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Identifying post-COVID vulnerable groups: A cross-sectional survey among different professions in China during the final stage of lockdown

Junfeng Du, Gwendolyn Mayer, Svenja Hummel, Neele Oetjen, Nadine Gronewold, Ali Zafar, Jobst-Hendrik Schultz

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Abstract

Background: COVID-19 has resulted in considerable mental health burden in the Chinese general population and health care workers at the beginning and peak of the pandemic. However, little is known about potentially vulnerable groups during the final stage of the lockdown.

Objective: The aim of this survey study was to assess the mental health burden of different professions in China in order to find vulnerable groups, possible influencing factors, and the successful ways of coping during the last four weeks of the lockdown in Hubei province.

Methods: A cross-sectional online survey asked participants about current residence, daily working hours, exposure to COVID-19 at work and media preferences. We used Depression-Anxiety-Stress Scales (DASS-21) for the assessment of mental health. Further assessments included perceived stress (CPSS-14), coping strategies for all participants and specific stressors for health care workers. We follow the reporting guidelines of the STROBE statements for observational studies.

Results: The sample (N=687) consisted of 158 doctors, 221 nurses, 24 other medical staff, 43 students, 60 teachers/government staff, 135 economy staff, 26 workers/farmers and 20 others. We found 17.9% cases of increased depression, 30.3% anxiety and 13.7% stress. Other medical staff and students were vulnerable to depression while doctors, nurses and students were vulnerable to anxiety. Other medical staff, students and economy staff were vulnerable to stress. Coping strategies were reduced to three factors: active, mental and emotional. Being female and emotional coping were independently associated with depression, anxiety or stress. Applying active coping strategies showed lower odds for anxiety while mental coping strategies showed lower odds for depression, anxiety and stress. Age, being inside a lockdown area, exposure to COVID-19 at work and having a high workload (8-12h per day) was not associated with any symptoms. WeChat was the preferred way of staying informed in all groups.

Conclusions: By the end of the lockdown a considerable part of the Chinese population showed increased levels of depression and anxiety. Students and other medical staff were the most affected, while economy staff were highly stressed. Doctors and nurses need support regarding potential anxiety disorders. Future work should focus on longitudinal results of the pandemic and develop targeted preventive measures. Clinical Trial: not applicable

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Introduction

Background

In December 2019 the first pneumonia cases of unknown aetiology in Wuhan, province Hubei, were reported by the Chinese authorities. By January 3rd, 44 cases requiring hospitalization were officially confirmed [1]. The disease was titled Coronavirus disease 2019 by the WHO in February, in short "COVID-19" [2]. As the infection spread rapidly all over the country [3], the public health response of the government included the largest quarantine in country's history. Starting from January 23rd, the lockdown in the Chinese province of Hubei, the epicentre of COVID-19, lasted 76 days and ended on April 8th, 2020 [4]. Another region that was put under lockdown was Zhejiang [5].

The pandemic put a considerable psychological burden on citizens, which was not merely the fear of getting infected but also isolation, helplessness, and grief over the loss of relatives without having the opportunity to take leave or to organize a funeral. Even more aggravating was that trusted persons could be infected and thus they became part of an invisible danger [6].

Previous epidemics like the Severe Acute Respiratory Syndrome (SARS) in Hong Kong 2003 or the Middle East Respiratory Syndrome (MERS) in Saudi Arabia 2012, have taught us to care for the mental health of the general population as well as of frontline healthcare workers [7-10]. In Hong Kong, suicide rates among older adults increased significantly in 2003 and 2004 [11]. It is noteworthy to recall that high-risk health workers suffered from long-lasting depression and posttraumatic stress responses even one year after the SARS outbreak [12].

Mental health and coping strategies

Several studies have investigated the mental health consequences of the ongoing pandemic in the Chinese population and their strategies to successfully cope with the demanding situation. Wang et al. found increased anxiety in nearly 30% of 1210 participants, especially caused by worrying about family members [13]. The same authors also reported longitudinal results, repeating the measures after four weeks in March 2020 [14]. They found no changes in the scores despite increased infection rates. High level of trust in doctors and health information as well as personal protective measures was rated as helpful. The harmful effects of hoarding food and medicine were described as being associated with elevated levels of depression at the beginning of the crisis [15]. Another study found that cognitive coping behaviour (e.g. getting knowledge about COVID) and prosocial coping styles (e.g. adherence to social distancing) proved protective for the population [16]. The same authors described the high impact of the pandemic on the livelihood of the population and at the same time harmful effects of media exposure on mental health.

Besides the obvious impact of the pandemic on mental health like the fear of infection and isolation due to quarantine measures [17], excessive media consumption was linked to mood disorders during the lockdown in China [18, 19]. But little is known about the media preferences of the population regarding mental health during the crisis.

