Associations of neighborhood-level workplace violence with workers' mental distress problems: a multilevel analysis of Taiwanese employees

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Abstract: Associations of neighborhood-level workplace violence with workers' mental distress problems: a multilevel analysis of Taiwanese employees: Li-Chung PIEN, *et al.* Institute of Health Policy and Management, College of Public Health, National Taiwan University, Taiwan—**Objective:**

Workplace violence is known to pose mental health risks. However, whether or not workplace violence in a surrounding area might further increase the risk of mental distress in workers has rarely been examined.

Methods: The study subjects were 9,393 male and 7,716 female employees who participated in a nationwide survey in 2010. Their personal experiences of workplace violence over the past 1 year were ascertained by a standardized questionnaire. Also assessed were their psychosocial work characteristics and mental distress problems. Neighborhood-level workplace violence was computed based on aggregated data at the county level and was categorized into low-, medium-, and high-level categories. Multilevel logistic regression models were constructed to examine the associations between neighborhood-level workplace violence and individual-level mental distress problems, with adjustment of individual-level experience of workplace violence. **Findings:** The neighborhood-level prevalence of workplace violence ranged from 4.7 to 14.7% in men and from 6.4 to 14.8% in women across 22 counties. As compared with those who live in counties of the lowest tertile of workplace violence, female workers who lived in counties of the highest tertile of workplace violence had a 1.72-fold increased risk for mental distress problems after controlling for individual experi-

ence of workplace violence and other psychosocial work characteristics. **Conclusion:** Neighborhood-level workplace violence was associated with poor mental health in female workers. Preventative strategies targeting workplace violence should pay attention to neighborhood factors and gender-specific effects that might influence societal tolerance of abusive work practices and workers' vulnerability to mental health impacts of workplace violence.

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Key words: Mental health, Multi-level analysis, Workplace violence

Workplace violence is a growing mental health concern^{1,2}. According to the International Labor Organization (ILO), World Health Organization (WHO), International Council of Nurses (ICN), and Public Services International (PSI), workplace violence is defined as “incidents where staff are abused, threatened or assaulted in circumstances related to their work, including commuting to and from work, involving an explicit or implicit challenge to their safety, well-being or health”. Besides physical violence, violent incidents in workplace can also be psychological, such as verbal abuse, harassment, bullying/mobbing, and threat³.

In epidemiologic studies, workplace violence is often classified into the following four types: physical violence, verbal violence, psychological violence, and sexual harassment^{4–6}. In a survey conducted in the United States, 0.4% of workers reported having experienced multiple forms of nonfatal workplace violence over the past year⁷. In a Dutch survey, 24% employees were found to have experienced workplace violence in the past year⁸. According to the Fifth

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European Working Conditions Survey (EWCS) of 2010, 11% of workers reported having been subjected to verbal violence during the month before the survey. In the same survey, the prevalences of employees who reported being bullied, experiencing physical violence, and being sexually harassed were 4%, 2%, and 1%, respectively. Investigation in Hong Kong showed that the prevalence of workplace violence injuries increased from 1998 of 0.26 per 1,000 employees in 1998 up to 0.39 in 2007⁹. All these studies indicated that workplace violence is an important occupational health issue.

In addition to immediate physical harms, victims of workplace violence are also found to have greater risks for mental health problems, including anxiety, depression, stress disorders, poor sleep, sleep disorders, and sickness absence^{10–17}. Some studies further indicated that workplace violence could lead to serious post-traumatic stress disorder (PTSD)¹³. Furthermore, workplace violence has also been found to cause job stress, job dissatisfaction, work-related burnout, turnover, and intention to leave^{8, 9, 13}. Regarding work organizations, negative impacts of workplace violence on work organizations have been documented, including increased interpersonal conflicts, reduced work morale, deteriorated work performance, and increased costs associated with workers' compensation and corporate administrative expenses^{9, 15, 18, 19}.

