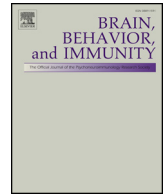




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Is returning to work during the COVID-19 pandemic stressful? A study on immediate mental health status and psychoneuroimmunity prevention measures of Chinese workforce

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ABSTRACT

This study aimed to quantify the immediate psychological effects and psychoneuroimmunity prevention measures of a workforce returning to work during the COVID-19 epidemic. Workforce returning to work was invited to complete an online questionnaire regarding their attitude toward the COVID-19 epidemic and return-to-work along with psychological parameters including the Impact of Event Scale-Revised, Depression, Anxiety, Stress Scale- 21 (DASS-21) and Insomnia Severity Index (ISI). Psychoneuroimmunity prevention measures include precautions at personal and organization levels. From 673 valid questionnaires, we found that 10.8% of respondents met the diagnosis of post-traumatic stress disorder (PTSD) after returning to work. The respondents reported a low prevalence of anxiety (3.8%), depression (3.7%), stress (1.5%) and insomnia (2.3%). There were no significant differences in the severity of psychiatric symptoms between workers/technicians and executives/managers. > 95% reported psychoneuroimmunity prevention measures including good ventilation in the workplace and wore a face mask as protective. Factors that were associated with the severity of psychiatric symptoms in the workforce were marital status, presence of physical symptom, poor physical health and viewing return to work as a health hazard ($p < 0.05$). In contrast, personal psychoneuroimmunity prevention measures including hand hygiene and wearing face masks as well as organizational measures including significant improvement of workplace hygiene and concerns from the company were associated with less severe psychiatric symptoms ($p < 0.05$). Contrary to expectations, returning to work had not caused a high level of psychiatric symptoms in the workforce. The low prevalence of psychiatric symptoms could be due to confidence instilled by psychoneuroimmunity prevention measures before the resumption of work. Our findings would provide information for other countries during the COVID-19 pandemic.

1. Introduction

An outbreak of the Coronavirus Disease 2019 (COVID-19) occurred in China in December 2019, resulting in 76936 cases and 2442 deaths.

Strict quarantine measures are important in stopping the transmission of COVID-19 in China even for people who have not contracted COVID-19 (Hao, 2020). Chongqing is a major city that suffered one of the most massive epidemics of COVID-19 in China. The government had imposed

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Table 1

The IES-R, DASS-21 and ISI scores of study respondents after they were approved to return to work.

	All respondents (n=673)	Workers and Technical staff (n= 551)	Management and executive staff (n = 122)	P-value
Impact of Event Scale-Revised (IES-R)				
Mean IES-R score (SD)	9.8 (11.0)	9.60 (10.99)	10.58(10.93)	p = 0.374
Presence of PTSD symptoms				
No PTSD like symptoms (17 or below)	547 (81.3%)	451 (81.9%)	96 (78.7%)	p = 0.477
Presence of PTSD like symptoms (18 - 23)	53 (7.9%)	44 (8.0%)	9 (7.4%)	
Diagnosis of PTSD (24 or above)	73 (10.8%)	56 (10.2%)	17 (13.9%)	
Depression, Anxiety, Stress and Stress Scale – 21 (DASS - 21)				
Mean DASS-21 Anxiety score (SD)	1.6 (3.7)	1.62 (3.89)	1.51 (2.91)	p = 0.760
DASS-21 (Anxiety)				
No (0-7)	632 (93.9%)	519 (94.2%)	113 (92.6%)	P = 0.378
Mild (8-9)	15 (2.2%)	11 (2.0%)	4 (3.3%)	
Moderate (10-14)	17 (2.5%)	12 (2.2%)	5 (4.1%)	
Severe (15-19)	4 (0.6%)	4 (0.7%)	0 (0.0%)	
Extremely Severe (20+)	5 (0.7%)	5 (0.9%)	0 (0.0%)	
Mean DASS-21 Depression score (SD)	2.1 (4.5)	2.59 (4.86)	2.57 (4.71)	p = 0.977
DASS-21 (Depression)				
No (0-9)	633 (94.1%)	522 (94.7%)	111 (91.0%)	p = 0.127
Mild (10-13)	15 (2.2%)	9 (1.6%)	6 (4.9%)	
Moderate (14-20)	19 (2.8%)	14 (2.5%)	5 (4.1%)	
Severe (21-27)	2 (0.3%)	2 (0.4%)	0 (0.0%)	
Extremely Severe (28+)	4 (0.6%)	4 (0.7%)	0 (0.0%)	
Mean DASS-21 Stress score (SD)	2.6 (4.8)	1.11 (0.51)	1.13 (0.44)	p = 0.440
DASS-21 (Stress)				
No (0-14)	651 (96.7%)	533 (96.7%)	118(96.7%)	P = 0.865
Mild (15-18)	12 (1.8%)	9 (1.6%)	3 (2.5%)	
Moderate (19-25)	6 (0.9%)	5 (0.9%)	1 (0.8%)	
Severe (26-33)	2 (0.3%)	2 (0.4%)	0 (0.0%)	
Extremely Severe (34+)	2 (0.3%)	2 (0.4%)	0 (0.0%)	
Insomnia Severity Index (ISI)				
Mean ISI score (SD)	3.3 (4.4)	3.74 (4.37)	4.07 (4.41)	p = 0.440
No clinically significant insomnia (0-7)	570 (84.7%)	473 (86.5%)	97 (80.2%)	p = 0.217
Subthreshold insomnia (8-14)	82 (12.2%)	61 (11.2%)	21 (17.4%)	
Moderately severe clinical insomnia (15-21)	13 (1.9%)	10 (1.8%)	3 (2.5%)	
Severe clinical insomnia (22-28)	3 (0.4%)	3 (0.5%)	0 (0.0%)	

