

# Factors Influencing Resilience of Medical Workers from Other Provinces to Wuhan Fighting Against 2019 Novel Coronavirus Pneumonia

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## Research article

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# Abstract

**Objective:** To investigate the resilience of medical workers from other provinces to Wuhan to support fighting against 2019 novel coronavirus pneumonia (COVID-19).

**Methods :** In February 2020, medical works supporting Wuhan in the fighting against COVID-19 were eligible to complete an online survey made up of Connor Davidson Resilience Scale (CD-RISC), Hospital Anxiety Depression Scale (HADS) and Simplified Coping Style Questionnaire (SCSQ).

**Results :** A total of 114 medical workers were investigated. The CD-RISC scores of medical workers were at a high level ( $67.03 \pm 13.22$ ). The resilience level was highest for physicians ( $73.48 \pm 11.49$ ), followed by supporting staff, including health care assistants, technicians ( $67.78 \pm 12.43$ ) and nurses ( $64.86 \pm 13.46$ ). There were also significant differences in education, training and support from hospital, adequate preparation and confidence to complete support tasks ( $P < 0.05$ ). Resilience was negatively correlated with anxiety ( $r = -.498$ ,  $P < 0.01$ ) and depression ( $r = -.471$ ,  $P < 0.01$ ), but positively correlated with active coping styles ( $r = .733$ ,  $P < 0.01$ ). Multiple regression analysis showed that active coping ( $\beta = 1.314$ ,  $p < 0.05$ ), depression ( $\beta = -.806$ ,  $p < 0.05$ ), anxiety ( $\beta = -1.091$ ,  $p < 0.05$ ) and training and support from hospital ( $\beta = -3.510$ ,  $p < 0.05$ ) were significant influence factors of resilience.

**Conclusion :** The manager of the health management system should be aware that active coping, depression, anxiety and training, and support from hospitals are the influential factor of resilience. In addition, it is necessary to need to take these preferences into account and develop psychosocial interventions to help reinforce the resilience of medical works fighting emerging contagious diseases such as COVID-19.

## Background

In December, 2019, the first novel coronavirus pneumonia case was reported in Wuhan, Hubei province, China, which was attracted worldwide attention and caused a global panic due to the high proportion of severe cases and the high mortality rate[1 2]. The World Health Organization (WHO) raised the risk assessment of COVID-19 from "high" to "very high" at global level[3]. The rapid transmission of the 2019 Novel Coronavirus Pneumonia (COVID-19) has resulted in more than 77 150 patients being diagnosed within 8 weeks[4]. Everyday a dramatic increase in the number of infected individuals is causing a huge work burden on medical workers. There is a shortage of doctors and nurses, who are compelled to work longer without taking enough rest. In order to better control the epidemic and relieve the pressure of local medical workers in Wuhan, the country's top health authority organized excellent medical workers from various provinces to support Wuhan. At the time of writing (February 17th 2020), a total of 32,395 medical workers in 278 teams from the country have been sent to Hubei province, to care for patients who are infected and those with suspected infection, strengthen logistics support, help reduce the pressure on local health-care personnel, and combat the ongoing novel coronavirus outbreak[5]. During an outbreak of infectious disease, medical workers are under great pressure due to heavy workload,

hazardous working environment[6]. The severe situation is causing mental health problems such as anxiety, depression symptoms[7 8]. These mental health problems not only affect the medical workers' attention, understanding, and decision making ability, which might hinder the fight against infectious disease, but could also have a lasting effect on their overall wellbeing[9 10]. In particular, the non-local medical works, facing the unfamiliar working environment, away from their families, are bound to bear more mental health problems than the local medical works in Wuhan. Protecting the mental health of these medical workers is thus important for control of the epidemic and their own long-term health[11]. Unfortunately, no study has focused on the psychological problems of medical workers from other areas to support the affected areas during infectious disease outbreaks.

