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**Organisational justice protects against the negative effect of workplace violence on  
teachers' sleep: a longitudinal cohort study**

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**ABSTRACT**

**Objectives:** This study aimed to examine the longitudinal association of workplace violence with disturbed sleep and the moderating role of organisational justice (i.e., the extent to which employees are treated with fairness) in teaching.

**Methods:** We identified 4988 teachers participating in the Finnish Public Sector study who reported encountering violence at work. Disturbed sleep was measured in three waves with 2-year intervals: the wave preceding exposure to violence, the wave of exposure, and the wave following the exposure. Data on procedural and interactional justice were obtained from the wave of exposure to violence. The associations were examined using repeated measures log-binomial regression analysis with the generalized estimating equations method, adjusting for gender and age.

**Results:** Exposure to violence was associated with an increase in disturbed sleep (RR 1.32 (95% CI 1.15 to 1.52)) that also persisted after the exposure (RR 1.26 (95% CI 1.07 to 1.48)). The increase was higher among teachers perceiving the managerial practices as relatively unfair (RR 1.46 (95% CI 1.01 to 2.09) and RR 1.59 (95% CI 1.04 to 2.42) for interactional and procedural justice, respectively). By contrast, working in high justice conditions seemed to protect teachers from the negative effect of violence on sleep.

**Conclusions:** Our findings show an increase in sleep disturbances due to exposure to workplace violence in teaching. However, the extent to which teachers are treated with justice moderates this association. Although preventive measures for violence should be prioritized, resources aimed at promoting justice in schools can mitigate sleep problems associated with workplace violence.

**Keywords:** workplace violence, sleep, organisational justice

What this paper adds

- The potential consequences of workplace violence, such as disturbed sleep, have not been examined in large-scale longitudinal studies among teachers.
- Furthermore, whereas the majority of studies on teacher targeted violence have focused on exploring its negative outcomes, fewer studies have tried to identify factors that may protect teachers from the adverse consequences of violence at work.
- Using a longitudinal design, we show that exposure to workplace violence is a risk factor for sleep disturbances among primary and secondary school teachers.
- While the effect of violence on sleep was most pronounced in relatively unjust work conditions, there was no increase in sleep disturbances due to violence among those perceiving high organisational justice.
- Promoting justice can mitigate sleep problems associated with workplace violence.

## INTRODUCTION

Workplace violence is considered a form of occupational hazard, which may have acute and long-term adverse consequences for individual well-being,[1,2] such as disturbed sleep.[3–5] Sleep disturbances pose a risk for individuals' health because they are frequently associated with psychiatric conditions, among which depression is the most common.[6] Current evidence linking workplace violence with sleep disturbances is thus far limited to the extent that it relies mainly on cross-sectional studies. Furthermore, only few studies have examined protective factors that could alleviate the adverse consequences of violence at work. We address these issues by applying a longitudinal design to investigate the association between workplace violence and disturbed sleep, and the potential moderating role of organisational justice (i.e., the extent to which employees are treated with fairness) in teachers' occupation.

The consequences of work-related violence are an emerging issue among teachers, as the level of teacher targeted violence has escalated over the last years.[7,8] According to teacher trade union surveys, up to 21% of Finnish teachers in basic education have experienced violence in their work during the preceding 12 months. [9] While the typical source of teacher targeted violence is students, teachers can also experience aggression from their colleagues or the students' parents.[10] Teacher victimisation has been shown to be associated with poor job attitudes and professional disengagement.[11] which may result in reduced learning outcomes in the classroom.[12] Furthermore, studies have linked violence towards teachers to adverse health outcomes commonly associated with occupational stress, such as poor emotional and psychosomatic well-being.[4] However, the potential consequences of workplace violence, such as disturbed sleep, have not been examined in large-scale longitudinal studies among teachers.

While the majority of studies on teacher targeted violence have focused on exploring its negative outcomes, fewer studies have tried to identify factors that may protect teachers from

the adverse consequences of violence at work. A recent cross-sectional study examining school support as a moderator in the relationship between experiences of violence and poor well-being among Belgian teachers failed to find evidence of a buffering effect of support.[11] Another cross-sectional study in the US discovered that work-related violence against teachers was associated with negative outcomes when teachers' satisfaction with how violence was handled by the school was low but not when it was high.[13] Based on this finding, it appears that factors related to justice in organisational policies and procedures might influence teachers' reactions to violent acts.