quarantine and lockdown on the city of Chongqing in an unprecedented effort to contain the COVID-19 epidemic, and all members of the workforce were required to cease working from January 31, 2020 to February 9, 2020, except for those who were responsible for providing living necessities and emergency services. The COVID-19 has shattered the daily routine, business, schools, lifestyle and economy of the globe (Gautam and Sharma, 2020). Most of the current COVID-19 research focused on physical health, but research data on mental health during the COVID-19 pandemic are lacking (Ho et al., 2020; Qiu et al., 2020). A recent study surveyed 1210 Chinese respondents during the COVID-19 outbreak and found that > 50% of respondents reported moderate or severe psychological impact (Wang et al., 2020a). COVID-19 was recently found to be associated with neurological damages (Wu et al., 2020). Psychiatric symptoms (e.g. depression) and neurological changes can impair cognitive functioning (Husain et al., 2020; Subramaniapillai et al., 2019; Wu et al., 2020) and work performance (Lee et al., 2018b). During the COVID-19 pandemic, a major focus of psychoneuroimmunology (PNI) research is on understanding disease vulnerability, prevention and psychological resilience (Sominsky et al., 2020).

During the COVID-19 pandemic, there is an urgent need to study the biopsychosocial aspects to return to work as part of the psychoneuro-immunity preventive strategies proposed by Kim and Su (Kim and Su, 2020). Outside the hospital setting, workplace can be perfect breeding ground for the virus (Kim and Su, 2020). As there is no effective vaccine and treatment against COVID-19, the psychoneuroimmunity preventive measures at the workplace should include personal preventive measures (e.g. wearing a face mask, hand hygiene, other personal precaution) and organizational measures (e.g. good ventilation, social distancing at work, COVID-19 testing for workers if adequate resources).

Due to prolonged lockdown and business closure, people experience social isolation, disruption of lifestyle and loss of personal income while society loses its productivity in a crippling economy. Returning to work and minimizing the spread of COVID-19 will improve self-esteem, financial situation and rebuild social connection while enhancing productivity of the society, leading to better quality of life, less depression and stress, and better immunity (Evans and Repper, 2000; Lu et al., 2017; Modini et al., 2016). The psychoneuroimmunity preventive measures can be seen from a systemic perspective. The resumption of productivity is particularly important for industries that produce medical supplies. This will protect front-line health professionals so that they turn their energy to focus on treatment of patients infected with COVID-19 (Kim and Su, 2020), rendering our health systems to be more resilient. Companies and factories also need to implement psychological support systems to provide a safe and healthy working environment to minimize potential anxiety and stress when workers return to work (Kim and Su, 2020). There will be a new model of the economy based on psychoneuroimmunity preventive measures, whereby the focus will be on protecting the immunity and health of workers against COVID-19, and at the same time, not sacrificing productivity.

Since February 10, 2020, members of the workforce were allowed to seek approval from the government to return to work in China. In the face of uncertainty, members of the workforce might return to work with the fear of contracting COVID-19. Psychoneuroimmunity prevention measures include personal hygiene measures (e.g. hand hygiene, wearing masks) and organizational measures (e.g. social distancing, good ventilation) (Kim and Su, 2020). These measures may safeguard mental health by improving mood and quality of sleep. The COVID-19 pandemic and the public health response substantially changed working conditions for the workforce by implementing

Table 2
Other psychiatric symptoms reported by respondents during the COVID-19 epidemic.

