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# Role of turnover, downsizing, overtime and night shifts on workplace violence against healthcare workers: a seven-year ecological study

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## Abstract

**Background** About one-third of workers identify organisational factors as contributors to workplace violence (WPV), but the associations between these factors and WPV have primarily been explored retrospectively and with measures of perceived organisational constraints, hence providing limited information for prevention. Therefore, we assessed whether objectively measured ward-level indicators of turnover, downsizing, overtime, and night shifts are associated with the occurrence of WPV and whether these associations vary by ward type.

**Methods** We conducted an ecological study at a university hospital in northern Italy from 2016 to 2022, using wards as statistical unit (average: 230 wards per year). Active surveillance of WPV was based on an in-hospital incident reporting procedure, updated in November 2021 based on Health Regional Administration guidelines; 2021 was therefore excluded as a transition year. Individual-level administrative data were used to compute ward-level yearly indicators of turnover, downsizing, overtime and night shifts per active worker. Using generalised linear models, we estimated rate ratios (RRs) for yearly WPV counts per 1 SD increase in the indicators, controlling for study period, ward type (emergency department [ED], psychiatric ward, other) and ward sociodemographic composition.

**Results** A total of 337 WPV episodes occurred in the 1381 ward-year observations. The WPV rates per 100 active workers per year increased from 1.40 (95%CI: 1.23–1.60) during 2016–2020 to 3.48 (2.90–4.17) in 2022. Higher turnover (RR, 95%CI: 1.47, 1.23–1.75) and downsizing (1.12, 1.00–1.24) were associated with a greater occurrence of WPV across all wards; these associations were consistent across the study periods. In wards with night shift scheduling, turnover (1.64, 1.40–1.92), downsizing (1.21, 1.04–1.40) and the mean number of night shifts (2.50, 1.37–4.56) were associated with WPV. The association between night shifts and WPV was greater in psychiatric wards (RR=8.73; interaction p-value=0.02), whereas the role of downsizing was greater in EDs (RR=1.42, interaction p-value=0.09) and the role of turnover was greater in the other wards (RR=1.34, interaction p-value=0.16).

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**Conclusion** Work organisational factors are associated with the occurrence of WPV episodes against healthcare workers. Ward type-tailored priorities should be given to minimising turnover and downsizing and promoting a fairer allocation of night shifts to decrease WPV occurrence.

**Keywords** Workplace violence, Personnel turnover, Personnel Downsizing, Night Shift Work, Workload, Health personnel

## Introduction

Type II workplace violence (WPV) against healthcare workers (HCWs) refers to instances of physical or verbal aggression, threats, intimidation, or sexual harassment perpetrated by patients, their relatives or visitors [1]. This form of violence is a public health concern due to its detrimental impact on the safety, physical and mental well-being of HCWs and the quality of care they provide, leading to the decision to leave the profession [2, 3]. Its rate varies widely depending on the methodology used to record it, which may involve passive retrospective surveys based on the recall of WPV episodes, often conducted on self-selected or at-risk samples, or active surveillance systems that have the advantage of covering the entire workforce. In the latter, the 12-month rate is approximately 2–3 per 100 workers, with higher levels observed in emergency departments (EDs) and psychiatric wards [4, 5]. The most studied risk factors are those related to the offender, such as a history of mental health conditions and altered mental state, and to the victim, such as being a nurse, being male and having less work experience [6–9]. In addition, work organisational factors may significantly contribute to the occurrence of WPV episodes by creating conditions that facilitate them [7]. Indeed, a previous study based on data from an active surveillance system revealed that healthcare workers identified organisational factors as contributing elements in approximately 31% of WPV incident reports [4]. However, despite their potential impact, these factors are less frequently studied and often with inconsistent methodologies.

Work organisational factors that might play a role are related to staffing issues, defined as “insufficient personnel” [7, 10], “personnel cutbacks” [11], or turnover, as well as to factors such as high workload, overtime [12], shift work [13, 14], and frequent night shifts [15]. While these issues may arise from different causes, they share a common link as they are shaped by management decisions regarding worker allocation and scheduling, as well as the psychosocial work environment, which can lead to absenteeism and turnover, increasing the workload for those who remain [16]. These aspects might facilitate WPV episodes since they deplete resources to meet patient demands, increase wait times, and reduce security and organisational support [7]. However, their role in WPV has generally been explored through self-report methods that are susceptible to recall bias and are based

on workers’ perceptions (e.g. what constitutes “personnel cutbacks”), with definitions varying across studies. In addition, studies on this topic are often retrospective, which introduces the risk that HCWs who have experienced violence may describe their work environment more negatively. These shortcomings undermine the robustness of the evidence, resulting in limited information for developing effective prevention strategies.