Previous studies showed that residents living in a violent neighborhood were prone to mental disorders including depression and anxiety disorders²⁰. While experiences of workplace violence are known to pose mental health risks in affected workers, little research has been conducted to examine whether or not working in a violent area or neighborhood where aggressive behaviors more prevalent entails additional mental health risks for workers, regardless of the workers' actual experiences of workplace violence. There are potentially multiple possible reasons for increased mental health risks when working in a violence-prone environment. First, workers who witness or hear of workplace violence might also feel threatened and anxious. Second, a high prevalence of workplace violence can be seen as an indicator of an unsafe working environment in which the safety and mental health well-being of employees are not considered as a major issue by the management. Employees working in such a social environment would be more likely to develop mental distress problems. While gender differences have been noticed in previous studies showing that women were more susceptible than men in developing mental distress when exposed to a violent living environment^{21–24}, to our knowledge, there has been no investigation concerning gender differences in the effects of area-level workplace

violence on workers' mental health risks.

In this study, we utilized data from a national survey of the general working population in Taiwan to examine the prevalence of workplace violence by neighborhood and to examine the associations between neighborhood-level workplace violence and individual-level mental distress status by gender, with adjustment of individual-level experience of workplace violence.

Methods

Study population and procedures

The Ministry of Labor of Taiwan has conducted nationwide surveys of the working population every 3–5 years since 1994. The subjects for the present study were participants in a cross-sectional survey conducted in September 2010. In this survey, a representative sample of employees in Taiwan was selected by a two-stage random sampling process. In the first stage, all districts and villages throughout Taiwan were grouped into 23 urbanization levels. A sample of districts and villages was randomly selected from each level. In the second stage, a random sample of households was selected within each district or village, and residents of the sampled households who were currently working at the time of the survey were identified and invited to participate in the survey.

Self-administered questionnaires were delivered to each selected households by trained interviewers. Within 1 week, the same interviewer visited the household to collect the completed questionnaires, with on-site checking. A total of 28,077 subjects were sampled, and 24,427 (87%) of them agreed to participate and completed the questionnaires. The subjects included 17,286 employees and 7,141 employers and self-employed workers combined. In this study, we restricted the sample to employees who were in the age range between 25 and 65 years in consideration of the fact that working conditions of workers in this age range are stable. More information with regard to the sampling process and survey procedures can be found elsewhere^{25, 26}.

Assessment of workplace violence and mental distress problems

With a standardized questionnaire, study participants were asked if they had ever experienced any of the following four types of workplace violence during the 12 months prior to the survey: physical violence (such as beating, kicking, pushing, pinching, pulling, etc.), verbal violence (such as abusive language, verbal harassment, cynical comments, etc.), psychological violence (such as threats, intimidation, discrimination, exclusion, bullying, harassment, etc.), and sexual harassment (such as sexually suggestive and inappropriate behavior). For each type, one item was used,

and the answer was dichotomized into “yes” and “no” categories.

The presence of mental distress problems was assessed by one item, in which participants were asked how often they had experienced anxiety, depression, or strongly disturbed moods during the 12 months prior to the survey, and the answer was also dichotomized into “yes” and “no” categories.

Compositional variables

Compositional variables consisting of a range of work characteristics, including work shift, working hours, job control, psychological job demands, physical job demands, and employment insecurity were assessed by the questionnaire. Work shift was assessed by asking the study participant if he/she was on a fixed day shift, fixed night shift, or rotated shift during the week of the survey. The answers were categorized into two types: fixed day shift vs. night or rotated shift. Average working hours per week were measured by adding up all working hours during the week prior to the day of the survey. Psychosocial job characteristics were assessed by the Chinese version of Karasek's Job Content Questionnaire (C-JCQ), which included 3 items for job control scale (learning new things, non-repetitive work, allow own decision) and 5 items for psychological work demands (work fast, excessive work, insufficient time, concentrate on job for long time, hectic work)²⁷⁾. The JCQ is based on the Demand-Control model, which postulates that high demands and low job control at work will lead to a higher risk of stress-related health problems. Information regarding the psychosocial properties of the C-JCQ can be found elsewhere²⁸⁾. In this study, the Cronbach's α values for the job control scale were 0.375 for men and 0.381 for women, and those for the psychological work demands scale were 0.563 for men and 0.634 for women. Levels of workplace justice were assessed by a 7-item scale (trust employees, information reliable, work duties and responsibilities fairly arranged, benefits and welfare fairly arranged, performance fairly evaluated, information sufficient, employees being treated with respect). Its Cronbach's α values were 0.944 for men and 0.944 for women. Responses to the items for job control, psychological work demands, and workplace justice were recorded on a four-point Likert scale, ranging from 1 (strongly disagree) to 4 (strongly agree). The full statements, calculation formulas, and psychometric properties for job control, psychological job demands, employment security, and workplace justice can be found elsewhere²⁹⁾.