Vulnerable groups during COVID-19 regarding mental health

Since health care workers at the frontline were exposed to particularly demanding conditions during the peak of the pandemic, their mental health and coping strategies have become an early issue of concern. One of the first studies on this topic focused on medical and nursing staff in Wuhan and found elevated levels of subthreshold mental health disturbances in nearly 40% of the 994 participants [20]. A nationwide study in February reported nearly 5% of medical and non-medical staff with moderate and high levels of anxiety and about 13% with depression [21]. In this study nurses and young personnel were found to be particularly at risk for mental distress. A nationwide survey by the end of February showed even higher levels (anxiety: 13%, depression: 12%, insomnia: 38%) for doctors and nurses compared to non-medical health workers [22]. Risk factors were found to be: living in a rural area, being female and closeness to COVID-19. Additionally, health care workers were burdened by specific clinical and non-clinical stressors, e.g. the fear of bringing the

virus home to family members and the experience of losing colleagues [23].

There were some specific results on the psychological burden felt by nurses. Nurses in Anhui showed strong emotional responses. The closer the participants were confronted with COVID-19 cases, the more anxiety and anger were expressed [24]. Increased levels of insomnia were reported among nurses in Wuhan, which might have been caused by comorbid sleep apnea due to stress [25]. Despite showing symptoms of severe distress, the Wuhan nurses refused to accept psychological help at the beginning of the pandemic [26].

Another vulnerable group included students, the majority of whom lived in quarantine with their families and reported victimization by facing or witnessing various stressful events related to COVID-19 [27]. Other studies found an impact of the COVID-crisis on their sleep quality [28], and increased anxiety among students was reported even after the lockdown ended [29]. Teachers were also affected not only by the outbreak but also by the stress felt by their pupils [30].

In spite of many studies regarding the mental health of the general population and health care workers on the frontline of the pandemic, we found no data on further vulnerable groups and professions, who may be mentally or emotionally affected by indirect means. Although Huang and Zhao [31] found comparable depressive symptoms among employees in enterprises as in health care workers, and Wang et al. reported longitudinal results in February and March [13, 14], these results were from the initial stages of the lockdown and data from the end of the lockdown is missing to date.

Objectives of the study

The aim of this survey study was to assess the psychological burden of COVID-19 on the mental health of the Chinese population during the last four weeks of the lockdown in Hubei province. We analyzed different professions in order to find vulnerable groups, possible influencing factors, and the successful ways of coping. Moreover, we looked for specific stressors for doctors and nurses.

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Methods

Study Design

We used a cross-sectional online survey design in order to investigate the impact of the COVID-19 pandemic on the mental health, stress, specific stressors and coping strategies of different groups of the Chinese population. The study team of Heidelberg University Hospital developed the concept and the questionnaire, which was translated into Chinese. Its implementation into an online format and sampling was carried out by a publicity enterprise in Wuhan. The Tongji Medical College of the Huazhong University of Science and Technology (HUST) supported the study by spreading the link. The study started on 19 March and data was included until 7 April. The lockdown in Hubei officially ended on 8 April, declared by the government [4].

Ethical approval for this study was granted by the Ethics Commission of the Medical Faculty of Heidelberg (S-361/2020). We follow the reporting guidelines of the STROBE statements for observational studies [32].

Measures

The questionnaire was derived from validated instruments and structured into four major parts. The first part asked for demographic data (place of residence, gender, age, marital status, education background and occupation), exposure to people infected with COVID in general and at work, working hours per day, and the main way of access to information by the usage of media (multiple choice). The second part asked for mental health parameters like depression, anxiety and stress measured by the Depression-Anxiety-Stress Scale in its short version with 21 items (DASS-21) with a four-point Likert scale [33]. We used the validated Chinese translation [34]. The instrument refers to a time span of the past week and has been shown to distinguish well between symptoms of depression, anxiety and stress in clinical and non-clinical samples [35]. In order to assess stress levels during the past month, we used the Perceived Stress Scale in its 14-item version (PSS-14) that explicitly refers to a longer time span with a five-point Likert scale [36]. Again we used a validated translation, which is the CPSS-14 [37]. The third part of our questionnaire targeted at health care workers only and consisted of a questionnaire that was used in a former study on the SARS outbreak in 2003 [38]. The items asked for specific disease-related stressors of doctors and nurses and were rated on a 4-point Likert scale (0=not at all; 1=slightly; 2=moderately; 3=very much). Finally, the fourth part was again available for all participants and asked for successful coping strategies. The items were again taken from the SARS study [38] and recorded the frequency of use of various coping strategies on a 4-point scale (0 =almost never; 1=sometimes; 2=often; 3=almost always). Both scales were translated by a Chinese native speaker (JD).

Data Analysis

The responses of the participants were downloaded from the online survey tool and further processed and analysed by IBM SPSS statistics 24 [39]. We collected 1006 datasets and removed all datasets that were filled out after 7 April (n=74) and the questionnaires filled out in less than 513 seconds (n=226), which corresponded to the lowest percentile of the mean processing time of all samples. In these cases, we assumed a lack of credibility if a participant was below this time. Finally, we removed all participants who were younger than the legal age (n=7) and who were not in China during the survey (n=9). We calculated descriptive statistics and reported frequencies, means, standard deviations, and percentages.