The concept of organisational justice refers to the extent to which employees are treated with fairness at the workplace.[14] The literature has identified different types of organisational justice components, such as distributional, procedural, and interactional justice.[15] In the present study, we focused on the procedural and interactional components of justice. Procedural justice is defined as perceived fairness of managerial procedures, such as consistency, bias suppression, accuracy, correctability, representativeness, and ethicality of the procedures.[16] Interactional justice refers to the perceived quality of interpersonal treatment to the extent the supervisor pays attention to the employees' rights, listens to their concerns, provides explanations for decisions, and treats them in a fair and truthful manner.[17,18]

Poor justice at the workplace has been identified as a psychosocial stressor,[19] which is a risk factor for employees' health and well-being.[20] Perceptions of low organisational justice have been shown to predict, for example, the onset of depression.[21] With regard to sleep, growing evidence suggests that working in unfair conditions increases the risk of poor sleep quality.[22,23]

On the other hand, high organisational justice can act as a resource in the psychosocial context of work. Stressors at work, such as high job demands, can be better coped by creating

a just work environment.[24] Similarly, high organisational justice has been shown to alleviate stress symptoms related to shift work and fixed-term employment.[25] One explanation for the protecting role of justice is that treating employees with justice induces feelings of trust,[26] which may buffer against the negative effects of stress.[27]

From a theoretical point of view, van den Bos and Lind's[28] uncertainty management model may provide additional explanation for this effect. The model suggests that individuals become more sensitive to fairness under unclear or unpredictable conditions and manage this uncertainty using fairness judgments. Furthermore, perceptions of justice can either remove uncertainty or alleviate the stress and discomfort associated with it. With regard to workplace violence, violent encounters may contribute to perceptions of uncertainty in the work environment because they are associated with feelings of loss of control, vulnerability, and fear of future violence.[4,29] Nevertheless, the role of justice as a buffer against the negative effects of workplace violence remains largely unexamined.

The first aim of the current study was to examine the longitudinal association between teacher targeted violence and disturbed sleep. Because it is argued that exposure to any form of workplace violence should be considered as a stressor in the work environment,[30] we included in the analysis reports of violent and threatening behaviours covering both physical and nonphysical forms of violence at work. In addition, we build on the existing research by examining whether organisational justice moderates the association between violence and sleep. We expected exposure to violence to increase the risk of sleep disturbances. Furthermore, we expected that high organisational justice could buffer against the negative influence of workplace violence on sleep.

## **METHODS**

### **Participants and procedure**

Data for this study was drawn from the Finnish Public Sector study, which is an ongoing biennial cohort study of municipal employees working in ten towns and five hospital districts in Finland.[31] First, we identified those participants who worked as teachers in primary or secondary education in the ten towns and who reported encountering a violent event in their work at any of the study waves in 2004, 2006, 2008, 2010, 2012, or 2014 ( $N = 6274$ ). If a participant reported encountering violence in multiple waves, the first wave with a violent event was selected as the timing of exposure to violence. Data on procedural and interactional justice were collected from the wave of exposure, and on sleep in 2004, 2008, 2010, 2012, and 2014.

We included in our analyses three subsequent waves with 2-year intervals: the wave preceding a violent event (baseline), the wave when a participant reported exposure to a violent event, and the wave following the wave of reported exposure. Participants without information on sleep at least from the wave of exposure were excluded ( $N = 1210$ ), as were those without data on organisational justice ( $N = 76$ ). The final analytic sample, therefore, comprised 4988 participants, representing 80% of the original selection. The mean number of sleep measurements per participant was 1.6 waves: out of 4988 participants having at least one sleep measurement, 2233 (45%) had information on sleep also from one or two additional waves. More precisely, 1056 (21%) participants had information on sleep also prior to the event and 529 (11%) participants had information on sleep from all three waves.