Resilience refers to the means and ability for effective adjustment, or to cope successfully with adverse circumstances[12]. As a psychosocial resource, resilience is commonly regarded as positive adaptations when faced with threats or challenges, and resilience is also found to be significantly associated with anxiety and depression symptoms of medical works[13]. An expected influenza pandemic indicated a need to build resilience to maintain the health of individuals within the organization[14]. Consequently, the concept of resilience among medical works facing natural disasters has gained increasing attention since the outbreak of SARS in 2002[11 14]. Studies have found that nursing staff from China to Liberia to support fighting against Ebola had higher levels of resilience when compared with the wider population[15]. However, there was a lack of information on whether or not these findings are applicable to non-local medical workers from other provinces to Wuhan to support fighting against COVID-2019. Our study may fill this gap. This study aims to investigate resilience, anxiety, depression and coping of medical works from other provinces to Wuhan to support fighting against COVID-19. Moreover, we aim to determine the impact of demographic variables, such as sex, age and occupation on these factors. Finally, we hope to assess the factors most strongly related to resilience of these medical workers.

## **Methods**

### **Design and sample**

In February 2020, a cross-sectional on-line survey on the first-line medical workers from other provinces to Wuhan to support fighting against COVID-2019 was conducted. Voluntary respondents were included if they held a professional certificate. Respondents were excluded if they experienced major negative events (such as serious illness, death of a family member, personal health problems) during the study.

### **Data collection**

A QR code was generated by the e-questionnaire website and sent to participants through the WeChat platform so that they could access the questionnaire. The contact information for a member of the research team was included in the survey in case subjects had any questions or required further explanation. The questionnaires took an average of  $10 \pm 4.48$  min to complete.

### **Demographic characteristics**

Demographic information was collected through a self-designed questionnaire consisting of questions regarding personal variables, such as sex, age, occupation, marital status and education.

## **Hospital Anxiety and Depression Scale**

Hospital Anxiety and Depression Scale (HADS) was used to determine the presence of depression and anxiety among medical workers[16]. It consists of 14 total items, 7 items each for depression and anxiety scale. A score between 0 and 21 is given for either anxiety or depression. For each scale, scores of 8–10 indicate mild symptoms and greater than or equal to 11 indicate moderate/severe symptoms. Higher scores on each individual scale reflect severe forms of depression and/or anxiety. In this study, Cronbach's alpha was 0.428 for anxiety, 0.702 for depression.

## **Resilience**

Resilience was measured using the Connor Davidson Resilience Scale (CD-RISC). This is a 25-item test that yields a score between 0 and 100. Higher scores indicate higher resilience. The 25 items are subdivided into three factors, including hardiness (13 items), strength (8 items), and optimism (4 items). Previous studies have demonstrated that this scale has good reliability and validity for use with Chinese adults[17]. In the present study, Cronbach's alpha 0.931.

## **Coping style**

Coping style was measured by a Simplified Coping Style Questionnaire (SCSQ). This questionnaire was developed in Chinese by Xie YN[18] based on the Ways of Coping questionnaire by Folkman and Lazarus. It is a 20-item self-report questionnaire that includes two dimensions, active coping (12 items) and passive coping (8 items), with higher scores representing greater active/passive coping manners. Participants were asked to agree or disagree on a 4-point Likert scale according to how frequently they adopt on each item from 0 "never" to 3 "very often". The instrument has been commonly used in Chinese and the Cronbach's alpha coefficients for the two dimensions were 0.890 and 0.802, respectively. Coping strategies are classified as active or passive. Higher scores reflecting more frequent use of the strategy.

## **Statistical analyses**

SPSS 20.0 were used for data analyses. Data showing a normal distribution were reported as mean  $\pm$  SD. Differences in resilience scores between medical staff with different demographic characteristics were assessed for significance using the independent-samples t test and one-way ANOVA. Pearson correlation was used to explore the correlation among anxiety, depression, coping style and resilience. Potentially influence factors for resilience were analysed using a multiple linear regression analysis. For all tests, the level of significance was set at  $P < 0.05$ .

## **Results**

### **Socio demographics**

This study involved 114 medical staff of whom 116 (98.3%) completed questionnaires that could be further analyzed. Participants were predominantly female (79.8%) and 31–40 years old (43.0%). 61.40% of respondents were nurses, 18.4% were doctors, and 20.2% were other medical works. Over half of participants (53.5%) were married, while 46.5% were single. Most medical staff (74.6%) held a bachelor's degree as their highest degree (Table 1).