Participants answering from Hubei and Zhejiang provinces were regarded as being affected by the lockdown (n=460). All other participants were not directly affected by the lockdown (n=226).

The scoring of the DASS-21 are calculated as sum scores that have to be multiplied by two. The total depression subscale score was divided into normal (0–9), mild (10–13), moderate (14–20), severe (21–27), and extremely severe depression (28+). The anxiety subscale score was divided into normal (0–7), mild (8–9), moderate (10–14), severe (15–19), and extremely severe anxiety (20+). The total stress subscale score was divided into normal (0–14), mild (15–18), moderate (19–25), severe (26–33), and extremely severe stress (34+). In a next step, we grouped the levels of severity into normal-

mild (NM) and moderate-extremely severe (MES) for each score. We decided to put mild symptoms into one group together with a normal level, because we considered mild symptoms of depression and anxiety as part of a regular mental health issue worldwide regardless of the pandemic [40].
The CPSS-14 scores were calculated by sum scores as well. We report the CPSS14-scores and DASS-21 scores nationwide for each profession. For deeper analysis we calculated Pearson-Correlations in order to assess the relationship of perceived stress during the past four weeks and mental health scores depression, anxiety and stress during the past week.
The coping strategies and major stressors were calculated as means and standard deviations. We carried out a factor analysis (principal component analysis (PCA) with varimax rotation) for all coping strategies. The KMO- and Bartlett Test indicated a sufficient cohesion of the variables with a value of KMO=.76 [41]. Finally, binary logistic regression models were calculated and thereby investigated the associations of gender, lockdown area, contact to COVID-19 infections at work, and coping strategies (factors) with the Odds ratios of belonging to the group of moderately to extremely severely (MES) affected by depression, anxiety or stress. A non-significant value of p=.40 in the Hosmer-Lemeshow test indicated the goodness-of-fit of the models [42], and a Nagelkerkes R^2 of .17 showed an acceptable coefficient of determination [41].
In all analyses. p values < .05 were considered statistically significant.

Results

Participants

The sample included N=687 participants, 496 (72.3%) of whom were female and (190) 27.7% male. The mean age was 36.92 years (SD=9.83) with a range from 18 to 71 years. The participants consisted of doctors (n=158, 23.0%), nurses (n=221, 32.2%), other medical staff (n=24, 3.5%), students (n=43, 6.6%), teachers/government staff (n=60, 8.7%), economy staff (n=135, 19.7%), workers/famers (n = 26, 3.8%) and others (n=20, 2.9%). We included doctors and dentists into one category. Other medical staff were professionals in healthcare, who were no doctors or nurses. Economy staff consisted of employees and self-employed people in the IT and finance sector.
A majority of the participants were from Hubei province (n=449, 65.4%), 30 (4.4%) came from Jiansu, 21 each from Shanxi and Guangdong (3.1%). A small group (n=11, 1.6%) came from Zhejiang, which was affected by a lockdown as Hubei. Demographic characteristics and details of the professional groups are summarised in Table 1.

Table 1: Demographic characteristics of the study participants.

Characteristics		**Participants, n (%)**
Age (years), mean (SD)		36.92 (9.83)
Gender		
	male	190 (27.7)
	female	496 (72.3)
Family status		
	single	146 (21.3)
	married	501 (72.9)
	divorced	30 (4.4)
	widowed	2 (0.3)
	in a relationship	8 (1.2)
Children		
	yes	499 (72.6)
	no	188 (27.4)
Level of education		
	middle school	10 (1.5)
	high school	25 (3.6)
	junior college	168 (24.5)
	bachelor	384 (55.9)
	master	77 (11.2)

Characteristics		Participants, n (%)
Profession	doctor	23 (3.3)
	doctors/dentists	158 (23.0)
	nurses	221 (32.2)
	other medical staff (volunteers, pharmacists, midwifes)	24 (3.5)
	students	43 (6.3)
	teachers/government staff	60 (8.7)
	economy (employees, self-employed, sellers)	135 (19.7)
	workers/farmers	26 (3.8)
	others (e.g. housewifes)	20 (2.9)
Residence	Hubei	449 (65.4)
	Jiansu	30 (4.4)
	Guangdong	21 (3.1)
	Shanxi	21 (3.1)
	Shandong	17 (2.5)
	Fujian	16 (2.3)
	Sichuan	15 (2.2)
	Shanghai	15 (2.2)
	Hunan	14 (2.0)
	Zhejiang	11 (1.6)
	Provinces with less than 10 part.	78 (11.2)
Total		687 (100)

Perceived Stress and Mental Health

Perceived stress was measured with a mean score of *M*=23.70 (*SD* = 7.52). The mean values of DASS-21 depression was *M*=6.62 (*SD*=7.80), of DASS-21 anxiety was *M*=7.01 (*SD*=7.00), and of DASS-21 stress was *M*=10.18 (*SD*=8.63). Perceived stress was significantly correlated with DASS-21 depression (*r*=.61, *p*<.01), DASS-21 anxiety (*r*=.57, *p*<.01) and DASS-21 stress (*r*=.66, *p*<.01). Mental health status findings for the professions are reported in table 3, while the DASS-scores were put into categories normal-mild and moderate-extremely severe.

