ORIGINAL RESEARCH

Mental Health Problems in Chinese Healthcare Workers Exposed to Workplace Violence During the COVID-19 Outbreak: A Cross-Sectional Study Using Propensity Score Matching Analysis

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Objective: This study aimed at examining the effect of medical workplace violence (MWV) on the mental health of Chinese healthcare workers during the outbreak of coronavirus disease 2019 (COVID-19).

Methods: An anonymous online survey was issued to Chinese healthcare workers (N=1063) from 31 provinces and autonomous regions between February 13th and February 20th. Mental health was measured by the Chinese Depression Anxiety Stress Scales-21 (DASS-21). Medical workplace violence was measured using a single item, whether any type of workplace violence was experienced during the COVID-19 outbreak. Propensity score matching was used to assess the impact of MWV on mental health.

Results: Out of 1063, 217 (20.4%) reported experiencing MWV during the COVID-19 outbreak. Before matching, MWV was correlated with elevated mental health problems (b=8.248, p<0.001), after adjusting for other variables. After matching, Chinese healthcare workers who experienced MWV were more likely to suffer from mental health problems than those who did not.

Conclusion: MWV exerts a detrimental effect on mental health among Chinese healthcare workers during the COVID-19 outbreak. It is necessary to create a more supportive and safer work environment for healthcare workers at this special context of the COVID-19 outbreak.

Keywords: workplace violence, mental health, COVID-19, propensity score

Introduction

Medical workplace violence has been recognized as one of the biggest public health concerns that disproportionately affect the health of healthcare workers and the smooth delivery of health care services.[1,2] The incidence rate of medical workplace violence (MWV) was repeatedly documented worldwide,[3–6] and a recent meta-analysis study revealed that the prevalence of MWV reached as high as 61.9%, especially in Asian countries.[7]

The ongoing Coronavirus Disease 2019 (COVID-19) pandemic has become a threat to the psychological health (depression, anxiety) of many people around the world.[8,9] Healthcare workers are at the frontline of the fight against COVID-19, which puts them at heightened risks of being infected. By the end of this investigation, nearly 3400 Chinese healthcare workers have contracted severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), along with 13 deaths.[10] The surge of confirmed cases, longer waiting

time-intervals, misinformation about SARS-CoV-2, and misplaced anger may be likely drivers of violence against healthcare workers.[11–13] An Indian study also showed that the COVID-19 pandemic stirred an upsurge of MWV, and incognizance and anxiety exacerbated by the pandemic may explain this phenomenon.[14]

MWV relates to a wide range of physical problems, including physical impairment, temporary or permanent disability, or even death.[15] On the other hand, the effects of MWV on the mental health of healthcare workers should not be ignored. Previous studies have consistently indicated positive links between workplace violence and mental health problems.[16,17] For instance, employees exposed to work-related threats and violence had a higher risk of depression than non-exposed employees.[18] Similarly, among healthcare workers, it exerted considerable negative impacts on their mental health, including anxiety, stress, and depression.[19–21] A recent study in China also found that healthcare workers who experienced workplace violence were more likely to suffer from depression and anxiety.[22]

The mental health problems not only affect the healthcare workers' decision-making capacity, but it may also have a lasting effect on their overall well-being.[23] Therefore, providing a safer workplace for healthcare workers is crucial for the continuity of their service and long-term health. Despite considerable exploration of the associations between MWV and mental health, no research to date has examined the effects of MWV on the mental health of healthcare workers in the context of the COVID-19 outbreak.

Most previous studies regarding MWV and mental health were observational. Their methodological limitations like selection bias would hinder the understanding of the relationship between MWV and mental health problems. Propensity score matching (PSM) is a useful analytic approach that can provide less biased findings when randomization fails or is impossible.[24] Therefore, this study aims to investigate the prevalence and the influence of MWV on mental health using PSM among Chinese healthcare workers during the COVID-19 outbreak.

Methods
Participants
A cross-sectional study was conducted among Chinese healthcare workers between February 13th and 20th, 2020, through electronic questionnaires from 31 provinces, municipalities, and autonomous regions in mainland

China. Relying on the authors' networks, a link or a quick response (QR) code of an online questionnaire was sent to Chinese healthcare workers through WeChat (similar to WhatsApp). Electronic informed consent was also obtained from all participants via WeChat.

Ethical approval for this study was obtained from the Medical Ethics Committee of Xuzhou Medical University.

Measures
Medical Workplace Violence
Medical workplace violence was measured using a single item (yes or no): "have you experienced any type of workplace violence during the COVID-19 pandemic, including physical, mental and verbal violence?"