Table 1  
Demographic characteristics and scores of resilience (n = 114).

Characteristic	n (%)	Mean (SD)	F/t	P
Sex				
Male	23 (20.2)	69.17 ± 14.09	.867	.388
Female	91 (79.8)	66.49 ± 13.02		
Age (years)				
≤ 25	21 (18.4)	69.19 ± 11.50	1.446	.233
26–30	32 (28.1)	69.31 ± 10.27		
31–40	49 (43.0)	64.08 ± 15.22		
41–50	12 (10.5)	69.25 ± 13.38		
Occupation				
Doctor	21 (18.4)	73.48 ± 11.49	3.640	.029
Nurses	70 (61.4)	64.86 ± 13.46		
Support staff	23 (20.2)	67.78 ± 12.43		
Marital status				
Single	53 (46.5)	65.70 ± 12.98	-1.006	.316
Married	61 (53.5)	68.20 ± 13.43		
Education				
Diploma degree	15 (13.2)	57.00 ± 13.78	5.660	.005
Bachelor	85 (74.6)	68.94 ± 12.62		
Master or above	14 (12.3)	66.21 ± 12.04		
Training and support from hospital				
Yes	42 (36.8)	71.43 ± 12.71	2.789	.006
No	72 (63.2)	64.47 ± 12.92		
Adequate preparation				
Yes	81 (71.1)	69.13 ± 12.48	2.715	.008
No	33 (28.9)	61.91 ± 13.78		
Confidence to complete task			2.557	.012

Characteristic	n (%)	Mean (SD)	F/t	P
Yes	109 (95.6)	67.70 ± 12.48		
No	5(4.4)	52.60 ± 21.56		

## Overall survey results

In general, participants showed a high level of resilience (67.04 ± 13.22). For the SCSQ, the active coping (26.61 ± 5.66) score was higher than the score of passive coping (10.32 ± 4.46). The medical staff had a mean score for anxiety 7.40 ± 2.16 and depression 5.40 ± 3.16.

### Associated factors analysis

The results revealed significant differences in the resilience for occupation, education, mental health training, adequate preparation, confidence to complete task (Table 1). Nurses obtained a lower resilience score (64.86 ± 13.46) compared to other professions (67.78 ± 12.43, 73.48 ± 11.49). The resilience of medical workers with bachelor's degree (68.94 ± 12.62) is higher than other degrees (66.21 ± 12.04, 57.00 ± 13.78). It means higher resilience score if medical workers have been mental health training since the outbreak, are well prepared, and are confident of completing the task (p < 0.05).

### Correlational analysis

The Pearson correlation coefficients of all variables are shown in Table 2. Resilience, active coping, anxiety and depression were significantly correlated with one another (p < 0.05). The passive coping were not significantly correlated with resilience in Pearson's correlation analysis.

Table 2

Pearson correlation analysis to identify potential relationships among resilience, anxiety, depression and coping style

	Resilience	Active coping	Passive coping	Anxiety	Depression
Resilience	1	.733**	.012	-.498**	-.471**
Active coping	.733**	1	.109	-.423**	-.366**
Passive coping	.012	.109	1	-.041	.270**
Anxiety	-.498**	-.423**	-.041	1	.380**
Depression	-.471**	-.366**	.270**	.380**	1
Note: ** , P < 0.05					

### Multiple linear regression analysis

To identify the critical factors that predict resilience, a multiple linear regression was conducted for independent variables, occupation, education, mental health training, adequate preparation, confidence to complete task, anxiety, depression, active coping, passive coping. In this study, occupation and education were multiple classification variables. After setting dummy variables for multiple classification variables, resilience was taken as the dependent variable and each dummy variable, mental health training, adequate preparation, confidence to complete task were set as independent variables. Stepwise was