Other psychiatric symptoms	All respondents (n = 673)	Workers and Technical staff (n = 551)	Management and executive staff (n = 122)	P - value
Worried about own physical health				
No worry	446 (66.3%)	371 (67.3%)	75 (61.5%)	0.307
Mild worry	146 (21.7%)	116 (21.1%)	30 (24.6%)	
Moderate worry	48 (7.1%)	37 (6.7%)	11 (9.0%)	
Severe worry	17 (2.5%)	12 (2.2%)	5 (4.1%)	
Very severe worry	16 (2.4%)	15 (2.7%)	1 (0.8%)	
Experience of discrimination during COVID-19 epidemic				
No discrimination	629 (93.5%)	511 (92.7%)	118 (96.7%)	0.435
Mild discrimination	24 (3.6%)	21 (3.8%)	3 (2.5%)	
Moderate discrimination	10 (1.5%)	10 (1.8%)	0 (0.0%)	
Serious discrimination	6 (0.9%)	5 (0.9%)	1 (0.8%)	
Very serious discrimination	4 (0.6%)	4 (0.7%)	0 (0.0%)	
Auditory hallucination				
No auditory hallucination	652 (96.9%)	534 (96.9%)	118 (86.7%)	0.834
Mild auditory hallucination	14 (2.1%)	11 (2.0%)	3 (2.5%)	
Moderate auditory hallucination	3 (0.4%)	2 (0.4%)	1 (0.8%)	
Severe auditory hallucination	2 (0.3%)	2 (0.4%)	0 (0.0%)	
Very severe auditory hallucination	2 (0.3%)	2 (0.4%)	0 (0.0%)	
Paranoid Idea				
No paranoid idea	658 (97.8%)	539 (97.8%)	119 (97.5%)	0.903
Mild paranoid idea	6 (0.9%)	5 (0.9%)	1 (0.8%)	
Moderate paranoid idea	4 (0.6%)	3 (0.5%)	1 (0.8%)	
Severe paranoid idea	3 (0.4%)	2 (0.4%)	1 (0.8%)	
Very severe paranoid idea	2 (0.3%)	2 (0.4%)	0 (0.0%)	
Anger and impulsivity				
No anger and impulsivity	598 (88.9%)	491 (89.1%)	107 (87.7%)	0.491
Mild anger and impulsivity	51 (7.6%)	42 (7.6%)	9 (7.4%)	
Moderate anger and impulsivity	18 (2.7%)	13 (2.4%)	5 (4.1%)	
Severe anger and impulsivity	2 (0.3%)	1 (0.2%)	1 (0.8%)	
Very severe anger and impulsivity	4 (0.6%)	4 (0.7%)	0 (0.0%)	
Alcohol use				
No alcohol use	642 (95.4%)	525 (95.3%)	117 (95.9%)	0.922
Mild alcohol use	26 (3.9%)	22 (4.0%)	4 (3.3%)	
Moderate alcohol use	4 (0.6%)	3 (0.5%)	1 (0.8%)	
Severe alcohol use	1 (0.1%)	1 (0.2%)	0 (0.0%)	
Very severe alcohol use	0 (0.0%)	0 (0.0%)	0 (0.0%)	
Suicidal ideation				
No suicidal ideation	662 (98.4%)	541 (98.2%)	121 (99.2%)	0.839
Mild suicidal ideation	8 (1.2%)	7 (1.3%)	1 (0.8%)	
Moderate suicidal ideation	2 (0.3%)	2 (0.4%)	0 (0.0%)	
Severe suicidal ideation	1 (0.1%)	1 (0.2%)	0 (0.0%)	
Very severe suicidal ideation	0 (0.0%)	0 (0.0%)	0 (0.0%)	
The intention of hurting others				
No intention of hurting others	664 (98.7%)	545 (98.9%)	119 (97.5%)	0.487
The mild intention of hurting others	5 (0.7%)	3 (0.5%)	2 (1.6%)	
The moderate intention of hurting others	2 (0.3%)	1 (0.2%)	1 (0.8%)	
The severe intention of hurting others	1 (0.1%)	1 (0.2%)	0 (0.0%)	
The very severe intention of hurting others	1 (0.1%)	1 (0.2%)	0 (0.0%)	
Worrying about young children				
No worries	451 (67.0%)	370 (67.2%)	81 (66.4%)	0.028*
Mild worries	123 (18.3%)	93 (16.9%)	30 (24.6%)	
Moderate worries	43 (6.4%)	38 (6.9%)	5 (4.1%)	
Severe worries	28 (4.2%)	22 (4.0%)	6 (4.9%)	
Very severe worries	28 (4.2%)	28 (5.1%)	0 (0.0%)	

*p < 0.05

psychoneuroimmunity prevention measures. To date, there has been no published literature on the prevalence of psychiatric symptoms in the workforce who returned to work during COVID pandemic although Europe and the U.S. planned to get European get back to work and reopen American economy respectively (Chrysoloras, 2020). Recent research mainly focused on mental health of health professionals (Shi et al., 2020; Kang et al., 2020; Mukhtar, 2020; Shao et al., 2020). Studying the psychological impact and psychiatric symptoms of the Chinese workforce may provide valuable information for other countries. We, therefore, conducted the first study to investigate the immediate psychological impact on the workforce who returned to work

after lockdown and quarantine in Chongqing, China. We hypothesized that there was no difference between managers and workers in the mean scores of psychiatric symptoms. The objective of this study was to identify demographic and psychoneuroimmunity preventive measures that determined the mental health of the members of the workforce who returned to work when the risk for contracting COVID-19 remains unknown.

