

# Workplace violence against nursing interns and patient safety: The multiple mediation effect of professional identity and professional burnout

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## Research Article

**Keywords:** Chinese nursing interns, workplace violence, professional identity, professional burnout, patient safety, serial-multiple mediation model

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# **Workplace violence against nursing interns and patient safety: The multiple mediation effect of professional identity and professional burnout**

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## **Abstract**

**Background:** Most nursing interns indicated they had experienced some form of workplace violence on clinical placement, which could be linked to higher adverse events. Prior researches have examined the effects of workplace violence on patient safety, but there have been very few explorations of whether workplace violence affects patient safety through professional identity and burnout among nursing interns. The purpose of this study is to test whether professional identity and professional burnout play mediating roles in the relationship of workplace violence and patient safety among nursing interns.

**Methods:** Our study used a cross-sectional design. The study consisted of 466 nursing interns from three tertiary grade A hospitals in Shandong Province, China. The Chinese version of the Workplace Violence Scale, the Professional Identity Scale, the Chinese version of the Maslach Burnout Inventory-General Survey, the Patient Safety Behavior Scale were used to gather data. Descriptive analysis, *t* tests, analysis of variance, Pearson correlation, the serial multiple mediation analysis were used to analyze data.

**Results:** Workplace violence, professional identity, professional burnout and patient safety were significantly correlated ( $p < 0.01$ ). Workplace violence can not only have a direct positive impact on patient safety of the nursing interns (effect=-0.3280;SE=0.1492;95%CI: LL=-0.6212, UL=-0.0347), but also have an indirect impact on the patient safety through three paths: the independent mediating role of professional identity (effect=-0.3070;SE=0.1282;95%CI: LL=-0.6495, UL=-0.1399), the independent mediating role of professional burnout(effect=-0.1151;SE=0.0432;95%CI:

LL=-0.2246, UL=-0.0456), and the chain mediating role of professional identity and professional burnout (effect=-0.1432;SE=0.0762;95%CI: LL=-0.3338, UL=-0.0331).

**Conclusion:** Workplace violence first had a negative correlation with professional identity and then increased professional burnout, which was in turn related to reduce nursing interns-reported patient safety.

**Key words:** Chinese nursing interns; workplace violence; professional identity; professional burnout; patient safety; serial-multiple mediation model

## **Background**

Patient safety is one of the most important underlying principles in the provision of medical services. However, providing safe care is one of the biggest challenge in hospital management [1]. The WHO (2018) noted that patient harm is the 14<sup>th</sup> principal reason of the disease burden worldwide [2]. One in 10 patients is injured in the therapeutic process, and about 43 million patient-safety-related adverse events happen annually [3]. As new members of the nursing staff in hospitals, nursing interns provide direct basic care to patients and spend a lot of work time with patients; thus, they play a very important role in patient safety [4]. However, nursing interns are prone to adverse events because they are unfamiliar with hospital environments, unskilled in operation, lack theoretical knowledge, and lack communication skills. A cross-sectional survey showed that approximately 40%-50% of medical errors are related to nursing interns [5]. In addition, nearly 17%–53.2% of nursing interns reported nursing safety events [6]. Unsafe care can increase morbidity and mortality, additional medical expenses, disability, nosocomial infections, and low healthcare efficiency [7]. According to the World Health Organization (WHO) (2017), unsafe care incurs approximately \$19 billion annually [1]. Although patient safety events among nursing interns occur frequently, they are still neglected and underestimated in clinical practice. Exploring the reasons and paths of patient safety for nursing interns may provide a fresh perspective for identifying risk factors and undertaking effective measures to improve patient safety.