selected as the method to establish the multiple linear regression model. Multi-collinearity between the predictors (e.g., numbers of hospital admissions, numbers of diseases diagnosed, asthma, disc, atopic dermatitis) was suspected but collinearity among these predictors was not found; for example, the range of tolerance, variation inflation factor, and condition index were 0.747–0.963 (evaluation criteria: >0.1), 1.038–1.339 (evaluation criteria: <10), and 1.00-23.204 (evaluation criteria: <30), respectively. The results showed that the prediction model for resilience was significant ( $F = 45.244, p < 0.05$ ), and the adjusted  $R^2$  of this model was 0.610; i.e., this model explained 61% of the variance of resilience. Moreover, active coping ( $\beta = 1.314, p < 0.05$ ), depression ( $\beta = -.806, p < 0.05$ ), anxiety ( $\beta = -1.091, p < 0.05$ ) and mental health training ( $\beta = -3.510, p < 0.05$ ) were significant predictors of resilience. The final coefficients are presented in Table 3.

Table 3  
Multiple linear regression analyses to assess the influence factors of resilience.

Model	Unstandardized Coefficients		Standardized Coefficientst	Sig.
	B	Std. Error	Beta	
Constant	50.189	7.091		7.007 .000
Active coping	1.314	.159	.562	8.276 .000
Depression	-.806	.274	.193	-2.940 .004
Anxiety	-1.091	.412	-.178	-2.647 .009
Training and support from hospital	-3.510	1.633	-.129	-2.1493 .034
R = .790; R <sup>2</sup> = .624; Adjusted R <sup>2</sup> = .610				
Dependent Variable: resilience				

## Discussion

Resilience is an ability of reduce the effect of a distressing event by anticipation and preparation or to “bounce back” once it has occurred[19]. In this study, we measured the situation of resilience, anxiety, depression, and coping among medical workers from other provinces to Wuhan to support fighting against COVID-19 and explored influence factors of resilience. The most important and significant finding of this study was that resilience of medical workers from other provinces to Wuhan to support fighting against COVID-19 were related to active coping, depression, anxiety and mental health training. Firstly, the resilience of medical workers in this study was negatively associated with depression and anxiety. In other words, participants who scored higher on resilience showed a lower score on anxiety and depression. Data collected from 1,012 Greek nurses suggested that resilient nurses had lower anxiety[20]. In a study among health care workers in Toronto, incidence of new episodes of psychiatric disorders after the SARS outbreak were similar to or lower than community incidence rates, which may indicate the resilience of medical workers who continued to work in hospitals one to two years after the SARS outbreak[21]. The results indicated that resilience could work as protective factor for anxiety, depression. In addition, there is a positive association between positive coping and resilience, that is, medical workers who tend to adopt positive coping have higher resilience. A survey on the psychological status of Chinese medical workers during the SARS outbreak in 2003 showed that they tended to adopt healthier forms of coping[22]. The study among American nurses suggests that, during times of change in the workplace, if nurses are encouraged to use positive coping strategies, they may have higher levels of resilience[23]. A study in China suggested that new nurses with high levels of resilience could buffer the negative

influence of workplace incivility by using a positive coping style[24]. Based on the knowledge of the relationship, we could develop a training intervention providing information about effective coping to improve individual resilience. Moreover, medical workers trained from hospitals have higher resilience. Resilience is supported at an organizational level by effective training and support, during an epidemic[25]. The variables that were associated with psychological distress were also associated with an inverse (protective) association with the perception of being adequately trained and supported by the hospital or clinic ( $\beta = -.20$ ,  $p = .03$ ) among Toronto hospital workers one to two years after the SARS outbreak[21].