Table 3
Views of respondents towards the strict quarantine and lockdown before returning to work.

	All respondents (n=673)	Workers and Technical staff (n= 551)	Management and executive staff (n = 122)	P-value
Do you think the strict quarantine and lockdown is useful to stop the spread of the virus?				
No	50 (7.4%)	47 (8.5%)	3 (2.5%)	0.08
A little bit	193 (28.7%)	163 (29.6%)	30 (24.6%)	
Moderate	73 (10.8%)	58 (10.5%)	15 (12.3%)	
Useful	189 (28.1%)	147 (26.7%)	42 (34.4%)	
Extremely useful	168 (25.0%)	136 (24.7%)	32 (26.2%)	
Do you think the 2-week duration of the closure of the workplace was useful to stop the spread of COVID-19?				
No	43 (6.4%)	40 (7.3%)	3 (2.5%)	0.033*
A little bit	123 (18.3%)	106 (19.2%)	17 (13.9%)	
Moderate	79 (11.7%)	68 (12.3%)	11 (9.0%)	
Useful	221 (32.8%)	169 (30.7%)	52 (42.6%)	
Extremely useful	207 (30.8%)	168 (30.5%)	39 (32.0%)	
Do you think returning to work is a threat to your life during the COVID-19 epidemic?				
None	313 (46.5%)	265 (48.1%)	48 (39.3%)	0.157
A little bit	260 (38.6%)	207 (37.6%)	53 (43.4%)	
Moderate	70 (10.4%)	52 (9.4%)	18 (14.8%)	
Serious	22 (3.3%)	20 (3.6%)	2 (1.6%)	
Extremely serious	8 (1.2%)	7 (1.3%)	1 (0.8%)	
Do you think the workplace hygiene has improved after the COVID-10 outbreak?				
Workplace hygiene was enough before the COVID-19 outbreak	166 (24.7%)	131 (23.8%)	35 (28.7%)	0.072
Substantial improvement since the outbreak	182 (27.0%)	141 (25.6%)	41 (33.6%)	
Moderate improvement since the outbreak	176 (26.2%)	150 (27.2%)	26 (21.3%)	
Small improvement since the outbreak	120 (17.8%)	103 (18.7%)	17 (13.9%)	
Need further improvement	17 (2.5%)	17 (1.3%)	0 (0.0%)	
Do you think your company cares and concerns about your health?				
No care and concern at all	18 (2.7%)	15 (2.7%)	3 (2.5%)	0.107
Little care and concern	6 (0.9%)	3 (0.5%)	3 (2.5%)	
Neutral or no comment	99 (14.7%)	87 (15.8%)	12 (9.8%)	
Moderate level of care and concern	228 (33.9%)	189 (34.3%)	39 (32.0%)	
High level of care and Concern	322 (47.8%)	257 (46.6%)	65 (53.3%)	

*p < 0.05

2. Methods

2.1. Participants

During the peak period of the COVID-19 epidemic and with approval from the government to resume work, 1323 members of the workforce were invited to participate in the study [from 24 Feb to 25 Feb 2020]. An online questionnaire was administered via an online platform to potential participants through companies. As part of the infection control, this study was conducted via electronic means because the government prohibited face-to-face contact. A short recruitment period allowed us to measure the psychological impact when members of the workforce began to return to work during the peak of the COVID-19 epidemic when strict infection control was in place. This project was approved by the Institutional Review Board of the China-Singapore (Chongqing) Demonstration Initiative on Strategic Connectivity Think Tank (CCITT) (IRB No. 2020-02-001).

2.2. Inclusion and exclusion criteria

Members of the workforce were aged 18 years or above and lived in Chongqing. They were full-time employees who received approval from the government to return to work during the peak of the COVID-19 epidemic. Exclusion criteria included healthcare workers, lack of access to the Internet, inability to complete an online survey, the presence of severe psychiatric illnesses (e.g. schizophrenia, bipolar disorder, dementia), life-threatening medical conditions including severe stroke or life-threatening cancer and suspected or confirmed cases of COVID-19 that prevented an employee from full-time employment.

2.3. Measures

The structured questionnaire consisted of questions that covered several areas: (1) demographic and occupational data; (2) physical symptoms and self-rating physical health status in the past 14 days; (3) Impact of Event Scale-Revised (IES-R), (4) Depression, Anxiety and Stress Scale (DASS-21), (5) The insomnia Severity Index (ISI), (6) Other psychiatric symptoms and (7) psychoneuroimmunity preventive measures at personal and organizational levels. The psychometric properties of the questionnaires used in this study were established during the COVID-19 pandemic (Wang et al., 2020a; Hao, 2020). Socio-demographic data were collected on age, gender, education level, marital status, household size and number of children. Occupational data included the type of occupation, weekly working hours and duration of returning to the workplace after strict quarantine measures. Respondents were asked to report the presence of physical symptoms resembling COVID-19 and rate their physical health status and presence of any chronic disease.