Table 2: Results of the CPSS-14 (Scores in M and SD) and the DASS-21 (Categories in frequencies and percentages for normal-mild (NM) and moderate-extremely severe (MES))

		CPSS-14	**DASS-21 Depression**		**DASS-21 Anxiety**		**DASS-21 Stress**	
	n	M (SD)	NM (n, %)	MES (n, %)	NM (n, %)	MES (n, %)	NM (n, %)	MES (n, %)
Doctors	158	23.16 (7.26)	134 (84.8)	24 (15.2)	106 (67.1)	52 (32.9)	138 (87.3)	20 (12.5)
Nurses	221	23.62 (7.19)	183 (82.8)	38 (17.2)	152 (68.8)	69 (31.2)	197 (89.1)	24 (10.9)
Other medical staff	24	22.25 (8.09)	19 (79.2)	5 (20.8)	17 (70.8)	7 (29.2)	20 (83.3)	4 (16.7)
Students	43	26.30 (7.79)	33 (76.7)	10 (23.3)	25 (58.1)	18 (41.9)	34 (79.1)	9 (20.9)
Teachers/ govt staff	60	22.98 (6.09)	51 (85.0)	9 (15.0)	44 (73.3)	16 (26.7)	53 (88.3)	7 (11.7)
Economy staff	135	23.93 (8.68)	108 (79.4)	27 (20.0)	102 (75.6)	33 (24.4)	112 (83.0)	23 (17.0)
Workers/ farmers	26	23.15 (6.69)	21 (77.8)	5 (19.2)	19 (73.1)	7 (26.9)	23 (85.5)	3 (11.5)
Others	20	26.25 (7.62)	15 (75.0)	5 (25.0)	14 (70.0)	6 (30.0)	16 (80.0)	4 (20.0)
Total	**687**	**23.70 (7.52)**	**564 (82.1)**	**123 (17.9)**	**479 (69.7)**	**208 (30.3)**	**593 (86.3)**	**94 (13.7)**

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Working hours per day

The majority of the participants reported working 4-8 hours per day (n=427, 61.4%). This was the case in the following groups: nurses: n=145/221, 65.6%; students: n=39/43, 90.7%; teachers/government staff: n=47/60, 78.4%; economy staff: n=97/135, 71.9%; workers/farmers: n=18/26, 69.3%; others: n=15/20, 75.0%.

A sizeable part of the sample reported working 8-12 hours per day (n=260, 37.4%). This high workload typically affected doctors (n=103/158, 65.2%) and other medical staff (n=13/24, 54.2%).

Contact with COVID-19 at work

Six participants were infected themselves (0.9%), 2 of them were doctors, 3 nurses and one member of the group teachers/government staff. Of all participants 180/687 (26.2%) had contact with people infected by the virus at work. The most affected group were doctors, n=68/158 (43.0%) of whom had contact at work, followed by other medical staff (n=10/24, 41.7%), nurses (n=88/221, 39.8%) and teachers/government staff (8/60, 13.3%) (economy: n=5/135, 3.8%; workers/farmers: 1/26, 3.8%; students: 0/43, 0.0%; others: 0/20, 0.0%).

Media preferences

When asked for the main way to get information during the last month the majority of participants answered to have been informed via WeChat (n=606, 88.2%). For further results see figure 1.