Our data suggest that medical workers in the present study had a good resilience, active coping and a relatively low level of anxiety and depression. The respondents in this study had a mean CD-RISC score of  $67.04 \pm 13.22$  scoring higher for resilience than medical workers of other published Chinese study ( $59.50 \pm 12.77$ )[26]. Since the outbreak of SARS in 2003 and the Wenchuan earthquake in 2008, Chinese government pays unprecedented attention to health sector[27]. Substantial resources have been devoted to improving disaster resilience in China, with a particular emphasis on mitigating the impact of widespread infectious diseases and mass casualty incident. Adequate material and psychological support has been provided to front-line medical personnel from the state to the provinces. In addition, scores of anxiety and depression after the COVID-19 outbreak were similar to or lower than community incidence rates, which may indicate the resilience of medical workers who from other provinces to Wuhan after the COVID-19 outbreak. Furthermore, nurses' resilience scored ( $64.86 \pm 13.46$ ) lower on than doctors ( $73.48 \pm 11.49$ ) and other support staff ( $67.78 \pm 12.43$ ). Given the workload of nurses during the pandemic and the level of close contact with patients, the differences in resilience between nurses and other medical workers were not unexpected. In the 2008 Wenchuan earthquake, the resilience of nursing survivors was ( $57.57 \pm 21.13$ )[28]. The trend was for nurses to report higher psychiatric morbidity than administrative staff controls or doctors, which may lead to higher resilience among nurses[7 29]. This finding indicates that the resilience of nurses faced public health emergencies was improved, but also needs to be concerned.

We further found that there were significant differences in the resilience in terms of education, training and support from hospital, adequate preparation, and confidence to complete task. Our data show that a bachelor's degree has a higher resilience score than a master's degree or above, and a diploma degree ( $p < 0.05$ ). This is probably due to the sampling error that nearly 75% of our sample has a bachelor's degree. Future studies should expand the sample size to explore the impact of different education on the resilience of medical workers during the pandemic. In our data, training and support may bolster the resilience of medical workers who are at higher risk by virtue of their psychiatric history and fewer years of health care experience. Based on the knowledge that resilience following SARS was higher in health care workers who felt effectively trained and supported[25], the health system could develop a training intervention that provides information about the status of the epidemic and knowledge about infectious disease prevention, easing the fear and anxiety of supporting medical workers. Our study suggests that in addition to more training, it seems that more time should be left for support staff to be adequate prepared, which provides implications for future pandemics.

Last but not least, it is important to remember that many of the interventions adopted were not isolated, but were part of a package includes educating, informing and boosting the morale of the medical workers to enhance the confidence to complete the task during the outbreak.

### Limitations

First of all, all variables were evaluated using electronic questionnaires, which carries the risk of bias. Respondents may not want to report truthfully about negative aspects at their job for electronic rather than paper-and-pencil. Moreover, due to time and place limitations, the study included only the first-line of medical works from other provinces to Wuhan to support fighting against COVID-19, not the follow-up medical works. Therefore, this study failed to clarify the resilience level of this medical workers in different time periods and track its changes. Future research should employ a longitudinal design to test the level of resilience.

## Conclusions

In conclusion, this study may be the first report to describe resilience levels of medical workers from other provinces to Wuhan to support fighting against COVID-19 and to investigate the association between their resilience and mental-related variables. It is necessary to examine the resilience of medical workers for establishing a safe healthcare system to respond effectively when national disasters occur. The present findings suggest that efforts to enhance resilience should focus on different occupations and educational levels, provide training in knowledge and skills related to infectious diseases, and strengthen psychological assistance, so as to help medical workers fully prepare and enhance their confidence in the face of illness.

## Abbreviations

COVID-19: 2019 Novel Coronavirus Pneumonia; CD-RISC: Connor Davidson Resilience Scale; HADS: Hospital Anxiety Depression Scale; SCSQ: Simplified Coping Style Questionnaire.

## Declarations

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### Authors' contributions

YX-M contributed to experimental design. LJ and GH-J were the first-line nurses from Guangxi province to support Wuhan fighting against COVID-19, and assisted in the questionnaire survey with RY-H. CY and

HY-F were responsible for data collection, input, and analyses. RY-H drafted and revised the manuscript, to which YX-M contributed with significant knowledge and critical expertise. All the authors read and approved the final manuscript.

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None.

## **Availability of data and materials**

All data generated during this study are included in this published article.

## **Ethics approval and consent to participate**

Data collection commenced after obtaining ethical clearance from Guangxi Medical University Affiliated Tumor Hospital Ethics Committee (No:LW2020013). Participants were asked to read the purpose of the study and had to tick the box "I agree to participate" in order to enter the main survey. Respondents were allowed to withdraw consent at any time during the study.

## **Consent for publication**

Not Applicable.

## **Competing interests**

The authors have declared that no competing interests exist.

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