The psychological impact of the COVID-19 epidemic was measured using the Impact of Event Scale-Revised (IES-R) based on previous studies (Wang et al., 2020a; Tan et al., 2020; Wang et al., 2020a) The IES-R is a self-administered questionnaire that has been well-validated in Chinese for determining the extent of psychological impact after exposure to the public health crisis within one week of exposure (Zhang et al., 2014a; Zhang et al., 2014b) The total IES-R score was divided into 0–17 (normal), 18 – 23 (PTSD like symptoms) and > 24 (diagnosis of PTSD) (Lee et al., 2018a).

Mental health status was measured using the Depression, Anxiety, and Stress Scale (DASS-21) and calculation of scores were based on the previous studies (Le et al., 2019). DASS has been demonstrated to be a valid measure in assessing mental health in the Chinese population (Ho et al., 2019; Quek et al., 2018) and during COVID-19 pandemic (Wang

Table 4
Views of respondents towards psychoneuroimmunity preventive measures when returning to work during COVID-19 epidemic.

	Participants (n = 673)	Workers and Technical staff (n = 551)	Management and executive staff (n = 122)	P-value
Avoidance of sharing utensils (e.g., chopsticks) during meals				
Always	569 (84.5%)	473 (85.8%)	96 (78.7%)	0.040*
Most of the time	51 (7.6%)	41 (7.4%)	10 (8.2%)	
Sometime	15 (2.2%)	13 (2.4%)	2 (1.6%)	
Rarely	15 (2.2%)	9 (1.6%)	6 (4.9%)	
Never	23 (3.4%)	15 (2.7%)	8 (6.6%)	
Proper handwashing with soap and water				
Always	535 (79.5%)	438 (79.5%)	97 (79.5%)	0.048*
Most of the time	100 (14.9%)	80 (14.5%)	20 (16.4%)	
Sometime	27 (4.0%)	25 (4.5%)	2 (1.6%)	
Rarely	6 (0.9%)	6 (1.1%)	0 (0.0%)	
Never	5 (0.7%)	2 (0.4%)	3 (2.5%)	
Washing hands immediately after coughing, rubbing the nose, or sneezing				
Always	486 (72.2%)	396 (71.9%)	90 (73.8%)	0.43
Most of the time	106 (15.8%)	90 (16.3%)	16 (13.1%)	
Sometime	50 (7.4%)	39 (7.1%)	11 (9.0%)	
Rarely	22 (3.3%)	20 (3.6%)	2 (1.6%)	
Never	9 (1.3%)	6 (1.1%)	3 (2.5%)	
Washing hands after touching a contaminated object				
Always	548 (81.4%)	449 (81.5%)	99 (81.1%)	0.037*
Most of the time	89 (13.2%)	72 (13.1%)	17 (13.9%)	
Sometime	19 (2.8%)	17 (3.1%)	2 (1.6%)	
Rarely	10 (1.5%)	10 (1.8%)	0 (0.0%)	
Never	7 (1.0%)	3 (0.5%)	4 (3.3%)	
Covering mouth when coughing and sneezing				
Always	525 (78.0%)	426 (77.3%)	99 (81.1%)	0.073
Most of the time	82 (12.2%)	70 (12.7%)	12 (9.8%)	
Sometime	40 (5.9%)	35 (6.4%)	5 (4.1%)	
Rarely	15 (2.2%)	14 (2.5%)	1 (0.8%)	
Never	11 (1.6%)	6 (1.1%)	5 (4.1%)	
Wearing a face mask regardless of the presence or absence of symptoms				
Always	590 (87.7%)	480 (87.1%)	110 (90.2%)	0.305
Most of the time	54 (8.0%)	47 (8.5%)	7 (5.7%)	
Sometime	11 (1.6%)	11 (2.0%)	0 (0.0%)	
Rarely	12 (1.8%)	9 (1.6%)	3 (2.5%)	
Never	6 (0.9%)	4 (0.7%)	2 (1.6%)	
Having good ventilation in the workplace				
Always	596 (88.6%)	489 (88.7%)	107 (87.7%)	0.737
Most of the time	62 (9.2%)	51 (9.3%)	11 (9.0%)	
Sometime	9 (1.3%)	6 (1.1%)	3 (2.5%)	
Rarely	2 (0.3%)	2 (0.4%)	0 (0.0%)	
Never	4 (0.6%)	3 (0.5%)	1 (0.8%)	

*p < 0.05.

et al., 2020a; Tan et al., 2020; Wang et al., 2020b). The sleep quality of respondents was measured using the Insomnia Severity Index (ISI) (Bastien et al., 2001). The total ISI score was divided into no clinically significant insomnia (0–7), subthreshold insomnia (8–14), moderately severe clinical insomnia (15–21) and severe clinical insomnia (22–28).

