the Social Sciences (SPSS) version 23.0 was used to perform the statistical analyses, with a 2-tailed probability value of $<$ 0.05 considered statistically significant. First, we report the prevalence and demographic data of the subjects. Second, the Student's *t*-test or the chi-squared tests were used to compare the differences between groups as appropriate. Thirdly, the correlation analysis was used to test the relationships between depressive symptoms and other demographic and clinical components. Finally, the stepwise logistic regression analysis was performed to explore the risk factors for depression in front-line non-medical workers.

3. Results

We obtained 202 completed questionnaires totally, and 11 questionnaires were excluded because the answer time for all questions was

Table 1
Demographic and clinical characteristics of the front-line non-medical workers with and without depression.

	DP group (N = 96)	NDP group (N = 95)	t/X^2	P
Age			8.136	0.004
Post-90s	66	46		
Non-90s	30	49		
Sex			5.876	0.015
Male	30	46		
Female	66	49		
Occupation			3.908	0.048
Student	47	60		
Non-student	49	35		
Education level			2.904	0.574
Junior high school or below	7	8		
Senior high school	12	17		
Journal college	13	16		
Undergraduate	49	45		
Master or above	15	9		
Overall risk	5.92 ± 2.57	5.96 ± 2.39	0.115	0.909
Overall feeling	5.55 ± 2.41	5.22 ± 2.24	0.984	0.327
Overall behavior response	6.75 ± 2.48	7.04 ± 2.49	0.811	0.418
PANAS				
Positive affect	27.04 ± 5.33	29.91 ± 6.18	3.429	0.001
Negative affect	25.61 ± 7.19	20.00 ± 5.91	5.898	<0.001
SQR				
Total score	105.68 ± 23.86	129.36 ± 11.42	8.762	<0.001
Emotional reaction	46.02 ± 11.40	56.62 ± 4.65	8.433	<0.001
Physical reaction	29.35 ± 7.68	36.86 ± 3.74	8.608	<0.001
Behavior reaction	21.97 ± 5.25	26.68 ± 3.67	7.196	<0.001
PHQ score	9.48 ± 4.04	1.33 ± 1.46	18.563	<0.001

Note: Data presented as Mean ± SD or N; DP, depressed front-line non-medical workers; NDP, not depressed front-line non-medical workers; PANAS, the Positive and Negative Affect Schedule; SQR, the Stress Reaction Questionnaire; PHQ, the Patient Health Questionnaire-9.

more than 30 min (N = 6) or less than 2 min (N = 5). Finally, a total of 191 front-line non-medical workers were included in the final analysis. There were 9 cadres of state organs, twelve company staff, seven service personnel, nineteen biopharmaceutical related industries, fifteen workers, thirteen farmers, three retired persons, eight individual practitioners, one migrant workers in cities, ten science and education related personnel, eighty-four students and 10 others. The results showed that 50.3% (96) participants reported the clinically significant symptoms of depression. Among them, 33.0% (63) participants were with mild depression, 10.5% (20) participants with moderate depression, 5.8% (11) with moderately severe depression, and 1.0% (2) with severe depression. Table 1 shows the demographic and clinical characteristics of the DP and NDP participants. Our results indicated that female participants had a higher risk of depression compared to male participants (x^2 = 5.876, P = 0.015). The risk of depression in post-90 s or students was higher than that in others (x^2 = 8.136, P = 0.004; x^2 = 3.908, P = 0.048, respectively). However, there was no significant difference in education level between DP and NDP participants. For clinical characteristics, DP participants had higher level of negative affects but lower levels of positive affects compared to NDP participants (t = 3.429, P = 0.001; t = 5.898, P < 0.001, respectively). In addition, our results showed DP participants had a higher perception of stress (emotional reaction, physical reaction, and behavior reaction) than NDP participants (All P < 0.001). Although significant differences in positive, negative affect and perception of stress exist in these two groups, there were no significant differences in the overall emotional state (overall risk, overall feeling, overall behavioral response) evaluated by three questions between them (All P > 0.05).

Of these post-90 s participants, 58.9% reported the clinically significant symptoms of depression. In order to further understand the psychological status of post-90 s front-line non-medical workers who volunteered in Wuhan during COVID-19 outbreak, we compared the clinical characteristics between post-90 s and non-90 s. Compared to non-90 s, post-90 s had higher PHQ scores but lower positive affects scores (t = 2.380, P = 0.018; t = 2.412, P = 0.017, respectively). In the COVID-19 outbreaks, post-90 s feel a greater degree of overall risk compared to non-90 s. There were no significant differences in perception of stress (total scores and subscale scores in SQR), negative affects, overall feeling and overall behavior response between post-90 s and non-90 s (All P > 0.05) (see in Table 2).