Among the many complicated reasons that influence patient safety in healthcare systems, workplace violence has gradually drew the attention of scholars. Workplace violence refers to incidents in which staff are threatened, assaulted, or abused in circumstances associated with their work, including physical assault, verbal abuse or

threats, bullying, sexual harassment, and aggression [8]. A high prevalence of workplace violence against nursing interns has been reported. Tee et al. (2016) investigated 657 nursing interns and found that nearly half of them indicated that they had experienced harassment or bullying in the past year while on clinical placement [9]. In another US study, over 50% of nursing interns reported experiencing horizontal violence at least once in a clinical setting [10]. Cheung et al. (2019) found that 37.3% of nursing interns in Hong Kong reported having experienced clinical violence [11]. A growing body of literature has linked workplace violence to patient safety. Further research has linked healthy workplace environments to higher quality patient care and fewer adverse events [12]. Liu et al. (2019) analyzed data from 23 hospitals in China and collected data from 1502 nurses to demonstrate that workplace violence against nurses was linked to lower patient safety and more negative events [3]. Roche et al. (2010) conducted a cross-sectional study collecting data on 94 nursing wards in 21 hospitals and demonstrated that violence toward nurses could delay tasks and increase medical errors [13]. However, these two studies had certain limitations which cannot be neglected. First, as these studies analyzed data from nurses, rather than nursing interns, the association between workplace violence and patient safety among nursing interns remains unclear. Second, prior to the investigation of the cause-and-effect relationship between workplace violence and patient safety, there was no single-factor analysis of patient safety. Thus, whether the presence of more workplace violence contributes to patient safety events among nursing interns requires explicit attention.

In addition to the direct influence of workplace violence on the patient safety of healthcare workers, the potential mechanism in this path is also quite important. Professional identity is becoming an important theme in the research on nursing interns; it refers to the professional self, self-concept, and working ability of nursing and represents how nursing students or nurses perceive the nursing profession [14]. According to past studies, a low level of professional identity could affect medical workers' quality of medical services and increase patient safety events [15, 16]. For example, an intervention study indicated that constructing a professional identity of nurses could reduce patient accidents [17]. In addition, some empirical studies have found that workplace violence among medical staff can decrease the level of professional identity [16, 18]. Considering the association of professional identity with workplace violence and patient safety, higher frequencies of workplace violence

may alleviate professional identity and further reduce the rate of patient safety. Thus, one aim of the current study is to verify whether professional identity mediates the influence of workplace violence on patient safety for nursing interns.

Prior researches supported the viewpoint that professional burnout may mediate the relationship between workplace violence and patient safety. Professional burnout refers to a syndrome characterized by emotional exhaustion, depersonalization, and reduced sense of personal achievement [19]. Based on the job demands-resources model, professional demands, such as high working pressure, unfavorable work environment, and interpersonal conflicts, may result in professional dissatisfaction and burnout and negatively influence employees' professional performance [20, 21]. A previous study showed that nurse-reported workplace violence may separate nurses from work and increase medical errors [22]. Boafo et al. (2017) found that nurses who had suffered from physical assaults were 2.7 times more likely to leave the nursing profession, and professional burnout was associated with unsafe patient care [8, 23]. However, few studies have explored the mediating role of professional burnout in the association between workplace violence and patient safety among nursing interns.

Furthermore, professional identity can predict burnout. For example, Zhang et al. (2021) conducted a national survey and found that professional identity negatively affects professional burnout [24]. Chen et al. (2020) demonstrated that adopting strategies that are more effective to improve professional identity could reduce the practical problems caused by professional burnout [25]. Therefore, we hypothesize that professional identity and burnout have a serial mediation effect on the relationship between workplace violence and patient safety for nursing interns.

Against this background, we expect a relationship between workplace violence, professional identity, professional burnout, and patient safety. The current study aims to investigate the serial multiple mediation of professional identity and burnout in the association between workplace violence and patient safety for nursing interns. As such, we made the following assumption: (a) higher frequencies of nursing interns-reported workplace violence are directly linked to less professional identity, more professional burnout, and lower ratings of patient safety. (b) Professional identity and burnout mediate the association between workplace violence and patient safety. (c) Professional identity and burnout have a serial mediation effect between workplace violence and patient safety.