2.4. Statistical analysis

Descriptive statistics were used to summarize the variables, mean and standard deviation were used for continuous variables, while frequency and percentage were used for categorical variables. Inferential statistics, including independent sample *t*-test and Pearson's Chi-square test, were used to examine if there was any difference in the outcome variables between the groups of workers and technicians as well as management and executives. Multiple linear regression with a backward selection method was used to examine the association between

the outcome variables (Mean IES-R, DASS-21 and ISI scores) and demographic, and psychoneuroimmunity prevention measure variables. All the analyses were conducted using IBM SPSS Statistics 22, and the level of significance was set at 5%.

3. Results

3.1. Response rate and Sociodemographic, occupational and physical health characteristics

A total of 673 valid questionnaires were analysed from a total of 1323 eligible participants, giving a response rate of 50.87%. The mean age was 30.8 (SD 7.4) years, and the majority were male (74.4% n = 501) (see [Supplementary Table 1](#)). A total of 54.4% were married, 42.2% single, and 3.4% divorced, separated or widowed. The majority of respondents stayed in a household of 3–5 family members (62%), and 44.7% of respondents had children aged below 16 years. For occupational characteristics, 81.8% of respondents were workers, and technical staff and 18.1% were executives, sales and marketing, management and others. The mean working hours was 61.3 (SD 16.2) hours per week. Of the number of days for returning to the workplace after the large scale of quarantine and lockdown, 42.3% had returned to the workplace for 15 days or more, 27.2% were still working at home and had not yet returned to workplace despite the approval, and 9.2% had returned to the workplace for 8 to 14 days. For physical health status, the majority of respondents reported no physical symptoms in the past two weeks (89.5%); reported good physical health (70.3%) and without any chronic medical condition (90.2%).

3.2. Immediate mental health status of the workforce who returned to work during the COVID-19 epidemic

The mean – IES-R scores of workers and technical staff were 9.60 (SD: 10.99) and of management and executives was 10.58 (SD: 10.93) (see [Table 1](#)). Fifty-three (7.9%) respondents received a score of 18 to 23 in keeping with clinically significant PTSD-like symptoms (See [Table 2](#)). Seventy-three (10.8%) respondents received a score of 24 or higher, which accords with the diagnostic criteria for PTSD. About 3.8%, 3.7%, 1.5% and 2.3% of respondents reported moderate to severe anxiety, depression, stress and clinical insomnia respectively. There were no significant differences between workers/technical staff and managers/executives in the mean score and severity of PTSD symptoms, depression, anxiety, stress and insomnia ($p > 0.05$).

3.3. Other psychiatric symptoms of the workforce during the COVID-19 epidemic

[Table 2](#) shows that the prevalence of other psychiatric symptoms as follows: moderate to severe worries about their physical health (12.0%), moderate to severe anger and impulsivity (3.6%), moderate to severe discrimination during the COVID-19 epidemic (3.0%), moderate to severe paranoid ideations (1.3%) and moderate to severe auditory hallucinations (1.0%). The prevalence of moderate to severe alcohol usage, suicidal ideation and intent to hurt others were < 1%. There were no significant differences between between workers/technical staff and managers/executives in worries about own physical health, the experience of discrimination, auditory hallucination, paranoid idea, anger and irritability, alcohol use, suicidal ideation and intention of hurting others ($p > 0.05$). About 16.0% of workers and technical staff and 9.0% of management and executive reported moderate to severe worries about the health of young children. There was a significant difference between the two groups ($p = 0.028$).

Table 5 (continued)

Variables	Mean IES-R score β (95% CI)	Mean DASS – 21 anxiety score β (95% CI)	Mean DASS – 21 depression score β (95% CI)	Mean DASS – 21 stress score β (95% CI)	Mean ISI score β (95% CI)
Sometime Never/Rarely		Non-Significant Reference group	–2.35 (–4.26, –0.44), $p = 0.016^*$		Non-Significant Reference group
Do you think the 2-week duration of the closure of the workplace was useful to stop the spread of COVID-19 before returning to work?		Reference			Reference
Not useful		1.36 (–0.13, 2.86), $p = 0.074$			1.53 (–0.08, 3.14), $p = 0.063$
Little usefulness		2.48 (0.86, 4.10), $p = 0.003^*$			3.29 (1.58, 5.01), $p < 0.001^{**}$
Moderate usefulness		0.86 (–0.58, 2.29), $p = 0.241$			1.08 (–0.46, 2.62), $p = 0.168$
Very useful		1.19 (–0.23, 2.62), $p = 0.101$			1.61 (0.08, 3.14), $p = 0.039^*$
Extremely useful					

* $p < 0.05$, $p < 0.001^{**}$.

[†]Recent physical symptoms in the past 14 days include fever, chills, headache, myalgia, cough, difficulty in breathing, dizziness, coryza, sore throat, nausea, vomiting or diarrhea.

^{*}All the regressions included demographics, occupational health and personal protection measure variables as independent variables and backward selection method was then applied to remove all insignificant variables.