Mental Health
The Chinese Depression Anxiety Stress Scales-21 (DASS-21)[25] was used to measure the symptoms of depression, anxiety, and stress. Each item was scored on a 4-point Likert scale (0 = did not apply to me at all, 3 = applied to me very much or most of the time). The composite score was multiplied by 2 to make it comparable to the DASS-42.[26] The total possible score ranges from 0 to 126, with higher scores representing more negative emotional states in the past week. The Cronbach's α coefficient of the scale in the current study was 0.94.

Control Variables
Control variables contained demographic information (age, gender, and education), job-related factors (job type, working time, working at a designated hospital for COVID-19, and adequacy of preventive medical equipment), interpersonal factors (experience discrimination for working in hospitals and household transmission-related fears) and social support. The 12-item perceived social support (PSS) scale[27] was applied to evaluate perceived social support from families, friends and significant others. Each item was rated on a 7-point Likert scale (1 = very strongly disagree, 7 = very strongly agree), with higher scores denoting greater perceived social support. The Cronbach's α coefficient of the scale in the current study was 0.94.

Statistical Analysis
Firstly, we compared control variables and mental health across workplace violence and non-workplace violence groups using Pearson's Chi-squared or *t*-test. Next, the ordinary least squares (OLS) model was applied to

examine the association between MWV and mental health problems, after adjusting for other covariates. Finally, to eliminate observed differences between the workplace violence and non-workplace violence groups, control variables were utilized to estimate the propensity score using 1:1 nearest neighbor matching (with replacement), 1:4 nearest neighbor matching (with replacement), caliper matching (width= 0.01), 1:4 caliper matching (width= 0.01), and kernel matching (width= 0.06). The average treatment effect on the treated (ATT) was estimated and reported in the current study. All statistical analyses were performed using Stata (version 12.0).

Results

In total, 1063 healthcare workers completed the questionnaire. 20.4% (217/1063) reported having experienced MWV during the COVID-19 pandemic. Healthcare workers who experienced MWV were significantly different from those who were not exposed to MWV in mental health problems and nearly all control variables, except education and job type (Table 1).

As shown in Table 2, MWV was correlated with elevated mental health problems (b = 8.248, p<0.001), after adjusting for other variables.

After matching, the standard bias of all control variables was less than 10.0%, and the p-value of LR Chi2 was larger than 0.05, suggesting a good balance of all matching (Table 3). Other details of balance check are summarized in Table 4. The post-matching comparisons using different methods revealed that none of the control variables remained statistically significant after the application of PSM. Sensitivity analysis indicated that the study becomes sensitive to hidden bias at Γ = 1.5 or 1.6 (Table 3); hence, further analysis controlling for additional biases is warranted.

As shown in Table 5, after matching, healthcare workers who reported MWV had higher levels of mental health problem (ATT =7.097–8.193, p<0.05) than those who did not.

Discussion

A review suggested that the COVID-19 pandemic resulted in unprecedented mental health hazards in the general population.[28] To our knowledge, this is the first study to examine the impact of MWV on the mental health of healthcare workers during the COVID-19 outbreak using PSM. Our findings indicated that Chinese healthcare workers exposed to MWV were more likely to have high levels

Table 1 Characteristics of Healthcare Workers Exposed to MWV Before PSM (N = 1063)

Variables	MWV		p value
	No (%) N=846	Yes (%) N=217	
Mental health problems	25.2	38.3	0.002
Age	34.2	33.4	0.039
Social support	65.5	61.7	0.008
Category			
Gender			0.019
Male	75.5%	24.5%	
Female	81.6%	18.4%	
Education			0.594
Junior college	75.0%	25.0%	
Bachelor	80.3%	19.7%	
Master or above	79.3%	20.7%	
Job type			0.171
Doctor	77.8%	22.2%	
Nurse	82.1%	17.9%	
Other	83.1%	16.9%	
Working at a designated hospital			0.036
Yes	77.3%	22.7%	
No	82.6%	17.4%	
Working time (hours/day)			< 0.001
≤ 8	84.9%	15.1%	
> 8	74.0%	26.0%	
Adequacy of preventive medical equipment			0.014
Enough or basically enough	81.8%	8.2%	
Insufficient	78.9%	21.1%	
Scarce	66.7%	33.3%	
Discriminated against for nature of their job			< 0.001
No	82.1%	17.9%	
Yes	69.2%	30.8%	
Household transmission-related fears			0.023
Yes	87.7%	12.3%	
No	78.6%	21.4%	

Abbreviations: MWV, medical workplace violence; PSM, propensity score matching.

of mental health problems (including depression, anxiety and stress symptoms).