We additionally included Finnish Public Sector data on teachers in primary or secondary education who did not report encountering violence at work ( $N = 5849$ ) as well as data on other municipal employees having a similar educational level as teachers and reporting exposure violence ( $N = 5426$ ) (Supplementary Table 1). Ethical approval for the Finnish Public Sector Study was obtained from the ethics committees of the Hospital District of Helsinki and Uusimaa and the Finnish Institute of Occupational Health.

## Measures

### Disturbed sleep

The 4-item Jenkins Sleep Problems Scale[32] (Cronbach's  $\alpha$  ranging from .77 to .80) was used to measure self-reported disturbed sleep. The items correspond to the diagnostic symptoms for sleep disturbances (DSM-IV): difficulties initiating sleep, waking up multiple times at night, early morning awakenings, and nonrestorative sleep. Participants were asked to rate on a scale from 1 (*never*) to 6 (*nearly every night*) to what extent they had experienced these symptoms within the previous four weeks. We obtained a mean score for the items and dichotomized the variable as "no disturbed sleep" (no symptoms or symptoms no more than once a week) and "disturbed sleep" (symptoms at least two to four times a week, reflecting clinically significant level of sleep disturbance).[6]

### Workplace violence

Exposure to violence (including threat of violence) at the workplace was assessed by asking the participant whether he/she had encountered threatening behaviour (e.g., vandalising property, verbal threats), physical violence (e.g., kicking, hitting), or armed threats (e.g., with a firearm or other weapon) during the preceding year.[33] The response format was either "yes" or "no".

### Organisational justice

Procedural and interactional justice were assessed by items derived from Moorman's study.[14] The 7-item procedural justice scale ( $\alpha = .93$ ) indicates perceived fairness of managerial procedures, such as consistency, bias suppression, accuracy, correctability, representativeness, and ethicality of the procedures.[16] The 6-item interactional justice scale ( $\alpha = .93$ ) measures perceived quality of interpersonal treatment, such as the extent to which the manager treats employees in a fair and truthful manner.[18] Responses were given on a



scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). For both justice components, mean scores were first obtained. As in previous studies, the participants were then divided into high, intermediate, and low justice groups based on the distribution of the mean justice score using a tertile split.[34,35]

#### Covariates

We adjusted all the analyses for gender (1 = male, 2 = female) and age (linear term) because previous studies have shown sleep disturbances to be more prevalent among females and generally increase with age.[36]

#### **Statistical analyses**

We applied a repeated measures log-binomial regression analysis using generalized estimating equations (GEE)[37] to examine the changes in sleep during the follow up. The GEE method is not sensitive to missing measurements and takes into account the within person correlation between sleep measurements over time. The sleep measurements were nested within participants, i.e., the same participant could contribute multiple observations to the dataset) and the non-independence of the within-person observations was taken into account in estimating the standard errors.

First, we examined the effect violence on sleep by calculating risk ratios (RRs) and their 95% confidence intervals (CIs) for sleep disturbances at the time of the violent event and post-event compared to the pre-event baseline. By using a supplementary sample of teachers who did not report exposure to violence at work, we also compared the sleep of participants who reported encountering a violent event and the sleep of those without a violent event. For those without exposure to violence, we randomly assigned a non-event year to represent the timing of the event. We additionally examined whether the association between exposure to

violence and disturbed sleep was different in teachers compared with other municipal employees with a similar level of education.

In the following analyses, we focused only on teachers reporting exposure to a violent event. We examined the effect of organisational justice by entering first the main effect of justice and then the interaction terms “time  $\times$  justice” to the model. The hypothetically most favourable condition (highest tertile) was selected as a reference category for the indicators of justice. We used predicted probabilities from the model including the interaction terms to provide an illustration of the effect of violence on sleep in high, intermediate, and low justice conditions. The two justice components (i.e., procedural and interactional justice) were analysed separately.

Finally, we performed a sensitivity analysis by replicating all the main regression analyses, this time including only those participants who had information on sleep at least from the wave preceding exposure to violence and the wave of reported exposure. Participants who encountered violence for example in 2004 were excluded in sensitivity analysis because they had data on sleep only from the wave of the violent event and not from the wave preceding the event (sleep was first measured in 2004). All analyses were adjusted for gender and age. The analyses were conducted using the STATA 13 statistical software (Stata Corporation, College Station, TX).