## **Methods**

### **Study design and Participants**

We conducted a cross-sectional design to collect survey data from nursing interns. Participants were recruited from three general hospitals in Shandong Province, China, from October to December 2021, using a convenience sampling method. The researchers contacted the nursing leaders in the three hospitals to obtain permission. Thereafter, the researchers invited all eligible nursing interns to participate. The inclusion criteria were that the nursing intern (1) was over 18 years old, (2) was during an internship for at least six months, (3) started their internship careers in 2021, and (4) volunteered to take part in the study. The exclusion criteria were as follows: (1) nursing intern was unwilling to participate in the study, (2) was diagnosed with psychological or mental disorders, and (3) was absent because of vacation, illness, or deployment in a non-nursing work unit for at least one month. We computed the sample size based on the sample size equation  $n = Z_{\alpha/2}^2 P(1-P)/\delta^2$  [26], assuming a type I error ( $\alpha$ ) of 0.05, and  $Z_{\alpha/2}$  was set at 1.96. For prevalence ( $P$ ), we set a reference value of 11.93%, consistent with a previous study that investigated the percentage of nursing safety events reported by nursing interns, which was 11.93% [27]. We used 0.03 for the absolute error ( $\delta$ ). A sample size of 449 was derived. Considering a 10% dropout rate, 499 nursing interns were screened for the study. Further, of 500 distributed questionnaires, 466 effective questionnaires were collected—a response rate of 93.2%.

### **Ethics statement**

The current study was approved by the Ethics Committee of \*\*\*, before the data collection. The attributes, benefits, uses, and disadvantages of the study were explained to all participants, and informed consent was obtained.

### **Data Collection**

All participants completed a questionnaire containing standardized survey questions. Demographic information, workplace violence, professional identity, professional burnout, and patient safety were obtained using anonymous self-report structured questionnaires.

### **Measures**

#### **Demographic characteristics**

Demographic characteristics included age, sex, ethnicity, level of education,

current department, and location, as well as whether they were an only child in the family, class officers, or healthcare workers among family members. Ethnicity was categorized as Han or other nationalities. The location was categorized as urban or rural. Education level was categorized as junior college or undergraduate. Current department was measured by an item on “which department are you interning in now?” (medical department, surgical department, ICU, pediatrics department, obstetric department, gynecological department, emergency department, operating room, or others).

### **Workplace Violence**

The prevalence of workplace violence was assessed using the Chinese version of the workplace violence scale (WVS). The scale was developed by Li et al. (2019) based on the WHO’s definition of “workplace violence,” and has been proven to have good reliability and validity among nursing interns in China [28]. The WVS evaluates nursing interns’ experiences with workplace violence in the past six months. Each item is scored on a four-point scale reflecting the respondents’ frequency of exposure to workplace violence (0=0 times, 1=1 time, 2=2 or 3 times, 3=more than 3 times). The total possible score is the sum of each item, ranging from 0 to 18, with a higher total score indicating a higher frequency of exposure to workplace violence. In the current study, the Cronbach’s  $\alpha$  for the WVS was 0.802.

### **Professional Identity**

The level of professional identity of nursing students was evaluated using the professional identity scale (PIS), which was developed by Liu et al. in 2011 and has satisfactory credibility. The Cronbach’s  $\alpha$  for the PIS was 0.938, and the split-half reliability was 0.88 [29]. This instrument consists of 30 items and five subscales: professional identity evaluation, professional social support, professional social proficiency, dealing with professional frustration, and professional self-reflection. Each item was ranked on a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). The total score ranged from 30 to 150, with higher scores indicating a higher level of professional identity. The PIS has displayed good reliability and validity in previous studies [30] and good internal consistency in the current study (Cronbach’s  $\alpha=0.975$ ).

### **Professional Burnout**

Professional burnout was measured using the Chinese version of the Maslach

Burnout Inventory-General Survey (MBI-GS) [31]. The MIB-GS consists of 22 items and three subscales: emotional exhaustion (EE), depersonalization (DP), and personal accomplishment (PA). Each item was rated on a seven-point Likert scale, ranging from 0 (never) to 6 (every day). The EE and DP items were positively scored. The PA items were reversed scored, and finally, the subscale was labeled as reduced personal accomplishment. The total score of the MBI-GS ranged from 0 to 132, with higher scores indicating a high level of professional burnout. The MBI-GS has displayed good reliability and validity in previous studies [32] and good internal consistency in the current study (Cronbach's  $\alpha=0.899$ ).