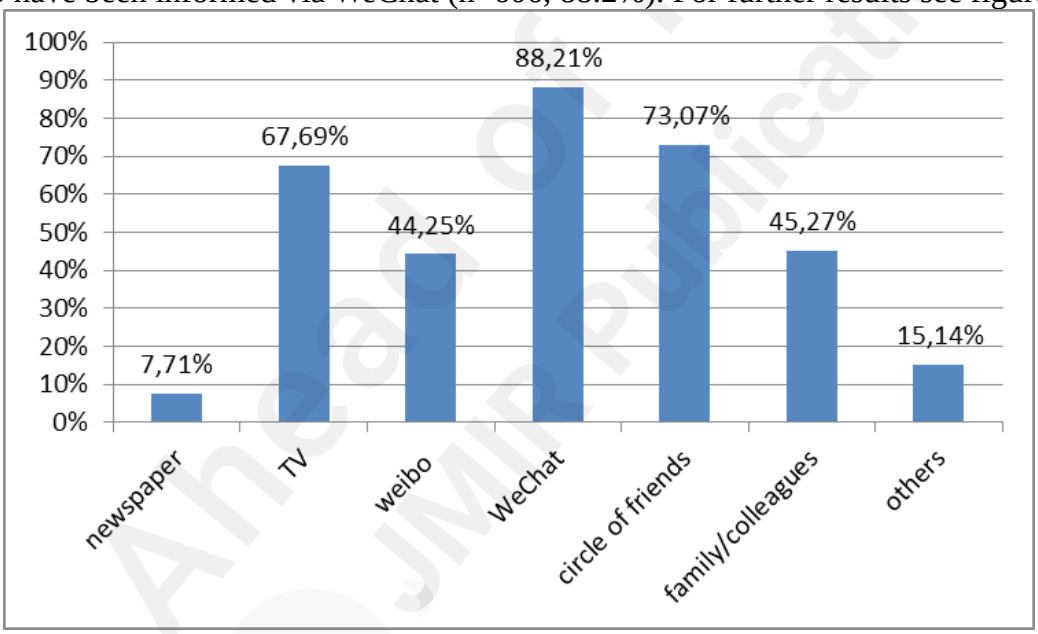

Figure 1: Answers to the question: What was the main way of getting information during the last month (multiple choice possible)? Results in percentages.

Coping strategies

The three most successful ways of facing the demands of COVID in the life and work out of 12 possible answers were: “Taking protective measures” (*M*=2.57, *SD*=0.67), “Actively acquiring more knowledge about COVID-19” (*M*=2.09, *SD*=0.78), and “Engaging in recreational activities” (*M*=1.94; *SD*=0.77*)*. All coping strategies are listed in table 3.

Three dimensions could be extracted after calculating a principal component analysis (PCA) and were named as active coping, mental coping, and emotional coping, respectively after analyzing the content of the items. The dimensions accounted for 47.2% of the variance (table 3).

Table 3: Matrix of components of Coping Strategies with Means and Standard deviations of the items, and three components after varimax-rotation (the rotation is converged in 5 iterations; method of extraction: main component analysis).

Items	M (SD)	Factor loadings		
		active	mental	emotional
Taking protective measures (washing hands, wearing mask, taking own temperature, etc.)	2.57 (0.69)	**0.77**	-0.03	0.01
Actively acquiring more knowledge about COVID-19 (symptoms, transmission pathway, etc.)	2.09 (0.78)	**0.75**	0.17	0.02
Switching thoughts and facing the situation with positive attitude	1.90 (0.83)	**0.53**	0.44	-0.12
Engaging in recreational activities (WeChat, Weibo, TikTok, online-shopping, online movies, exercises,)	1.94 (0.77)	**0.42**	0.23	-0.06
Video-Chatting with family and friends by phone to share concerns and support	1.69 (0.80)	0.40	**0.43**	-0.02
Engaging in health-promoting behaviors (more rest, exercise, balanced diet, etc.)	1.94 (0.77)	0.27	**0.68**	-0.06
Acquiring mental health knowledge and information	1.36 (0.91)	0.27	**0.63**	0.01
Practicing relaxation methods (meditation, yoga, Tai Chi, etc.)	0.88 (0.85)	-0.07	**0.83**	0.09
Limiting self from watching too much news about COVID-19	0.53 (0.73)	-0.11	0.13	**0.72**
Distracting oneself from thinking about COVID-19 issues by suppression or keeping busy	0.70 (0.82)	0.03	0.10	**0.75**
Venting emotions by crying, screaming, smashing things, and so on	0.23 (0.48)	-0.08	-0.08	**0.53**
Using alcohol or drugs	0.22 (0.53)	0.07	-0.10	**0.53**
Eigenvalue		2.89	1.71	1.07
Percentage of total variance		24.05	14.23	8.93
Total variance				47.21

Predictors of increased levels of depression, anxiety and stress

We calculated three binary logistic regression models in order to find associations of gender, lockdown area, contact to COVID-19 infections at work, and coping factors with the Odds ratios of belonging to the group of MES depression, anxiety or stress. Being female and applying emotional coping strategies increases the probability of belonging to the group of MES depression, anxiety or stress. Applying active coping strategies reduces the probability of being affected by MES anxiety, while mental coping strategies reduces the probability in all three MES mental health groups. Age, being in a lockdown area, having contact to COVID-19 at work and having a high workload (8 – 12 h per day) did not significantly predict significant odds of expressing MES symptoms of depression, anxiety or stress. The results are displayed in detail in Table 4.

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Table 4: Results of a logistic regression predicting the probability of being moderate to extremely severe (MES) burdened by Depression, Anxiety or Stress (DASS-21) dependent on the factors of coping strategies