## **RESULTS**

The overall prevalence of exposure to any form of violence was 33%, as measured in the last wave in 2014. In this wave, 24% of all teachers in primary or secondary education reported exposure to threatening behaviour, 20% to verbal threats, and 9% to physical violence. The characteristics of teachers exposed to violence and descriptive statistics for the study variables are shown in Table 1. Whereas majority of teachers reporting exposure to violence

had experienced threatening behaviour (70%) and/or verbal threats (72%), exposure to physical acts of violence was more infrequent (31%). More than half of exposed teachers (53%) had experienced multiple forms of violence.

According to log-binomial regression analyses with GEE, among teachers reporting exposure to violence, there was a small increase in sleep disturbances at the time of the violent event compared to the time prior to the event (RR 1.32, 95% CI 1.15 to 1.52) that persisted after the event (RR 1.26, 95% CI 1.07 to 1.48). As expected, there was no significant increase in sleep disturbances among teachers without exposure to violence at work (RR 1.10, 95% CI 0.96 to 1.27 and RR 1.13, 95% CI 0.95 to 1.35 for the randomly assigned time point and the subsequent wave, respectively). The effect of violence on sleep was found to be of similar magnitude among teachers and other municipal employees reporting exposure to violence (for other municipal employees RR 1.20, 95% CI 1.06 to 1.36 and RR 1.24, 95% CI 1.08 to 1.44 for the event and post-event, respectively).

We aggregated violent events of varying severity (i.e., from threatening behaviour to physical acts of violence) to an overall indicator of exposure to violence because teachers were typically exposed to multiple forms of violence and it was, consequently, not possible to differentiate exclusive groups of exposure. Nevertheless, we further examined whether the results were driven by a specific form of violence by analysing the data by three partly overlapping groups of participants (results available from the first author on request). Participants were categorized according to the severity of exposure to violence based on reports of encountering either (at least) threatening behaviour, verbal threats, or physical violence. The results indicated that particularly verbal threats were associated with an increase in sleep disturbances. These findings need, however, to be considered preliminary and interpreted with caution because of the overlap among the groups examined.

### **Table 1**

Overall, teachers working in low justice conditions experienced more frequent sleep disturbances compared to those in high justice conditions (for details, see Supplementary Table 2). Table 2 shows the results from log-binomial regression analyses with GEE on the associations between the two justice components and disturbed sleep during the follow up for teachers reporting exposure to violence. As illustrated in Figure 1, there was no increase in sleep disturbances at the time of the violent event among teachers with high procedural or interactional justice. By contrast, the increase was obvious in teachers who experienced intermediate or low levels of justice: 1.59-fold (95% CI 1.04 to 2.42) among those with intermediate procedural justice and 1.46-fold (95% CI 1.01 to 2.09) among those with low interactional justice. The increase in sleep disturbances in intermediate or low justice conditions did not persist after the violent event.

#### **Table 2**

#### **Figure 1**

Compared to high justice conditions, the level of sleep disturbances was relatively high already at the baseline in teachers experiencing low procedural justice. The strong main effect of low procedural justice on disturbed sleep could explain why there was no significant increase in sleep disturbances at the time of the violent event in conditions of low procedural justice. Thus, due to the relatively high level of sleep disturbances at baseline, exposure to violence might not have had a further substantial effect on sleep. Furthermore, in the final model including interactions, the main effect of intermediate procedural justice on disturbed sleep was lower than the main effect of high procedural justice (i.e., the reference category). This reflected the small, non-significant baseline difference in disturbed sleep for intermediate and high justice. Specifically, compared to high justice conditions, predicted baseline probability of disturbed sleep was slightly lower in intermediate procedural justice

conditions (see Figure 1). Overall, the results were thus more coherent for interactional than procedural justice.

Sensitivity analysis excluding participants who had missing information on sleep in the wave preceding exposure to violence or the wave of exposure replicated the findings of the main analysis in terms of an increase in sleep disturbances in association with a violent event (Supplementary Table 3). The associations of exposure to violence with disturbed sleep across different levels of justice were similar to those observed in the main analysis, especially with regard to a rise in sleep disturbances in low justice conditions. In this smaller sample ( $N = 1056$ ), the interaction terms for justice were, however, non-significant.