Our study found that the prevalence of workplace violence toward healthcare workers (mainly doctors and nurses) was relatively lower (20.4%) than rates reported by previous studies in China (ranging from 59.64% to

Table 2 Association Between MWV and Mental Health Problems: Based on OLS

Variables	Coefficient	SE
MWV (ref: No)	8.248***	1.518
Social support	−0.599***	0.054
Age	−0.038	0.085
Gender (ref: Female)	−0.387	1.360
Education (ref: Junior college)		
Bachelor	0.301	2.598
Master or above	−0.092	2.778
Job type (ref: Doctor)		
Nurse	−2.174	1.773
Other	1.058	1.729
Working time (ref: ≤ 8 hours/day)	5.179***	1.227
Working at a designated hospital (ref: No)	2.332+	1.232
Household transmission-related fears (ref: No)	1.286	1.955
Discriminated against for nature of their job (ref: No)	6.665***	1.551
Adequacy of preventive medical equipment (ref: Enough or basically enough)		
Insufficient	3.370**	1.280
Scarce	9.914***	2.336
Intercept	58.06***	5.970
R^2	0.231	-
N	1061	-

Note: ***$p<0.001$, +$p<0.1$.
Abbreviations: MWV, medical workplace violence; OLS, ordinary least squares.

Table 3 Results of Balance Check and Sensitivity Analysis

Method	Index	
1:1 Nearest neighbor matching	Pseudo R^2	0.011
	Mean of bias (%)	4.800
	LR chi2 (p value)	0.923
	N (pairs)	217
	Rosenbaum bound	1.5
1:4 Nearest neighbor matching	Pseudo R^2	0.004
	Mean of bias (%)	3.200
	LR chi2 (p value)	1.000
	N (pairs)	217
	Rosenbaum bounds	1.5
Caliper matching	Pseudo R^2	0.009
	Mean of bias (%)	4.200
	LR chi2 (p value)	0.968
	N (pairs)	217
	Rosenbaum bounds	1.6
1:4 Caliper matching	Pseudo R^2	0.005
	Mean of bias (%)	2.700
	LR chi2 (p value)	0.998
	N (pairs)	217
	Rosenbaum bound	1.5
Kernel matching	Pseudo R^2	0.001
	Mean of bias (%)	2.000
	LR chi2 (p value)	1.000
	N (pairs)	217
	Rosenbaum bound	1.5

76.2%)[29,30] and other countries, such as Israel (58.4%)[31] and Australia (71.0%).[32] The extant research typically investigated the experience of exposure to MWV in the past year, but we only surveyed MWV experience during an approximately one-month period of the outbreak, which may provide some explanations for the difference.

Both OLS and PSM revealed that MWV was an independent risk factor for mental health problems among Chinese healthcare workers. Healthcare workers reporting MWV experience were more likely to suffer from depression, anxiety and stress symptoms than those who did not. Similarly, a substantial part of the literature has found that workplace violence may increase the prevalence of anxiety and depression among healthcare workers.[17,33–35] In the context of the COVID-19 outbreak, exposure to violence may further exacerbate the already unprecedented COVID-19-related stress and burnout that healthcare workers are experiencing.[13] Consequently, exposure to violence has detrimental effects on healthcare workers' mental health. Hence, it must be prevented and condemned, and creating a more

supportive and safer working environment for healthcare workers at this time is particularly helpful.

Effective interventions at a national, hospital and individual levels should be taken to address MWV. For example, the government should issue strict, permanent, and strongly enforce legislation to protect healthcare workers from violence, signals the government's "zero tolerance" concerning MWV.[36] Hospital administration should invest in health security measures, like improving an orderly medical system, optimizing the process of consultation, classifying the management of disease, establishing security patrols, and installing cameras.[22] In addition, telemedicine has been critical during the COVID-19 pandemic, as it has the potential to continue a "normal" job for healthcare workers and avoid MWV.[37] In terms of healthcare workers, staff training for improving communication skills can improve empathetic care and patient-healthcare worker relationship which in turn may minimize MWV.