In addition, there was 1 item—my job security is good—for the assessment of employment security, and 1 item—my job is physically demanding—for the

assessment of physical demands. The responses to these items were dichotomized for analyses. Other information such as gender, age, educational level, and workplace (county) were also obtained by the questionnaire.

Contextual variable

Neighborhood-level of workplace violence was computed based on aggregated data by county or city. There are a total of 23 counties and cities in Taiwan, with populations ranging from 230,673 to 3,897,367. The cities and counties were classified into low-, medium-, and high-level neighborhood violence categories based on the aggregated level of workplace violence.

Statistical analysis

We excluded subjects who did not complete items for the assessment of workplace conditions ($n=40$). Subjects in the Penghu County were also excluded, taking into consideration that the size of this subgroup was small (84 males and 53 females) and the fact that Penghu County is a small offshore island where working conditions are dramatically different from those in Taiwan. This resulted in a final sample size of 17,109 employees (9,393 males and 7,716 females).

Descriptive statistical analyses and individual level logistic regression were performed with SAS 9.3, while multilevel logistic regression analyses were performed using HLM software version 7. All analyses were stratified by gender, taking into consideration that adverse psychosocial work factors and mental distress problems are known to differ by gender and that gender-specific factors such as coping behaviors, social roles, family burdens, and socioeconomic conditions may alter the exposure-outcome associations.

Descriptive statistics were performed to summarize the sociodemographic characteristics, mental distress problems, and work conditions of the study population. Multivariate logistic regression analyses were applied to explore the associations of the experience of workplace violence with mental distress problems. Controlled in the models were demographic and work-related variables that have been documented in previous literature to be associated with mental health outcomes. Scores for job control, psychological work demands, and workplace justice were treated as continuous variables, and other work factors such as shift work, long working hours, employment insecurity, and physical work demands were treated as dichotomized variables in logistic regression models.

Due to the hierarchical structure of the data, we employed a two-level random-effect logistic regression analysis³⁰⁾ with data from individual employees (9,393 males and 7,716 females) in the first level and

data from counties in the second level ($n=22$). This approach allowed us to account for level variations and to estimate the variance for the parameter of interest. First, an empty model was constructed to assess whether or not the prevalence of mental distress problems among employees varied from county/city to county/city. Next, we added several compositional variables into the empty model to examine their effects on mental distress problems among employees. Finally, we used the intercept as outcome statistical model and added the contextual variable (levels of workplace violence prevalence) to the model.

Results

Table 1 displays the distribution of selected compositional variables of the studied population. The mean ages were 40.9 and 39.3 years old in men and women, respectively, and the average working hours were 43.3 and 42.8 hours per week in men and women, respectively.

The prevalence rates of workplace violence in the last 12 months in men and women were as follows: 6.9 and 7.6% for verbal violence, 3.4 and 4.1% for psychological violence, 0.8 and 0.5% for physical violence, and 0.4 and 1.7% for sexual harassment.