## **DISCUSSION**

We found that, overall, exposure to a violent event at work was associated with a significant increase in concurrent and subsequent sleep disturbances among primary and secondary school teachers. The effect of violence on sleep was most pronounced among teachers working in intermediate or low justice conditions. By contrast, the sleep of those perceiving high organisational justice was not affected by exposure to violence. To our knowledge, this is the first large-scale prospective study to demonstrate the protective effects of justice against the negative impact of workplace violence on sleep.

Our results support previous cross-sectional studies showing that workplace violence is associated with impaired sleep.[3,4] Importantly, according to our main analysis, encountering violence at work affected teachers' sleep not only concurrently with the violent event, but also two years after the event. Although sensitivity analysis supported these findings by showing a similar trend, the prolonged effect of violence on sleep was not significant in the smaller sample. Because of the relatively high prevalence of teacher targeted violence, it is, however, possible that higher levels of disturbed sleep after the

violent event could also reflect repeated exposure to violence. Finally, the effect of violence on sleep was similar among teachers and other municipal employees with a corresponding level of education, suggesting that exposure to violence could be a comparable risk factor for disruptions in sleep also in other professions.

Compared with teachers who experienced high justice at work, disturbed sleep was more common among those working in relatively unjust work conditions. Additionally, justice moderated the association between exposure to violence and disturbed sleep. A similar pattern was also evident in the sensitivity analysis, although, most likely due to loss of power, the interaction terms lacked significance. Our results are in agreement with previous research demonstrating the adverse effect of poor justice on sleep.[22,23] Furthermore, they are in line with the previous findings indicating that teachers' satisfaction with the school's procedures of handling violent acts can mitigate the negative effects of teacher targeted violence.[13]

There are several possible explanations for our results. Encountering violence at work has been associated with anger, anxiety, and poor mental health, as well as with symptoms of post-traumatic stress disorder.[1,5] Violent events can thus cause heightened state of physiological and psychological alertness, which may result in disruptions in sleep. In addition, fear of future violence may explain both the acute and the sustained impact of violence on teachers' sleep.[4] With regard to the protecting role of justice, it is possible that fair organizations and supervisors are more reactive towards workplace violence and perhaps promote a work environment where violent acts are taken seriously. In conditions of poor justice, teachers' perceptions of injustice may contribute to occupational stress,[19] lack of trust in supervisors,[26] and difficulties enduring uncertainty,[28] which may intensify their reactions to violent encounters at work.

Taken together, this study has several strengths and makes important contributions to the literature. Whereas the past research has mainly explored the cross-sectional associations of

work-related violence, we used a large-scale longitudinal design to examine the association of workplace violence with sleep. Our results provide new evidence on the short and long-term consequences of workplace violence on teachers' sleep and offer insight on the potential buffering factors that may protect teachers against the negative outcomes associated with violence at work.

When interpreting the results, some limitations should be noted. Because violence was operationalized in a broad sense, including both verbal and physical threats, the overall prevalence of violence was relatively high in our sample. We relied solely on self-report measures, introducing the possibility that the observed associations may have been inflated by common method variance.[38] Nevertheless, we used well-validated measures to assess organisational justice and sleep disturbances to minimize the problems associated with self-reports. Collecting more objective data on sleep (e.g., with accelerometers) would have increased the validity of our findings. Future studies would benefit from using independent measures of additional health outcomes, such as records of sickness absence, when examining the longitudinal effects of workplace violence.

It is also worth noting that the amount of missing sleep measures was relatively high particularly before the wave of exposure to violence. This partially reflects nonresponse but, probably to a larger extent, the process of data collection in the Finnish Public Sector study and the design of the current study. In the Finnish Public sector study, new participants are regularly recruited as some participants retire or move to private sector jobs. Especially in waves preceding the violent event, missing values in sleep could reflect changes in the study population. Furthermore, because sleep was first measured in 2004 (i.e., the first possible wave of the violent event), participants reporting violence in this particular wave could not have prior measures of sleep.