Variables	**MES depression**		**MES anxiety**		**MES stress**	
	B (SE)	OR (95% CI)	B (SE)	OR (95% CI)	B (SE)	OR (95% CI)
gender female	0.81 (0.27)	2.24 (1.33; 3.77)	0.47 (0.22)	1.61 (1.05; 2.47)	0.78 (0.30)	2.19 (1.21; 3.96)
age	0.01 (0.01)	1.01 (0.98; 1.03)	-0.01 (0.01)	0.99 (0.97; 1.00)	-0.01 (0.01)	0.99 (0.96; 1.01)
Hubei, Zejiang	-0.43 (0.25)	0.65 (0.40; 1.05)	-0.07 (0.21)	0.93 (0.61; 1.41)	-0.22 (0.28)	0.80 (0.46; 1.39)
contact to CoV inf. at work	0.07 (0.26)	1.08 (0.64; 1.80)	0.15 (0.49)	1.16 (0.76; 1.79)	-0.03 (0.30)	0.97 (0.54; 1.74)
daily workload 8-12h	0.06 (0.22)	1.06 (0.69; 1.65)	0.23 (0.19)	1.26 (0.87; 1.83)	0.32 (0.25)	1.38 (0.85; 2.25)
active coping	-0.14 (0.11)	0.87 (0.71; 1.07)	-0.21 (0.09)	0.81 (0.68; 0.97)	-0.11 (0.12)	0.89 (0.70; 1.13)
mental coping	-0.56 (0.12)	0.57 (0.45; 0.72)	-0.42 (0.10)	0.67 (0.55; 0.81)	-0.67 (0.14)	0.51 (0.39; 0.67)
emotional coping	0.63 (0.10)	1.89 (1.55; 2.30)	0.80 (0.10)	2.16 (1.80; 2.60)	0.82 (0.11)	2.27 (1.81; 2.84)

Major stressors (health care workers only)

Out of 18 stressors the three most demanding aspects in the work of the health care workers (n=375) were related to: Worry about inflicting COVID-19 on their family (*M*=1.46, *SD*=0.86), followed by the potential deterioration of the patients' condition (*M*=1.42, *SD*=0.79) and the patients' emotional reaction (*M*=1.3, *SD*=0.81).

Table 5: Answers of the doctors and nurses to the question: "When you think about COVID-19 in your life and work how often did you thought or worried about the following things?" (0=not at all, 3=very much) (Means, Standard Deviations)

	N	M	SD
Worry about inflicting COVID-19 on family	375	1.46	0.86
Deterioration of patients' condition	375	1.42	0.79
Patients' emotional reaction	375	1.3	0.81
Patient families' emotional reaction	375	1.29	0.79
Uncertainty about when the epidemic will be under control	375	1.27	0.78
Coworkers displaying COVID-19-like symptoms	375	1.27	0.79
Worry about getting infected	375	1.24	0.78
Worry about being negligent and endangering patients	375	1.23	0.88
Worry about lack of proper knowledge and equipment	375	1.23	0.79
Worry about being negligent and endangering coworkers	375	1.18	0.83
Worry about nosocomial spread	375	1.15	0.82
Conflict between duty and safety	375	1.15	0.81
Be infected of the colleagues	375	1.12	0.81
Protective gears being a drag in providing quality care	375	1.12	0.80
Blaming from commanding officers	375	1.1	0.80
Yourself displaying COVID-like symptoms	375	1.09	0.77
Worry about lack of manpower	375	1.07	0.91
Being without properly fitted environment	375	1.05	0.84
Protective gears cause physical discomfort	375	1.01	0.79
Equivocal definition of the responsibility between doctors and nurses	375	1	0.86
Frequent modification of infection control procedures	375	0.96	0.81
Coworkers being emotionally unstable	375	0.96	0.77
Documentation and reporting procedures unclear	375	0.92	0.78

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Discussion

Predictors of mental health symptoms

This survey aimed at assessing the psychological burden and mental health of the Chinese population during the final stages of the lockdown, finding out successful coping strategies and determining potentially vulnerable professional groups with specific support needs. Our results suggest that being a female and, separately from gender, applying certain coping strategies remarkably increased the incidence of symptoms of depression, anxiety and stress. Emotional coping strategies like venting emotions, consuming alcohol or limiting oneself from information were not successful for participants confronting COVID-related psychological problems. Active strategies to cope with MES anxiety, such as taking protective measures and acquiring more knowledge were more beneficial but the most effective strategy was focussing on mental coping like relaxation techniques and gaining knowledge about mental health. Our results confirm the findings of Guo et al. [16], who used another instrument for determining coping strategies but similarly found emotion-focused rather worsening, while cognitive and problem-focused coping strategies to be helpful. Interestingly, exposure to COVID-19 at work, living within a lockdown area and the daily workload did not play a significant role in predicting elevated symptoms.

We found no overall increased mean values in perceived stress and depression, anxiety, and stress in comparison to former (pre-COVID) samples e.g. in Hong Kong patients regarding perceived stress [43] or among Beijing residents regarding mental health scores [44]. This could be because the Chinese population had already got used to the burden by the end of the lockdown. The first studies in January investigating the psychological impact of the outbreak on the population reported high levels of burden [16, 31, 45]. While Wang et al. measured DASS-21 scores twice at the beginning and at the peak of the pandemic in China [13, 14] and found increased anxiety in nearly 30% of the participants, yet no longitudinal increase. With our study we added a third point of measurement at the final stage of the lockdown and found a considerable share of people who expressed moderate to extremely severe symptoms of depression (17.9%), anxiety (30.3%) and stress (13.7%). This result should be taken seriously as our sample revealed a higher percentage of people with increased levels of depression while stress scores were lower than in the studies by Wang et al. We also observed a high correlation of perceived stress in the past four weeks and actual scores in depression. Previous research on the aetiology of depression could show that stress might be one predictor for this mood disorder [46, 47]. Following this line of argument, an increase of depressive symptoms by the end of the lockdown could be interpreted as part of a concerning development.