Table 1. Demographic characteristics, job characteristics, and prevalence of workplace violence and emotional distress in both genders ($N=17,109$)

Variable	Men ($n=9,393$)		Women ($n=7,716$)	
	n	%/SD	n	%/SD
Demographic characteristics				
Age (years): mean (SD)	40.9	10.0	39.3	9.7
Education level				
Junior high and below	1,957	20.8	1,354	17.6
Senior high	4,746	50.5	3,866	50.1
University and above	2,690	28.6	2,496	32.4
Work shift				
Fixed day shift	7,129	75.9	6,120	79.3
Night/rotated shift	2,264	24.1	1,596	20.7
Working hours/week: mean (SD)	43.3	8.9	42.8	7.9
≤ 48 hours	8,106	86.3	6,881	89.2
> 48 hours	1,287	13.7	835	10.8
Job control: mean (SD)	20.7	3.4	20.3	3.4
Missing	27	0.29	18	0.23
Psychological work demands: mean (SD)	12.9	1.8	12.9	2.0
Missing	29	0.31	27	0.35
Workplace justice: mean (SD)	19.8	3.7	19.8	3.8
Physical job demand				
Yes	5,409	57.6	3,459	44.8
No	3,975	42.3	4,249	55.1
Missing	9	0.09	8	0.10
Employment security				
Yes	5,025	53.5	3,955	51.3
No	4,361	46.4	3,757	48.7
Missing	7	0.07	4	0.05
Any type of violence (yes/no)	757	8.1	730	9.5
Verbal violence (yes/no)	643	6.9	582	7.6
Psychological violence (yes/no)	321	3.4	316	4.1
Physical violence (yes/no)	77	0.8	37	0.5
Sexual harassment (yes/no)	36	0.4	132	1.7
Emotional distress (yes/no)	1,814	19.3	2,137	27.7

Table 2. Prevalence of workplace violence¹ by area in male and female employees

Area (county/city)	Male						Female					
	N	At least one type: n (%) and level ²	PV: n	VV: n	PSV: n	SH: n	N	At least one type: n (%) and level ²	PV: n	VV: n	PSV: n	SH: n
Total	9,393	757 (8.1)	77	643	321	36	7,716	730 (9.5)	37	582	316	132
Taipei county	1,071	78 (7.3) M	5	64	32	7	744	51 (6.9) L	2	38	21	9
Yilan county	235	11 (4.7) L	0	10	3	0	212	23 (10.9) M	3	19	8	5
Taoyuan county	788	52 (6.6) L	6	44	18	1	596	73 (12.3) H	4	54	30	21
Hsinchu county	238	18 (7.6) M	2	14	8	2	188	24 (12.8) H	0	19	8	7
Miaoli county	277	23 (8.3) M	2	21	12	1	175	21 (12.0) H	2	15	10	8
Taichung county	572	36 (6.3) L	3	33	5	1	423	27 (6.4) L	1	23	10	4
Changhua county	413	28 (6.8) L	6	20	14	1	322	29 (9.0) M	2	28	17	4
Nantou county	163	20 (12.3) H	2	15	8	2	151	19 (12.6) H	1	18	11	2
Yunlin county	251	37 (14.7) H	5	33	12	3	169	25 (14.8) H	1	16	13	2
Chiayi county	153	18 (11.8) H	1	12	12	0	140	10 (7.1) L	0	9	2	0
Tainan county	455	37 (8.1) M	3	29	21	1	392	30 (7.7) L	3	20	15	0
Kaohsiung county	413	37 (9.0) M	4	32	14	2	285	27 (9.5) M	3	21	9	4
Pingtung county	333	25 (7.5) M	3	21	8	0	269	18 (6.7) L	1	9	5	5
Taitung county	132	11 (8.3) M	3	11	6	2	102	8 (7.8) M	1	7	4	1
Hualien county	181	13 (7.2) L	3	13	9	1	147	20 (13.6) H	2	18	9	6
Keelung city	187	17 (9.1) H	1	15	11	3	123	14 (11.4) M	0	13	8	3
Hsinchu city	430	28 (6.5) L	1	25	15	0	325	34 (10.5) M	0	28	19	10
Taichung city	528	32 (6.1) L	4	30	10	0	505	31 (6.1) L	2	23	16	2
Chiayi city	174	18 (10.3) L	1	16	5	0	177	13 (7.3) L	0	12	4	2
Tainan city	433	45 (10.4) L	3	39	21	1	434	52 (12.0) H	1	43	20	6
Taipei city	1,337	109 (8.2) M	10	92	48	3	1,359	126 (9.3) M	7	104	51	23
Kaohsiung city	629	64 (10.2) H	9	54	29	5	478	55 (11.5) M	1	45	26	8