In the present study, we focused on workplace violence and organisational justice as predictors of disturbed sleep adjusting only for gender and age. Because the participants represented the same occupation, there was no need to control for socioeconomic status. However, the possibility of residual confounding cannot be ruled out in observational studies. Several other variables have been shown to influence sleep that were not considered, which is yet another limitation of this study. For example, research suggests that sleep disturbances are intimately related with depression[39] and burnout[40]. Other factors that may have affected the results of the current study include physical activity and alcohol consumption. Future research needs to be conducted to examine whether these or other confounders could have influenced the observed associations.

Despite the limitations, our findings have practical implications that may be useful to consider. Because violence towards teachers is typically clustered to certain schools,[33] ensuring that the school management and procedures are fair is particularly important in schools where there are frequent violent encounters. Justice in schools can be improved for example by giving teachers possibilities to participate in the decision-making process, listening to their concerns, and encouraging open dialogue with the management. With regard to violence towards teachers, school managers can be trained to handle violent situations in way that the teachers feel their concerns about violence are taken seriously and addressed appropriately. In spite of the importance of promoting justice at schools, designing preventive strategies for violence and ensuring a safe work environment for teachers are, obviously, public priorities deserving most attention.

To conclude, the current study provides evidence that exposure to workplace violence is associated with an increase in sleep disturbances in teachers' occupation. Working in an organization that is characterized by high justice may, however, protect teachers against the negative effects of violence on sleep. Our findings underscore the importance of



organisational justice in schools where teachers experience frequent victimisation. Promoting justice in schools can alleviate sleep disturbances associated with teacher targeted violence and complement interventions aiming to reduce violence towards teachers.

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**Table 1** Characteristics of the participants reporting exposure to a violent event and descriptive statistics

Variable	<i>N</i>	<i>M (SD)</i> or %	Range
Gender (% female)	4988	77%	-
Age	4988	42.76 (9.53)	24 to 68
Procedural justice	4988	3.15 (0.96)	1 to 5
Interactional justice	4988	3.73 (1.02)	1 to 5
Disturbed sleep <sup>a</sup>			
Pre-event	1056	2.48 (1.05)	1 to 6
Event	4988	2.65 (1.15)	1 to 6
Post-event	1696	2.61 (1.12)	1 to 6

*Note.* *M* = mean; *SD* = standard deviation. Age, procedural justice, and interactional justice were measured the same year when exposure to violence was reported. <sup>a</sup>Mean score for the Jenkins Sleep Problems Scale.