Vulnerable groups

Some groups in our sample were more affected by symptoms of depression, anxiety or stress than others. Students were vulnerable for moderate to extremely severe symptoms in all three categories. Besides the pandemic, Chinese students have been reported to be affected by mental health problems due to stressful academic demands [48, 49]. The consequences of the pandemic on students' life were even aggravated by regular infection-controls, online-learning in a tight work plan and uncertain future perspectives [50]. A cross-sectional study among medical students after the lockdown revealed high levels of anxiety (38% participants) and showed that social media played an important role in adherence to protective measures among them [29]. In our results, the main method of getting COVID-related information was WeChat, directly followed by "circle of friends", which in China refers to WeChat groups and other social media related groups.

Economy staff was highly burdened by stress, while not showing more depression or anxiety than other groups. This result does not go along with Huang and Zhao [31], who using different protocols asked enterprise employees in the beginning of February and found depression among 20% of the participants and anxiety among 34%. Increased stress levels in our sample could be explained by the fact that we put together all employees and self-employed people in the finance and IT sectors as well as sellers in one group. Enhanced stress may be a result of the concerns to ensure livelihood for

their own family during the lockdown, as shown previously [16]. Further differentiated results are needed to allow for a more specific statement.

Doctors and nurses in our sample were highly affected by anxiety while doctors had the highest workload per day. Nevertheless perceived stress and DASS-21 stress levels were not higher than other groups, which may be due to a high professional devotion, as reported formerly [51]. Issues about the care for patients like the deterioration of the patients' condition and the emotional reaction of patients and their families were perceived as stressful. In another study, nurses in Wuhan were found lacking in training for dealing with uncooperative patients [26]. Several studies have reported on the need for training Chinese medical staff on doctor-patient-communication independent from the COVID-19 crisis [52]. The anxiety felt by doctors and nurses in our results may be the result of the fear of bringing COVID-19 to the own family, the most intense stressor in our and in other samples [23, 51]. A further stressor found in other studies was spending too much time on social media while searching for COVID updates. By this, symptoms of depression and anxiety were promoted in Chinese adults in general as well as in health professionals [19].

Finally, other medical staff, a small group consisting of volunteers, midwifes and pharmacists in our sample, was more affected by depression and stress than other groups and was vulnerable to anxiety as well. During the pandemic, many volunteers supported the frontline hospitals [53] and our results show that these people, who had the second highest workload per day after doctors, have been overlooked so far and should get more attention since they seem to have special support needs. This group included different health care professionals like pharmacists, midwifes and volunteers, who might lack the institutional psychological support that is delivered to the core personnel in a frontline hospital.

Future Implications

By 2017 there were only 33.400 licensed psychiatrists in China [54]. In recent years, the Chinese National Health Commission has established several mental health initiatives to extend mental health care to the general population. During the coronavirus pandemic, the commission published guidelines and treatment instructions, uploaded videos of mental health education via WeChat and established expert emergency groups for mental health services at the hospitals [55].

Still health care workers are in dire need to gain further access to specific mental health services [56] while further research is needed on the role of media consumption and mental health during such crises. Although the internet provided many supporting measures like telemedicine for COVID-19 patients [57] and online mental health education and counselling [58], excessive exposure to media seems to play a significant role in explaining mental health problems during the pandemic [18]. The Chinese population might find itself in a paradox: acquiring knowledge about the virus and mental health measures is helpful but in order to maximise coverage this knowledge is spread by governmental and other institutions via social media [55, 59], which has its own harmful mental consequences [16, 19]. As a consequence, it is not possible for them to avoid media consumption in general. Conclusive findings on the role of media and mental health targeted on subgroups of the Chinese population are missing till now.

Limitations

Although we received 687 responses, the professional groups were not of the same size and only a few students and 'other medical staff' participated in the study, which reduces the power of statistical analysis. Targeted investigations may be needed to assess their situation in a differentiated way. Further, online studies are unable to allow a valuable diagnostic assessment and this limitation applies to all former studies. This is further aggravated due to the great variability in instruments used in different surveys which reduces the comparability of results. Some authors used the DASS-21 previously [13, 14], but with different cut off-scores (see below), while some relied on the SDS [45], PHQ [56], GAD-7 or the Center for Epidemiology Scale for Depression (CES-D) [31] and the PTSD-checklist [16]. In fact, only a face-to-face diagnostic interview by a qualified medical doctor or a clinical psychologist could allow a statement regarding a mental disorder. Therefore, our results

hint at a certain development but should not be understood as a diagnosis of the population. Moreover, we compared our results to the studies of Wang et al. [13, 14], who used slightly different cut off-scores in interpreting the borders between mild and moderate depression and anxiety as suggested originally by Lovibond [33]. But even without knowing their exact frequencies in the single scores, our findings in the increase of depression would have been even higher if Wang et al. had used the original cut off-scores. Finally, we only asked for media preferences and not for the time spent on media consumption. A detailed analysis on the reasons for media consumption (entertainment, information, relaxation), the way of usage (alone, together), and mental health is necessary to reveal a more differentiated picture.