¹Type of workplace violence: PV, physical violence; VV, verbal violence; PSV, psychological violence; SH, sexual harassment. ²Level of workplace violence: L, low; M, medium; H, high.

Table 3. Individual-level and county-level predictors of emotional distress: individual-level and multilevel models (male employees)

	Model with compositional variables only			Model with compositional and contextual variables			Model with compositional and contextual variables		
	OR	(95% CI)	<i>p</i> value ¹	OR	(95% CI)	<i>p</i> value ¹	OR	(95% CI)	<i>p</i> value ¹
Level 1									
Intercept 1	0.110	(0.085, 0.141)***		0.125	(0.097, 0.161)***		0.109	(0.085, 0.140)***	
Individual-level workplace violence (yes/no)	3.294	(2.792, 3.886)***		3.311	(2.805, 3.908)***		3.307	(2.800, 3.906)***	
Age 25–34	1			1			1		
Age 35–44	1.316	(1.209, 1.432)***		1.318	(1.211, 1.434)***		1.317	(1.210, 1.433)***	
Age 45–54	1.395	(1.270, 1.532)***		1.398	(1.273, 1.536)***		1.397	(1.272, 1.534)***	
Age 55–65	1.053	(0.838, 1.323)		1.055	(0.841, 1.324)		1.053	(0.839, 1.323)	
Shift work (yes/no)	1.138	(1.056, 1.226)***		1.139	(1.057, 1.227)***		1.139	(1.057, 1.227)***	
Working hours >48 hours (yes/no)	1.153	(0.999, 1.330)		1.151	(0.997, 1.328)		1.151	(0.997, 1.329)	
Job control (continuous)	1.088	(1.032, 1.148)**		1.089	(1.032, 1.148)**		1.089	(1.032, 1.148)**	
Psychological work demands (continuous)	1.252	(1.214, 1.290)***		1.252	(1.214, 1.290)***		1.252	(1.214, 1.290)***	
Employment insecurity (yes/no)	1.168	(1.004, 1.359)*		1.168	(1.003, 1.360)*		1.168	(1.003, 1.360)*	
Physical job demands (yes/no)	0.894	(0.773, 1.034)		0.895	(0.775, 1.034)		0.895	(0.774, 1.035)	
Workplace justice (continuous)	0.930	(0.912, 0.948)***		0.930	(0.912, 0.948)***		0.930	(0.912, 0.948)***	
Level 2									
Workplace violence low (reference)				1					
Workplace violence medium				0.961	(0.648, 1.426)				
Workplace violence high				0.705	(0.474, 1.050)				
Workplace violence (every 10% increase)							0.606	(0.292, 1.256)	
Variance component	0.151***			0.148***			0.149***		
ICC	0.151/(0.151 + 3.29)=0.044			0.148/(0.148 + 3.29)=0.043			0.149/(0.149 + 3.29)=0.043		

¹: **p*<0.05; ***p*<0.01; ****p*<0.001.

In total, 8.1% of men and 9.5% of women had been exposed to at least one of the four types of workplace violence. As shown in Table 2, there were substantial regional variations in the prevalence of any type of workplace violence across the 22 counties/cities, ranging from 4.7 to 14.7% in men and from 6.4 to 14.8% in women (Table 2).