Table 2
Clinical characteristics between post-90 s and non-90 s participants.

	Post-90 s (N = 112)	Non-90 s (N = 79)	t/X^2	P
Overall risk	5.35 ± 2.32	6.77 ± 2.45	4.074	<0.001
Overall feeling	5.13 ± 2.27	5.76 ± 2.37	1.869	0.063
Overall behavior response	7.04 ± 2.42	6.68 ± 2.58	0.989	0.324
PANAS				
Positive affect	27.61 ± 5.66	29.68 ± 6.13	2.412	0.017
Negative affect	22.04 ± 7.47	23.38 ± 6.88	1.276	0.204
SQR				
Total score	116.22 ± 22.66	119.20 ± 21.40	0.915	0.361
Emotional reaction	50.39 ± 10.83	52.57 ± 9.12	1.458	0.146
Physical reaction	32.60 ± 7.07	33.78 ± 7.16	1.137	0.257
Behavior reaction	24.29 ± 5.03	24.35 ± 5.25	0.091	0.361
PHQ score	6.15 ± 4.88	4.39 ± 5.24	2.380	0.018

Note: Data presented as Mean ± SD or N; PANAS, the Positive and Negative Affect Schedule; SQR, the Stress Reaction Questionnaire; PHQ, the Patient Health Questionnaire-9.

The correlation analysis was then performed (see in Table 3), the results showed that depressive symptoms were negatively correlated with the perception of stress (total scores and subscale scores), positive effects, but positively correlated with negative affects and overall emotion states (All P < 0.01). After stepwise logistic regression analysis was conducted, variables including post-90 s (β = 0.908, P = 0.016), the overall emotional reaction (β = 0.122, P = 0.005) and physical reaction (β = 0.124, P = 0.020) in SQR were significant independent responsible for the development of depression in front-line non-medical workers volunteered in Wuhan during COVID-19 outbreak.

4. Discussion

This cross-sectional survey was the first study aimed to explore the psychological states among front-line non-medical workers who volunteered in Wuhan during COVID-19 outbreak. Our results demonstrated that non-medical workers working in the hardest-hit areas during major public health events have serious psychological problems. Overall, approximately 50.3% of front-line non-medical workers reported the clinically significant symptoms of depression, and mild,

Table 3
Correlation between clinical characteristics and depressive symptoms.

	PHQ scores	
Clinical characteristics	r	P
Overall risk	0.122	0.094
Overall feeling	0.188	0.009
Overall behavior response	−0.111	0.127
PANAS		
Positive affect	−0.265	<0.001
Negative affect	0.521	<0.001
SQR		
Total score	−0.670	<0.001
Emotional reaction	−0.667	<0.001
Physical reaction	−0.637	<0.001
Behavior reaction	−0.591	<0.001

Note: PANAS, the Positive and Negative Affect Schedule; SQR, the Stress Reaction Questionnaire; PHQ, the Patient Health Questionnaire-9.

moderate, moderately severe and severe depression accounted for 33.0%, 10.5%, 5.8% and 1.0%, respectively. A recent study conducted in China found that 50.4% health care workers during COVID-19 outbreak developed depression (Lai et al., 2020), while only 30.3% were considered to suffer from depression among general population with the impact of COVID-19 outbreak (Wang et al., 2020b). Taken together, the incidence of negative emotions among the front-line medical and nonmedical workers is significantly higher than that of the general population. In addition to depression, the COVID-19 also triggered other psychological problems, such as panic disorder, anxiety and stress reaction (Qiu et al., 2020). In the present study, our results also indicated that front-line non-medical workers with depression had a higher perception of stress, including emotional reaction, physical reaction and behavior reaction, compared to those without depression. Moreover, previous evidence supports that after the outbreak of the major public health events such as SARS in 2003, the front-line workers still left with serious psychological problems for quite a long time (Lee et al., 2007; Liu et al., 2012; McAlonan et al., 2007). Hence, the findings of the present study suggest that more attention needs to be paid to the front-line non-medical workers volunteered in Wuhan during COVID-19 outbreak, and targeted psychological counseling and intervention should be built to reduce psychological distress and prevent further mental health problems for the front-line non-medical workers. As we know, Chinese government have sent a batch of mental health professionals to the front-line of the COVID-19 epidemic to carry out psychological intervention and treatment for the infected and front-line medical workers after its outbreak, which also achieved remarked effects. However, the psychological problems in front-line non-medical workers received little attention, and none to mention targeted intervention measures. Since the affected population may face unique concerns and experiences, the psychosocial responses of the patients, survivors, general population, medical and nonmedical workers differed from one group to another across outbreaks (Chew et al., 2020). Medical and non-medical workers on the front-line who directly contacted with the infected or suspected patient are at higher risk of infection. However, the professional ability to defend against infection and to judge the direction of the outbreak is more lacked in front-line non-medical workers compared to medical workers. The targeted psychological intervention measures should be developed to improve the mental health of medical and non-medical workers on the front-line of COVID-19 epidemic, respectively.