### **Patient Safety**

The patient safety behavior scale (PSBS) for nursing students' developed by Shih in 2008 used the measure of patient safety [33]. The PSBS comprised 12 items. Nursing students were asked to rate the frequency of these patient-safety-related adverse events. Each item was ranked on a five-point Likert scale (1=never to 5=always). The total PSBS score ranged from 12 to 60, with higher scores indicating better patient safety-related behavior. The PSBS has displayed good reliability and validity in previous studies [34] and good internal consistency in the current study (Cronbach's  $\alpha=0.860$ ).

### **Statistical analysis**

In this study, we used IBM SPSS Statistics version 20.0 to complete the data analysis. First, *t*-tests and analysis of variance were used to examine the differences in PSBS total scores among nursing interns with different characteristics. Two-tailed *p*-values < 0.05 were indicated as statistically significant. Second, Pearson's correlation was used to determine whether workplace violence, professional identity, professional burnout, and patient safety were correlated with each other. Lastly, to test whether there were multiple mediation effects of professional identity and professional burnout between workplace violence and patient safety, we used IBM SPSS Statistics version 20.0 PROCESS program (Model 6) designed by Hayes (Hayes, 2013) to conduct data analysis [35]. The indirect effect and bias-corrected confidence intervals (CIs), which were estimated using PROCESS, were based on 5000 bootstrapping samples. If the intervals of 95CI% did not include zero, the mediating effect was considered significant. The PIS and MBI-GS scores were entered as mediators, the WVS score was entered as the independent variable, and the

PSBS score was used as the dependent variable.

## Results

### Demographic characteristics of sample

Table 1 lists the demographic characteristics of the study sample. Data from 466 nursing interns were collected and the average age of the sample was 20.26±1.07 years (mean±SD). Most were female (83.48%), ethnic Han (98.93%), or rural (79.61%). Only 19.31% were children and 31.97% were class officers. Of the 466 interns, 87.55% were from junior college and 12.45% were from undergraduate school. For 2.36% of the interns, their family members had medical backgrounds.

**Table 1 Demographic characteristics of sample and differences in patient safety among different characteristics groups (N=466)**

Variables	Category	N(%)	Total score of patient safety, mean (SD)	t/F	P
Age, years	18~22	455 (97.64)	55.67 (5.41)	1.070	0.285
	≥23	11 (2.36)	53.91 (4.32)		
Sex	Male	77 (16.52)	55.19 (7.35)	-0.769	0.442
	Female	389 (83.48)	55.71 (4.92)		
Ethnic	Han	461 (98.93)	55.62 (5.41)	-0.156	0.876
	Others	5 (1.07)	56.00 (3.81)		
Location	Urban	95 (20.39)	54.68 (7.66)	-1.915	0.056
	Rural	371 (79.61)	55.87 (4.62)		
Only child in family	Yes	90 (19.31)	55.40 (6.48)	-0.444	0.658
	No	376 (80.69)	55.68 (5.10)		
Class officer	Yes	149 (31.97)	56.11 (5.15)	1.340	0.181
	No	317 (68.03)	55.40 (5.49)		
Level of education	Junior College	408 (87.55)	55.79 (5.40)	1.242	0.294
	Undergraduate	58 (12.45)	54.49 (5.31)		
Healthcare workers among family members	Yes	11 (2.36)	55.82 (4.81)	0.119	0.905
	No	455 (97.64)	55.62 (5.41)		
Current Department				1.006	0.431