The results of the multilevel analyses for men and women are shown in Tables 3 and 4. The intra-class correlation coefficient (ICC) was defined as the between-neighborhood variance divided by the within-neighborhood variance plus the between-neighborhood variance. Gender-specific analyses were conducted, and the ICC values of the null models were 3.5% in male subgroup and 2.9% in female subgroup, both reaching the level of statistical significance (*p*<0.001). The results indicated that there were significant regional differences in mental distress problems. In the models that included only compositional variables,

significant predictors for mental distress problems in both genders included the following: individual's experience of workplace violence, age in the range of 35–54 years old as compared with those in the age range of 25–34 years old, shift work status, low job control, high work demands, employment insecurity, and low workplace justice. It is clear that individual experience of workplace violence was the most significant predictor for mental distress problems in both men and women, with odds ratios of 3.66 and 3.25, respectively (Tables 3 and 4).

When neighborhood-level workplace violence was taken into account, noticeable reductions in statistical model variance components (in men from 0.154 to 0.138 and in women from 0.104 to 0.045) and in ICCs (in men from 0.045 to 0.040 and in women from 0.031 to 0.013) were found, indicating that neighborhood-level workplace violence contributed to the risk of mental distress problems. In particular, female workers who

Table 4. Individual-level and county-level predictors of emotional distress: individual-level and multilevel models (female)

	Model with compositional variables only			Model with compositional and contextual variables			Model with compositional and contextual variables		
	OR	(95% CI)	<i>p</i> value ¹	OR	(95% CI)	<i>p</i> value ¹	OR	(95% CI)	<i>p</i> value ¹
Level 1									
Intercept 1	0.264	(0.166, 0.418)***		0.185	(0.121, 0.284)***		0.265	(0.174, 0.403)***	
Individual-level workplace violence (yes/no)	2.945	(2.400, 3.614)***		2.921	(2.378, 3.588)***		2.924	(2.381, 3.592)***	
Age 25–34	1						1		
Age 35–44	1.178	(1.027, 1.352)*		1.179	(1.027, 1.353)*		1.178	(1.027, 1.352)*	
Age 45–54	0.970	(0.842, 1.117)		0.969	(0.840, 1.118)		0.968	(0.839, 1.116)	
Age 55–65	0.839	(0.631, 1.116)		0.841	(0.632, 1.119)		0.840	(0.631, 1.118)	
Shift work (yes/no)	1.155	(1.030, 1.296)*		1.155	(1.028, 1.297)*		1.154	(1.028, 1.294)*	
Working hours >48 hours (yes/no)	0.979	(0.736, 1.303)		0.978	(0.734, 1.304)		0.980	(0.736, 1.305)	
Job control (continuous)	1.096	(1.052, 1.142)***		1.096	(1.052, 1.142)***		1.096	(1.052, 1.142)***	
Psychological work demands (continuous)	1.255	(1.216, 1.297)***		1.256	(1.215, 1.297)***		1.256	(1.215, 1.297)***	
Employment insecurity (yes/no)	1.014	(0.904, 1.137)		1.015	(0.905, 1.138)		1.015	(0.905, 1.139)	
Physical job demands (yes/no)	1.012	(0.886, 1.155)		1.013	(0.887, 1.156)		1.012	(0.886, 1.156)	
Workplace justice (continuous)	0.930	(0.914, 0.946)***		0.930	(0.914, 0.946)***		0.930	(0.914, 0.946)***	
Level 2									
Workplace violence low (reference)				1					
Workplace violence medium				1.636	(1.276, 2.098)***				
Workplace violence high				1.749	(1.270, 2.410)**				
Workplace violence (every 10% increase)							2.154	(1.123, 4.132)*	
Variance component	0.108**			0.047**			0.068**		
ICC	0.108/(0.108 + 3.29)=0.032			0.047/(0.047 + 3.29)=0.014			0.068/(0.068 + 3.29)=0.020		

¹. **p*<0.05; ***p*<0.01; ****p*<0.001.

lived in counties of the highest tertile of workplace violence had a 1.72-fold increased risk of mental distress problems as compared with those who lived in counties of the lowest tertile of workplace violence, after controlling for individual experience of workplace violence and other work characteristics. However, no association was found in men.