3.4. Views of respondents towards the strict quarantine and lockdown before returning to work

About 75.3% of respondents reported that the 2-week duration of workplace closure was moderate to extremely useful to stop the spread of the virus (See Table 3). About 63.9% of respondents reported that strict quarantine and lockdown were moderate to extremely useful to stop the spread of the virus. Only 20.3% of respondents reported that there was a small improvement of workplace hygiene after the COVID-19 outbreak or needed further improvement. To a lesser extent, 14.9% of respondents reported that returning to work is a moderate to an extremely serious threat to their life during the COVID-19 epidemic. About 81.7% of respondents reported a moderate to a high level of care and concern of the company about their health. There were no significant differences between workers/technical staff and managers/executives on the views regarding the usefulness of strict quarantine and lockdown, returning to work as a health threat, improvement of workplace hygiene and concerns from the company ($p > 0.05$). However, there was a significant difference in the views of perceived usefulness of the 2-week closure of workplace ($p = 0.033$).

3.5. Views of respondents towards psychoneuroimmunity prevention measures when returning to work during COVID-19 epidemic

About 94.7% of respondents reported that they either most of the time or always washed their hands after touching a contaminated surface (see Table 4). Significantly higher proportion of management and executive reported that they always washed their hands after touching a contaminated surface than workers and technical staff ($p = 0.037$). About 94.4% of respondents reported that they always had proper handwashing with soap and water. Significantly higher proportion of management and executive reported that they always had proper handwashing with soap and water than workers and technical staff. ($p = 0.048$). About 92.1% of respondents reported that they always avoided sharing utensils (e.g., chopsticks) during meals. Significantly higher proportion of workers and technical staff reported that they always avoided sharing utensils during meals than management and executive ($p = 0.040$). The frequencies of other psychoneuroimmunity preventive measures are as follows: either most of the time or always wore a face mask regardless of the presence or absence of symptoms (95.7%), good ventilation in the workplace (97.8%), covered their mouths when coughing and sneezing (90.2%) and washed their hands immediately after coughing, rubbing nose or sneezing (88.0%). There were no significant differences between the two groups in their views on washing hands or covering mouths after coughing, wear a face mask and maintaining good ventilation ($p > 0.05$).

3.6. Demographics, occupational health and psychoneuroimmunity prevention measures associated with the immediate mental health status of the workforce during the COVID-19 epidemic

For demographics, respondents who were divorced, separated or widowed had significantly higher IES-R ($p = 0.009$), DASS-21 anxiety ($p = 0.042$), DASS-21 depression ($p = 0.028$) and ISI scores ($p = 0.004$) as compared to respondents who were single (see Table 5).

For health status, respondents who presented with at least one physical symptom had significantly higher DASS-21 anxiety ($p = 0.002$), depression ($p = 0.016$), stress ($p = 0.011$) and ISI scores ($p = 0.014$) as compared to respondents without physical symptoms. Respondents who rated poorer physical health had significantly higher IES ($p < 0.001$), DASS-21 stress ($p = 0.023$) and ISI scores ($p = 0.002$) as compared to respondents who rated good physical health.

Respondents who had not returned to work ($p = 0.015$) and returned to work within 7 days ($p = 0.026$) had significantly higher IES-R score as compared to respondents who had returned to work for > 15

days. For factors associated with organizational psychoneuroimmunity prevention measures, respondents who observed small improvement in workplace hygiene after the COVID-19 outbreak ($p < 0.001$) were significantly associated with higher IES-R score as compared to respondents who believed workplace hygiene was good enough before the outbreak. Notwithstanding, respondents who believed that workplace hygiene required further improvement after the COVID-19 outbreak had significantly higher IES-R value ($p = 0.001$) as compared to respondents who believed workplace hygiene was good enough before the outbreak. Regarding the view to return to work as a health hazard, respondents who viewed returning to work as serious health hazard had significantly higher mean IES-R, DASS-21 anxiety, depression, stress and ISI scores as compared to respondents who did not view returning to work as a health hazard ($p < 0.05$). Regarding the views towards whether the company cares about respondents' health, respondents who viewed the company showing moderate concern ($p = 0.019$) had significantly higher mean ISI score as compared to respondents who viewed company showing a lot of concern.

For personal psychoneuroimmunity prevention measures, respondents who always covered their mouths while coughing ($p = 0.041$) had significantly lower IES-R score when compared to respondents who rarely covered their mouth while coughing. Respondents who always washed hands after coughing were significantly associated with lower DASS-21 anxiety and depression scores as compared to respondents who rarely washed hands after coughing ($p < 0.05$). Respondents who always ($p = 0.013$) washed hands after coughing had significantly lower mean ISI score as compared to respondents who rarely washed hands after coughing.

For the usefulness of 2-week closure of the workplace to prevent the spread of COVID-19, respondents who reported moderate usefulness ($p = 0.003$) had significantly higher DASS-21 depression score as compared to respondents who reported closure as not useful. Respondents who reported moderate usefulness ($p < 0.001$) and extremely usefulness ($p = 0.039$) were significantly associated with DASS-21 stress score as compared to respondents who reported closure as not useful.