Medical Department	162 (34.76)	55.71 (5.43)
Surgical Department	137 (29.40)	55.89 (5.06)
ICU	42 (9.01)	54.40 (4.75)
Pediatrics Department	34 (7.30)	54.29 (8.71)
Obstetric Department	30 (6.44)	55.33 (4.11)
Gynecological Department	18 (3.86)	57.06 (4.52)
Emergency Department	13 (2.79)	56.23 (4.94)
Operating Room	23 (4.94)	57.00 (3.61)
Others	7 (1.50)	54.29 (5.88)

### Correlation of workplace violence, professional identity, professional burnout, and patient safety

The correlations between workplace violence, professional identity, professional burnout, and patient safety are presented in Table 2. The results showed that workplace violence was negatively related to professional identity ( $r=-0.257$ ,  $p < 0.001$ ) and patient safety ( $r=-0.249$ ,  $p < 0.001$ ) and positively related to patient burnout ( $r=0.321$ ,  $p < 0.001$ ). Professional identity was negatively related to professional burnout ( $r=-0.602$ ,  $p < 0.001$ ) and positively related to patient safety ( $r=0.492$ ,  $p < 0.001$ ). Professional burnout was negatively related to patient safety ( $r=-0.454$ ,  $p < 0.001$ ). P-values of all the analysis results were significant at  $p < 0.01$  (two-tailed).

**Table 2 Correlations between workplace violence, professional identity, professional burnout, and patient safety**

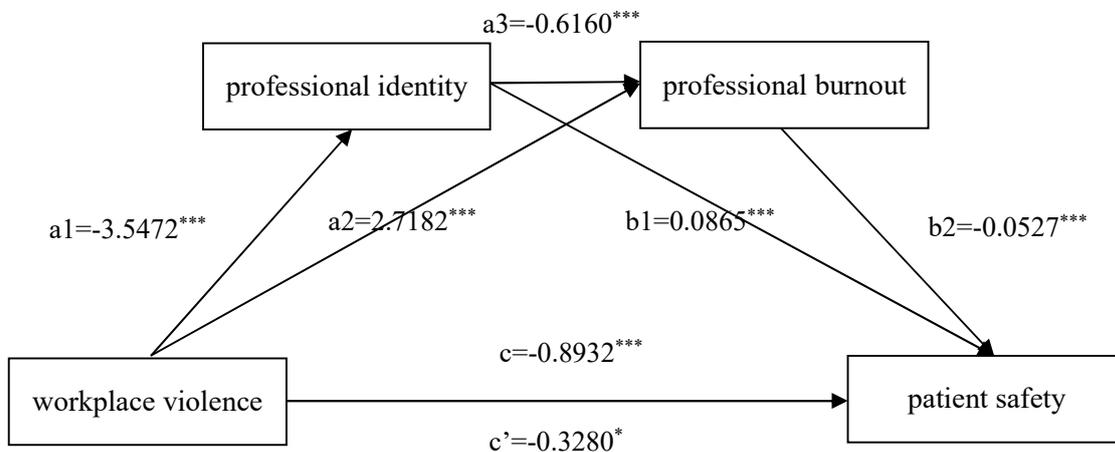
Variables	Workplace violence	Professional identity	Professional burnout	Patient safety
Workplace violence	1			
Professional identity	-0.257**	1		
Professional burnout	0.321**	-0.602**	1	
Patient safety	-0.249**	0.492**	-0.454**	1

Note: \* $p < 0.01$  (two-tailed)

### Mediation analysis of professional identity and professional burnout

The serial mediation analysis results of the impact of professional identity and burnout on workplace violence and patient safety are shown in Fig. 1 and Table 3. The total effects of workplace violence on patient safety are shown in Fig. 1 and Table 3 and were significant ( $p < 0.001$ ), indicating a higher frequency of workplace violence and a higher likelihood of patient safety issues.

Additionally, all three indirect and direct paths were significant. Specifically, the first direct pathway showed that professional identity significantly mediated the effect of workplace violence on patient safety, with an effect value of -0.3070. The second direct pathway showed that the effect of workplace violence on patient safety was significantly mediated by professional burnout, with an effect value of -0.1432. The third indirect pathway showed that the effect of workplace violence on patient safety was significantly mediated by both professional identity and burnout, with an effect value of -0.1151. Furthermore, professional identity had a significant direct effect on professional burnout, with an effect value of -0.6160. In conclusion, these results suggest that professional identity and burnout mediate the relationship between workplace violence and patient safety.