Discussion

While it is known that the experience of workplace violence constitutes a mental health risk in affected workers^{10, 13, 15–17, 31–34}, the results of the present study further suggest that a higher level of neighborhood-level workplace violence was associated with an additional increased risk of mental distress problems in female workers but not male workers. Gender differences may be due to a greater susceptibility of women to violent external environment as reported in previous studies^{21–24}.

The findings of this study suggest that the preva-

lence of workplace violence in Taiwan was not as high as in western societies. Nevertheless, direct comparisons of the level of workplace violence across countries and studies should be made with caution, because workplace violence might be defined and assessed quite differently. Furthermore, social awareness of workplace violence, which varies across cultures and societies, may also affect how this problem is defined and reported^{4, 5}. Especially for the types of verbal violence, psychological violence and sexual harassment, the measures would be subject to great variations due to social and cultural factors. However, in terms of the types of workplace violence, verbal violence and psychological violence were more prevalent than other types, which was consistent with findings from western countries^{5, 9, 18}. The reason for a higher risk of workplace violence in women than in men, as found in previous studies, is perhaps due to the disadvantaged working and socioeconomic conditions among female workers, which render them

relatively lower levels of social resources^{35, 36}). With regard to the uneven distribution in the levels of workplace violence across the occupational spectrum and regions, differences in industry structure, work conditions, and work cultures could be the causes of the differences⁴).

There were some limitations in this study. First, the nature of the cross-sectional study design precluded direct casual interpretation between workplace violence and the risk of mental health problems. Reverse causality cannot be ruled out. For instance, employees with mental health problems may be more vulnerable to becoming victims of workplace violence. In addition, there is a possibility that workers with a poor mental health status may over-interpret or over-estimate the problems of workplace violence. Future research should adopt a longitudinal study design to examine how the experience of workplace violence may deteriorate workers' mental health status, taking into account workers' personality traits or other confounders.

Second, the assessment of workplace violence in this study was rough and based on self-report. Because no further explanations were given and participants may perceive or interpret workplace violence differently, the validity of these measures may be questionable. Furthermore, despite the fact that four types of workplace violence were specified, the severity, frequency, and sources of workplace violence were not assessed. In contrast, studies from other countries such as the EU and the U.S. distinguished workplace violence arising inside the work organization (including supervisors and colleagues) from that arising outside the work organization (including clients, customers, and strangers)^{5, 9, 37}). The perception of workplace violence, especially for the types of psychological violence and sexual harassment, may also be influenced by respondents' subjective attitudes, which will also affect whether individuals evaluate problems as stressful or not¹⁴). Improvement in the measurement and classification of workplace violence as well as assessment of individual perceptions will be essential for the identification of leveraging points for interventions. We recommend that future research should obtain information concerning the sources, frequency, severity, and nature of workplace violence in a more objective manner, as well as information concerning participants' attitudes and perceptions toward different types of workplace violence.

Third, although potential confounding factors including age, shift work status, working hours, and work-related characteristics were controlled in our statistical models, there are still other potential work-related factors and individual characteristics (such as socioeconomic status, occupational status, social

support, or resources)^{38–40}) that could confound or modify the associations between workplace violence and mental health status of workers. Gender differences in the distribution of uncontrolled confounders might explain why a higher level of neighborhood-level workplace violence was associated with an additional risk of mental distress among female workers but not male workers.

Furthermore, neighborhood-level workplace violence was defined by aggregated data based on the administrative unit of "city or county", which may not reflect participants' real-life experiences in the community. Finally, the Cronbach's alpha value for the internal consistency of the measures for job control and psychological work demands in this study were low, because only a limited number of items were used.

Despite of the abovementioned limitations, the results of this study are still important because they indicate that working in a neighborhood where workplace violence is prevalent would increase the risk of mental health problems in female workers after controlling for their actual experiences of workplace violence. We suggest that preventative strategies targeting workplace violence should pay attention to neighborhood factors as well as gender-specific effects that might influence societal tolerance to abusive work practices and workers' vulnerability to mental health impacts of workplace violence.

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