4. Discussion

As the study was conducted at a time when China was facing the COVID-19 pandemic and imposed lockdown and quarantine measures, the full impact of COVID-19 on the mental health of the workplace at its peak could be captured. Based on our best knowledge, this is the first study that found 10.8% of workforce met the diagnostic criteria for PTSD just returning to work during the COVID-19 epidemic. The prevalence is about half of the prevalence of PTSD among healthcare workers (approximately 20%) during the Severe Acute Respiratory Syndrome (SARS) outbreak in 2003 (Chan and Huak, 2004).

Our study suggests that the experience of returning to work during the COVID-19 pandemic did not confer an increase in the prevalence of PTSD symptoms, depression, anxiety and stress when compared to results of a similar study which was conducted on 1210 respondents across China during the COVID-19 outbreak (Wang et al., 2020a). At the beginning of the outbreak, the mean IES-R score of the general population was 32.98, which was at least three times higher than the mean IES-R score (9.8) reported by the workforce in this study. Similarly, 16.5% of the general population reported moderate to severe depressive symptoms; 28.8% reported moderate to severe anxiety symptoms, and 8.1% reported moderate to severe stress levels at the beginning of the COVID-19 outbreak. In our study, the workforce showed a much lower prevalence of above symptoms. A recent study in China also found that the vicarious traumatization scores of the general public were significantly higher than those of the front-line nurses (Li et al., 2020).

Our study found several factors that could decrease the likelihood that the workforce would experience psychiatric symptoms. These

factors included personal psychoneuroimmunity prevention measures such as the frequent practice of hand hygiene and wearing face masks as well as organizational measures including significant improvement of workplace hygiene and concerns from the company on the health status of employees. From public health viewpoints, a recent study found that the extent that people proactively engaged in hand hygiene could predict the speed of COVID-19 outbreak (Lin et al., 2020). From psychoneuroimmunology (PNI) viewpoints, previous studies found that the immune system could be improved by reducing negative psychological state such as depression (Liu et al., 2012; Ng et al., 2018; Lu et al., 2017), which could reduce the risk of contracting COVID-19. In addition to above factors, the China government imposed the following psychoneuroimmunity prevention measures to prevent the in-house spread of COVID-19 at the workplace: avoidance of large gatherings and maintain interpersonal distance, tracking the health status of employees, disinfection of workplace, shutdown central air-conditioning and dissemination of facts about COVID-19 prevention (Xinhua, 2020). These psychoneuroimmunity prevention measures might play a role in causing a low prevalence of psychiatric symptoms observed in our respondents. Furthermore, we found that 93.5% of respondents did not experience any discrimination during the COVID-19 epidemic. It could be due to the recommendation from China government to request employers to prevent and curb discrimination against confirmed or suspected cases of COVID-19 within the business (Xinhua, 2020).

The whole workforce could benefit from other psychoneuroimmunity prevention measures including scheduled rest periods, regular exercise, nutritional meals, flexible staffing resources, and COVID-19 pandemic rehearsal (McAlonan et al., 2007; Kim and Su, 2020). Strengthening peer support in the workplace would benefit the majority of the workforce. Online staff forums or counselling hotlines would provide an opportunity for cathartic ventilation and sharing information while minimizing face-to-face contact during the COVID-19 pandemic. Early identification of risk factors by employers, stress management and professional psychological consulting services might reduce the severity of psychiatric symptoms of a small proportion of employees who were at risk. Early intervention could prevent the establishment of maladaptive cognitive or behavioural patterns among employees in response to the COVID-19 pandemic.

The study has several strengths and limitations. As the online questionnaires were administered when respondents just returned to work during the peak of the COVID-19 epidemic, the respondents did not have recall bias about their mental state. The questionnaires were administered online, and the recruitment of participants was not limited to respondents who were present at the workplace on the day of recruitment. As 27.2% of respondents were still working at home and had not returned to the workplace despite the approval, we did not just recruit respondents who agreed to return to work but those who were less psychologically prepared to return to work. Limitations include the use of self-report data and the generalizability of results. The present study adopted a cross-sectional survey design with self-administered online questionnaires to avoid contact between interviewers and respondents. Self-report data have limitations. However, as PTSD symptoms, stress, depression and anxiety are based on personal feelings, self-reporting was paramount in this study.

5. Conclusion

Our findings shed light on the need for governments and company administrators to be aware of the extent and factors associated with PTSD symptoms, stress, anxiety, depression and insomnia among members of the workforce when they just returned to work after quarantine and lockdown during COVID-19 pandemic. The experience from China shows that personal psychoneuroimmunity prevention measures including the frequent practice of hand hygiene and wearing face masks as well as organizational measures including improvement of workplace hygiene and concerns from the company on physical

health status were associated with less psychiatric symptoms in employees.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.bbi.2020.04.055>.

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