**Fig. 1.** Serial mediation models for workplace violence, professional identity, professional burnout, and patient safety. Note: \* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ .

**Table 3 Hypothesized serial mediation model of professional identity and professional burnout between workplace violence and patient safety**

Pathway	Effect	SE	BootLLCI	BootULCI
Total effect (c)	-0.8932	0.1614	-1.2103	-0.5761
Direct effect (c')	-0.3280	0.1492	-0.6212	-0.0347
a1	-3.5472	0.6197	-4.7649	-2.3295
a2	2.7182	0.5730	1.5923	3.8442
a3	-0.6160	0.0415	-0.6975	-0.5345
b1	0.0865	0.0128	0.0613	0.1117
b2	-0.0527	0.0118	-0.0759	-0.0294
Indirect effects				
Total indirect effects	-0.5652	0.1338	-0.8575	-0.3506
Indirect 1	-0.3070	0.1282	-0.6495	-0.1399
Indirect 2	-0.1151	0.0432	-0.2246	-0.0456
Indirect 3	-0.1432	0.0762	-0.3338	-0.0331

Abbreviation: Indirect 1, workplace violence→professional identity→patient safety; Indirect 2, workplace violence→professional identity→professional burnout→patient safety; Indirect 3, workplace violence→professional burnout→patient safety; BootLLCI, bootstrapping lower limit confidence interval; BootULCI, bootstrapping upper limit confidence interval; SE, standard error; Effect, standardized regression coefficient.

## Discussion

This study's primary objective was to examine whether professional identity and burnout would mediate the relationship between workplace violence and patient safety among nursing interns. First, the results showed that workplace violence significantly affected patient safety for nursing interns. Second, workplace violence had an indirect negative effect on patient safety through the mediating effect of professional identity and burnout partially. Finally, professional identity and burnout also had a serial mediation effect on the relationship between workplace violence and patient safety.

The results suggest that an increase in nursing interns' perception of the frequency of workplace violence could directly increase patient safety events. This result is consistent with prior studies that link workplace violence to negative patient outcomes [36, 37]. Hassankhani et al. (2018) indicated that exposure to work-related violence and aggression may increase the risk of negative responses by medical staff, ultimately leading to decreased quality of care[38]. Workplace violence had negative

effects on the social integrity, mental health, and professional performance of medical staff. A longitudinal study demonstrated that workplace violence experienced by medical staff is linked to lower patient ratings of quality of care [18]. This study highlights the significance of preventing workplace violence among nursing interns to build a healthy and safe work environment. Efforts are needed to encourage nursing interns to take part in developing and implementing programs that lower their risk of injury. In addition, our findings support the implementation of “safe hospital” policies and demonstrate zero tolerance of workplace violence among medical staff, including nursing interns, to improve patient safety.

This study aimed to reveal the potential relationship between workplace violence and patient safety for nursing interns. We demonstrated that professional identity and burnout can mediate the indirect effect of workplace violence on patient safety in nursing interns. On the one hand, the results indicated that nursing interns who experienced workplace violence were more likely to have reduced professional identity, which increased unsafe patient care. This finding is consistent with prior studies linking workplace violence to lower professional identity, lower job satisfaction, and negative patient outcomes [16, 37, 39]. Liu et al. (2019) showed a negative indirect effect of workplace violence on patient safety among nurses through job satisfaction [8]. A phenomenographic study indicated that workplace violence can reduce emergency nurses’ professional identity at work and increase burnout and turnover intention, eventually leading to unsafe care [40]. On the other hand, the results indicated that nursing interns who experienced more workplace violence experienced increased professional burnout, which in turn increased adverse patient safety events. This mechanism can be explained by the job demands-resources model, which posits that job demands, such as an unfavorable work environment, high work pressure, and interpersonal conflicts, may result in professional burnout and negatively influence employees’ professional performance [21]. These results are congruent with previous research that shows a negative indirect effect of workplace violence on negative patient outcomes, such as falls and medication errors, because of nurses’ lower job satisfaction and intent to leave [13, 41]. Our study’s results indicate that concerns about nursing interns’ attitudinal or emotional changes, along with workplace violence, cannot be underscored. Exploring how to improve nursing interns’ professional identity and reduce professional burnout after experiencing workplace

violence may be helpful in increasing the quality of healthcare services.