Conclusion

A considerable part of the general population in China reported elevated symptoms of depression, anxiety and stress during the final stages of the COVID-19 lockdown. Doctors, nurses, students and other medical staff were found to be in imminent danger of developing mental health problems. Similarly, economy staff was also highly stressed. The female gender was an additional risk factor for potential vulnerability towards developing mental health problems. We recommend giving more specific information to these subgroups targeted at their respective mental health profile and to personalize the successful coping strategies found in our results, which were active and mental coping. These refer to constructive ways of behaviour, e.g. actively acquiring knowledge, applying protective measures and mental health strategies like relaxation techniques, psycho-education and promoting social contacts. Profession-specific mental health prevention programs should be developed and provided in those formats, preferred by the respective age, gender or professional groups.

Conflict of interests

The authors declare no conflict of interests.

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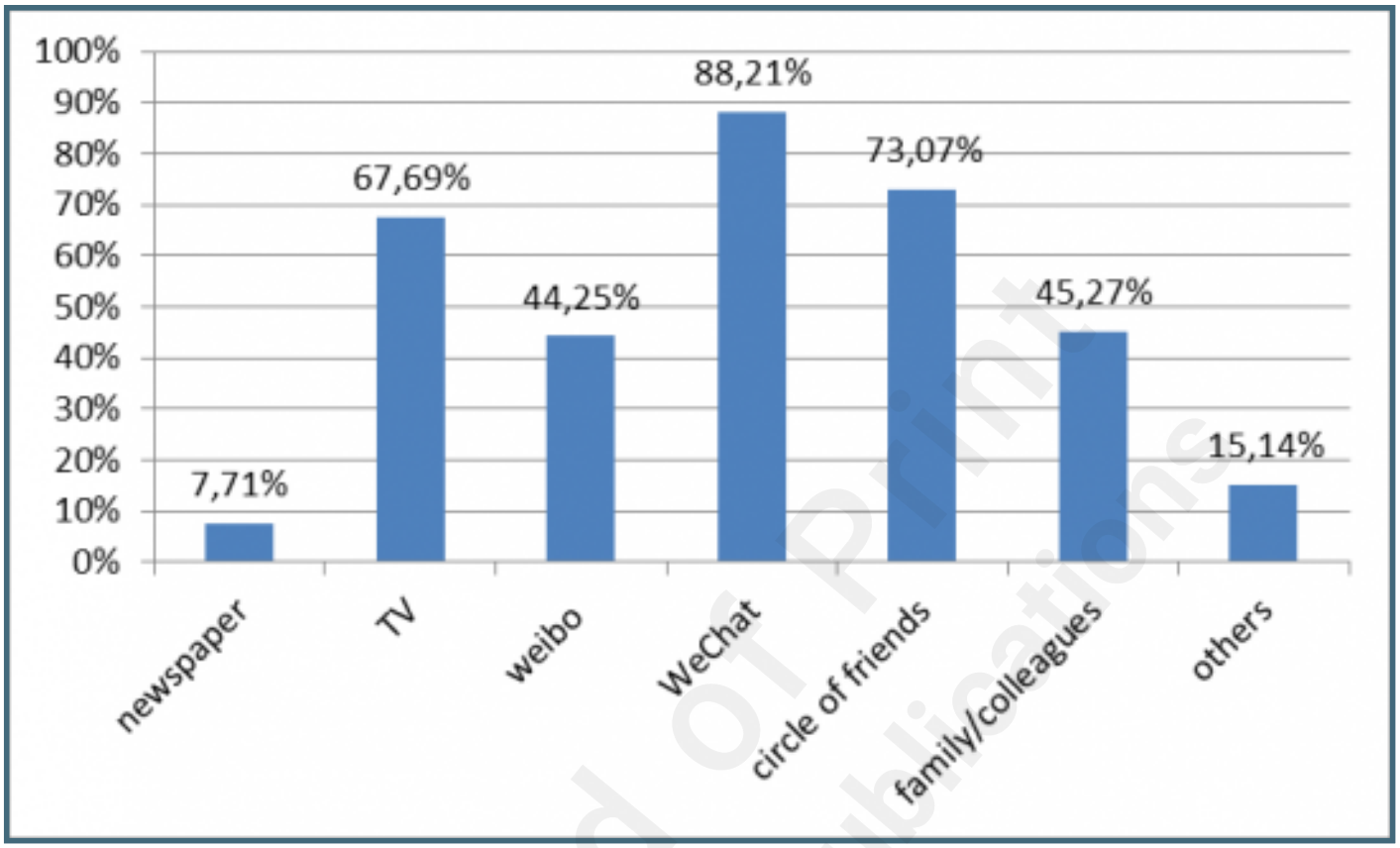
Answers to the question: What was the main way of getting information during the last month (multiple choice possible)? Results in percentages.



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