## WORKPLACE VIOLENCE, JUSTICE, AND DISTURBED SLEEP

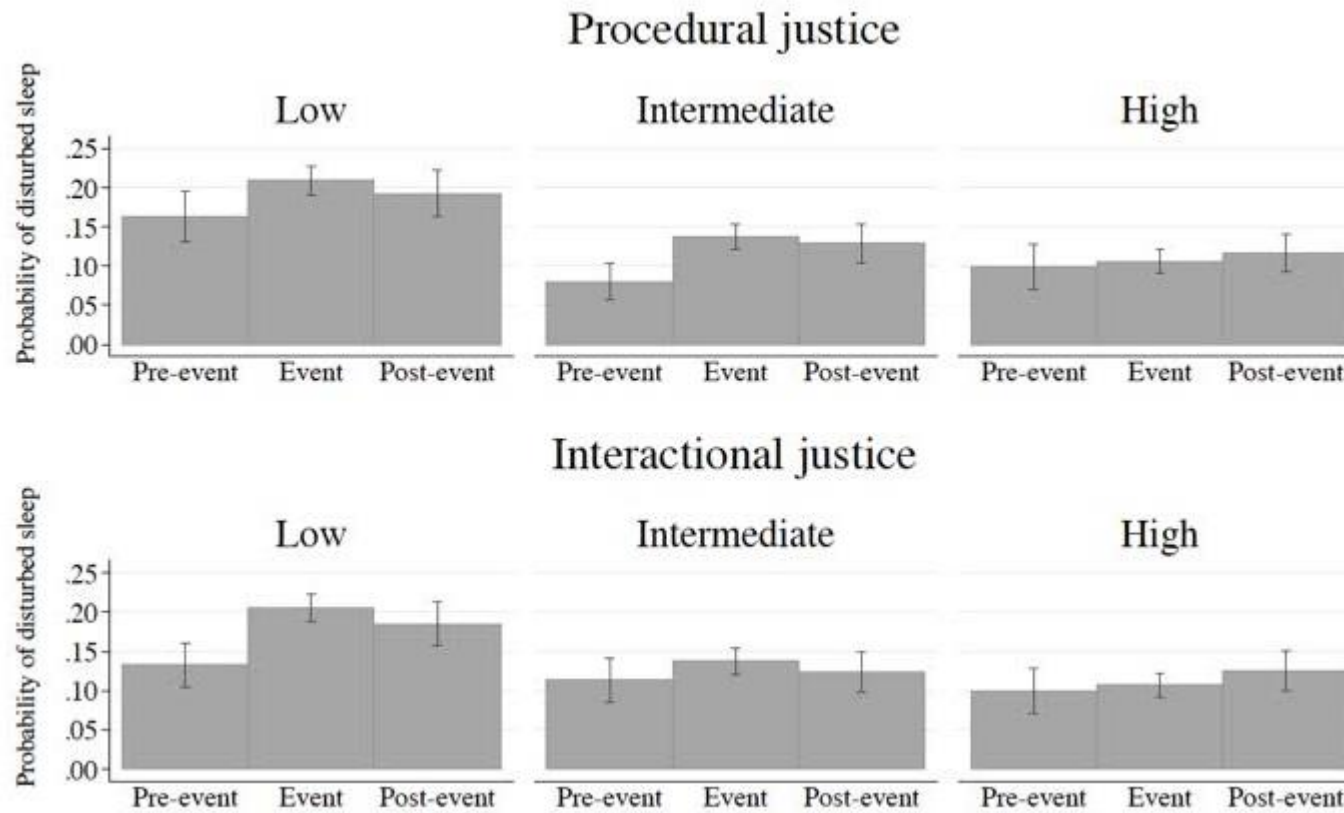
**Table 2** Regression analyses predicting disturbed sleep in association with a violent event and different levels of organisational justice

Variable	Procedural justice						Interactional justice			
	Step 1		Step 2a		Step 3a		Step 2b		Step 3b	
	RR	(95% CI)	RR	(95% CI)	RR	(95% CI)	RR	(95% CI)	RR	(95% CI)
Time										
Pre-event	1		1		1		1		1	
Event	1.32***	(1.15 to 1.52)	1.32***	(1.15 to 1.52)	1.08	(0.80 to 1.47)	1.32***	(1.15 to 1.52)	1.07	(0.80 to 1.43)
Post-event	1.26**	(1.07 to 1.48)	1.28**	(1.08 to 1.50)	1.19	(0.84 to 1.68)	1.27**	(1.08 to 1.49)	1.25	(0.90 to 1.74)
Organisational justice										
High			1		1		1		1	
Intermediate			1.21*	(1.02 to 1.44)	0.82	(0.54 to 1.24)	1.21*	(1.02 to 1.43)	1.13	(0.77 to 1.66)
Low			1.88***	(1.60 to 2.20)	1.67**	(1.17 to 2.37)	1.77***	(1.52 to 2.08)	1.32	(0.92 to 1.90)
Event × intermediate justice					1.59*	(1.04 to 2.42)			1.14	(0.77 to 1.68)
Event × low justice					1.19	(0.83 to 1.70)			1.46*	(1.01 to 2.09)
Post-event × intermediate justice					1.35	(0.84 to 2.18)			0.88	(0.56 to 1.37)
Post-event × low justice					0.99	(0.66 to 1.49)			1.12	(0.74 to 1.69)

*Note.*  $N = 4988$ . RR = risk ratio; CI = confidence interval. Adjusted for gender and age. Components of organisational justice are indicated in the column headings. Steps 2a and 3a are for procedural justice; steps 2b and 3b for interactional justice.

\* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$

## WORKPLACE VIOLENCE, JUSTICE, AND DISTURBED SLEEP



**Figure 1** Predicted probabilities of disturbed sleep among teachers reporting exposure to a violent event in low-justice, intermediate-justice and high-justice conditions. Predictions were derived from log-binomial regression analysis using generalized estimating equations, adjusted for gender and age. N = 4988.