In the present study, fifty-eight point six percent of the participants were born after 1990, our results revealed that the post-90 s front-line non-medical workers had a higher incidence of depression and presented with more severe depressive symptoms compared to the non-90 s front-line non-medical workers. Furthermore, the post-90 s were significant independent responsible for the development of depression in front-line non-medical workers volunteered in Wuhan during COVID-19 outbreak. After the outbreak of COVID-19, volunteered born after 1990 rushed to the front-line and became the main force to fight the epidemic. However, the post-90 s was just a kid when SARS broke out in 2003. In the absence of sufficient experience and relevant training when suffered from such a major public health event, those younger persons may have higher risk for infection and more serious psychological problems when working in the front-line of the COVID-19 outbreak. Hence, their mental health status warrant enough attention and investigation. During the SARS outbreak, early research also supported that younger subjects including infected patients and general population showed more significant depressive and anxiety symptoms (Sim et al., 2010; Su et al., 2007). Additionally, recent studies also support that younger people or student status was significantly associated with a greater psychological impact of the outbreak and higher levels depression (Huang and Zhao, 2020; Wang et al., 2020b). Taken together, these results suggest that young people suffered from greater psychological impact when a major public health event occurs. Hence, a better understanding of the psychological states in younger volunteers worked on the front-line of COVID-19 outbreak will provide important evidence to direct the promotion of mental well-being among non-medical young people. Moreover, the education department should attach importance to the mental health education of students and strengthen the ability to cope with stress events. The above efforts may help to reduce the psychological problems and their adverse effects caused by future outbreaks.

In line with previously extensive epidemiological studies support that female were at higher risk of depression (Kessler et al., 2003; Lim et al., 2018), the present study revealed that female non-medical workers on the front-line had a higher rate of clinically significant depression compared to males. Sex difference has been widely recognized for the occurring of depression, and a range of biopsychosocial factors may contribute to this gender difference in depression (Qi et al., 2020). Hence, special attention should be paid to mental health of female volunteers during epidemic outbreaks. In the present study, our results showed front-line non-medical workers with depression had higher stress reactions including emotional, physical and behavioral reaction. The stepwise logistic regression analysis further identified that emotional reaction and physical reaction caused by the COVID-19 outbreak were significantly responsible for the emergence of depression in the front-line non-medical workers. Thus, the front-line non-medical workers could benefit from stress management and crisis intervention.

Several limitations of this current study should be mentioned here. First, self-reporting of psychological impact, depression and perception of stress may have certain limitations, and the assessment by mental health professionals would be more reliable. Second, this is a cross-sectional design and lack of longitudinal follow-up to better understand causation. Third, since the size of the sample is relatively small, a larger sample size is needed to verify the results.

In summary, the findings of the present study suggest that non-medical workers on the front-line of COVID-19 outbreak also had high rates of symptoms of depression. The female gender, younger age, and increased stress reactions were associated with the increased risk for depression. The targeted psychological intervention measures should be developed to improve the mental health of non-medical workers on the front-line of COVID-19 outbreak, especially the females and younger individuals. Our investigation may provide valuable information for policymakers and mental health professionals worldwide regarding the psychological impact for future outbreak to the front-line non-medical workers.

Declaration of Competing Interest

No conflict of interest was disclosed.

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Author statement contributors

XF, WT and CZ conceptualized and designed the study. XF, JZ, CT, KZ, WT and CZ recruited the participants and completed the screening assessments. XF, WT and CZ analyzed the data and performed the statistical analysis. XF, WT and CZ wrote the first draft of the manuscript,

Professor KS and ZW guided the whole research and polished the article. All authors approved the final manuscript.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.jad.2020.06.078.

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