Finally, in addition to examining the independent mediating role of professional identity and burnout, we also tested whether a chain-mediating role between workplace violence and patient safety exists. The results of the current study indicated that workplace violence first had a negative correlation with professional identity and then increased professional burnout, which was in turn related to reduced nursing interns-reported patient safety. Regarding the relationship between workplace violence and professional identity, Guan (2017) pointed out that workplace violence can lead to serious consequences such as reduced work efficiency, frequent absenteeism, and increased occupational turnover [42]. This may be because medical staff experiencing workplace violence physically or mentally will hardly concentrate at work and will have difficulties handling their relationships with patients. This will lead to nursing interns doubting their original choice as nurses and a low level of professional identity. Regarding the relationship between professional identity and burnout, Zhang et al. (2021) showed that professional identity is an important factor in turnover intention and burnout [24]. Job satisfaction is associated with an individual's perception and evaluation of the profession, and this perception is influenced by person-specific values, demands, and expectations. Therefore, nursing interns with higher levels of professional identity achieve greater accomplishment from work and have higher enthusiasm for work, which in turn reduces professional burnout. Finally, this study showed that professional burnout is negatively related to patient safety. A systematic review found that individual professional burnout could help explain variations in safety culture within organizations [43].

### **Implications for research and practice**

Based on our results, we suggest that, on the one hand, we should take steps to prevent workplace violence among nursing interns. On the other hand, the healthcare system can adopt a “safe hospital” policy, in which hospital administrators can provide support when nursing interns experience workplace violence. In addition, these findings indicate that increasing professional identity and decreasing professional burnout may be novel targets for interventions aimed at ensuring patient safety. For example, we can reframe medical education [44], apply stress-reduction techniques, and provide implications for burnout management to increase professional identity and decrease professional burnout [45].

## **Limitations**

The current study has some limitations that should not be ignored. First, our research design was cross-sectional, which did not allow us to determine the causal relationships between variables. Second, the data we measured on patient safety were nursing intern-reported, thus not objective patient-outcome data. Finally, other factors such as subjective job stress and professional tasks, which may influence adverse patient outcomes, were not included in this study.

## **Conclusion**

Our findings indicate that workplace violence can influence patient safety through professional identity and burnout. Based on the results of our study, the significance of preventing workplace violence in nursing interns to maintain both nursing interns and patient safety is strengthened. A significant implication of the current study is the need for remedies after workplace violence occurs in the form of support to increase professional identity and decrease burnout.

## **Declaration**

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

The current study was approved by the Ethics Committee of Liaocheng People's Hospital (2021098), before the data collection. And the study was carried out in accordance with the guidelines set down in the Helsinki Declaration. The attributes, benefits, uses, and disadvantages of the study were explained to all participants, and informed consent was obtained.

### **Consent for publication**

Not applicable.

### **Availability of data and materials**

The datasets generated and/or analysed during the current study are not publicly available due to ongoing analysis addressing other research questions, but are available from the corresponding author on reasonable request.

### **Competing interests**

The authors declare that they have no competing interests. The authors alone are responsible for the content and the writing of this manuscript.

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### **Authors' contributions**

Authors' contributions QQ Y and LL Y contributed to the study design. LL Y, CL Y, X W, Y C and PP Y carried out the data collection. QQ Y assured the quality of all data before statistical processing and calculation. QQ Y undertook the initial analysis and interpretation of the data. All authors have read and approved the final version of the manuscript before submission.

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