Our results also revealed that low levels of social support, long working time, working at a designated hospital, discrimination experience, and scarcity of preventive medical equipment were related to increased mental health

Table 4 Results of Balance Check

	Before Matching	1:1 Nearest Neighbor Matching	1:4 Nearest Neighbor Matching	Caliper Matching	1:4 Caliper Matching	Kernel Matching
	SB (t)	SB (t)	SB (t)	SB (t)	SB (t)	SB (t)
Social support	−31.10 (−4.32***)	-9.10 (-0.95)	-3.10 (-0.31)	-5.40 (-0.57)	0.10 (0.01)	-2.50 (-0.25)
Gender (ref: Female)	17.70 (2.36*)	-6.80 (-0.68)	0.90 (0.09)	-2.10 (0.20)	2.20 (0.22)	0.50 (0.05)
Age	−11.00 (−1.41)	4.40 (0.48)	−0.10 (−0.01)	1.00 (0.10)	−0.50 (−0.06)	1.70 (0.18)
Education (ref: Junior college) Bachelor	−4.90 (−0.65)	-7.40 (-0.77)	−2.70 (−0.28)	−5.00 (−0.50)	−1.20 (−0.12)	2.40 (0.24)
Master or above	1.60 (0.21)	2.80 (0.30)	6.80 (0.71)	2. 00(0.20)	1.80(0.19)	-1.10(-0.11)
Working time (ref: ≤8 hours/day)	34.20 (4.46***)	-1.90 (0.20)	3.50(0.36)	-2.00 (0.20)	3.70 (0.37)	4.10 (0.42)
Working at a designated hospital (ref: No)	16.20 (2.10*)	6.60 (0.70)	2.60 (0.27)	8.10 (0.81)	1.20 (0.12)	1.10 (0.11)
Household transmission-related fears (ref: No)	18.80 (2.29*)	1.60 (0.19)	2.80 (0.33)	1.70(-0.19)	3.60 (0.39)	0.40 (0.04)
Discriminated against for nature of their job (ref: No)	29.70 (4.14***)	-4.40 (-0.42)	6.40 (0.62)	-2.40(-0.23)	2.90 (0.28)	2.90 (0.28)
Adequacy of preventive medical equipment (ref: Enough or basically enough) Insufficient	3.30(0.44)	-2.90 (-0.29)	-1.60 (-0.17)	2.00 (0.20)	-0.40 (-0.04)	3.50 (0.36)
Scarce	20.80 (3.00**)	−11.1 (−0.98)	−6.80 (−0.61)	−17.00 (−0.160)	-15.2 (−1.44)	-3.30 (-0.32)
Job type (ref: Doctor) Nurse	−8.60 (−1.11)	−2.20 (−0.24)	−3.70 (−0.39)	−4.80 (−0.49)	−2.00 (−0.20)	−1.60 (−0.17)
Other	−9.10 (−1.17)	-1.30 (-0.14)	-0.30(-0.03)	−0.30 (−0.03)	-0.30 (-0.03)	−0.90 (−0.09)

Note: ***P<0.001, *P<0.05.

Table 5 The Effect of MWV on Mental Health Problems

Treatment	Matching	Coefficient	SE	p value
MWV	1:1 Nearest neighbor matching	7.343	2.978	0.014
	1:4 Nearest neighbor matching	7.546	2.340	0.001
	Caliper matching	8.193	2.653	0.002
	1:4 Caliper matching	7.677	2.287	0.001
	Kernel matching	7.097	1.999	< 0.001

Abbreviation: MWV, medical workplace violence.

problems among healthcare workers during the COVID-19 outbreak. With the surge of confirmed and suspected cases, healthcare workers are obliged to overwork to meet health requirements, which may result in mental exhaustion.[23,38] Providing social support, as well as creating a safe working environment through logistical support, nondiscrimination, an arrangement of adequate rest would appear to alleviate their psychological pressure.

Limitations

Several limitations should be noted in the current study. First, this was a cross-sectional study. Hence, the causal relationship between MWV and mental health cannot be established. Second, despite the efforts to recruit participants from 31 provinces, municipalities, and autonomous regions in mainland China, non-random sampling of healthcare workers limits generalizability of our findings. Third, MWV was measured as a binary variable using unvalidated scales. Additionally, data on different types of violence should be collected in future research. Fourth, PSM cannot control unobserved confounders. Last, sensitivity analysis indicated that the study was sensitive to hidden bias; hence, further research should include other important variables.

Conclusions

In summary, despite the relatively low occurrence of MWV among Chinese healthcare workers during the COVID-19 outbreak, healthcare workers who experienced MWV were more likely to suffer from mental health problems than those who did not. Providing safer workplace for healthcare workers should be urgently prioritized. Once healthcare workers experience violence, it is vital to focus on their emotional reactions to attenuate the detrimental effects of MWV on their mental health. Future longitudinal studies with a nationally representative sample would verify the causal relationship between MWV and the mental health of healthcare workers.

Data Sharing Statement

Data obtained for the study will not be made available to others.

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Disclosure

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