To provide more sound evidence for prevention it is instead important to collect objective measures (e.g., turnover and downsizing on the basis of actual personnel movement rather than on HCW perceptions). In addition, the impact of work organisational factors unfolds over time and is related to the dynamic status of the workforce, with its composition continuously changing due to hirings, terminations and absences. Conducting cross-sectional assessments at a single point in time, on the basis of the registered workers at that moment, fails to account for the fact that each worker’s contribution to the overall active time in a ward varies owing to factors such as long-term absences or movement between wards. This approach can lead to an overestimation of the available workforce and a corresponding underestimation of the impact of organisational factors [17]. To address these issues, administrative data can be leveraged to provide an objective and accurate reconstruction of workforce dynamics over time [18, 19].

The objective of this ecological study was to evaluate at the ward level the associations between turnover, downsizing, overtime, night shift scheduling, and the number of night shifts and the occurrence of WPV episodes against HCWs in hospital departments, adopting an objective and accurate method to assess the exposures from administrative data. In addition, this study aimed to assess these relationships in wards with night shifts, and to assess whether these associations vary by ward type.

## Methods

This ecological seven-year study based on wards as statistical units stems from the “Determinants of Violence against Health Care Workers” (Determinanti Violenze Operatori Sanitari [DeVOS]) project, a multiphase initiative aimed at designing and implementing a guideline-based incident reporting protocol for WPV in two publicly funded referral hospitals in the Lombardy Region [4]. Briefly, the project consisted of the retrospective collection of available WPV data before its start

(2016–2020), and the implementation of a new WPV surveillance system, which became effective in November 2021. Among its specific objectives, DeVOS aims to assess the associations between work organisational factors and WPV occurrence. To answer this question, we designed an ecological study using ward-level aggregated yearly information on WPV counts and on indicators of work organisational factors between 2016 and 2022. We excluded 2021 as a transition year between the existing and the new registration standards. In addition, we included only one of the two referral hospitals, namely the Azienda Socio-Sanitaria Territoriale (ASST) Sette Laghi, owing to the lack of consistent ward indications on the retrospective WPV data for the other hospital.

The ASST Sette Laghi is a referral hospital that consists of hub-and-spoke hospitals, rehabilitation hospitals, hospitals dedicated to mothers and children, and outpatient clinics. We included all the medical and surgical units and EDs from spokes and other facilities that were part of the ASST organisation for the entire study period. The DeVOS project received approval from the Ethical Committee of Insubria (ID 82/2021).

#### Workplace violence registration

The outcome of this study was the count of WPV per ward. WPV was defined as any occurrence of verbal abuse, threats, physical assaults (directed at individuals or property), or sexual harassment occurring at the workplace and perpetrated by patients and visitors [1].

During the study period, an active WPV monitoring system was in use throughout the entire ASST. This was achieved through the affected worker submitting an incident reporting notification to the hospital risk management office within 48 h of the episode. The form for incident reporting changed in November 2021, with the implementation of the new monitoring standard. Time changes in WPV underreporting and characteristics of the reported violence were documented in a previous study, which found that the ratio of observed to expected WPV episodes based on the literature increased from below 1 prior to the implementation of the DeVOS project to 1.14, i.e. 14% higher than expected from the literature, and that the active monitoring was able to capture both severe WPV episodes (e.g., causing a work injury) and less severe ones (e.g., verbal abuse without co-occurrence of other violence types) [4].

#### Definition of the exposure variables

Work organisational factors were investigated via administrative datasets through an epidemiologically-oriented methodology [17], locally developed to assess basic working stress conditions in large working populations, taking into consideration the method proposed by the Italian National Institute for Insurance against Accidents at

Work (INAIL) [20]. The starting datasets, provided by the ASST management, included individual-level data of full- and part-time hospital employees, with temporary and permanent contracts, but excluded external consultants. The available information included sociodemographic data, complete employment history with corresponding wards, absences, shift schedules, number of hours worked, hours of absence and hours due by contract for the investigated years. For every worker, we computed the active time at work as the sum of worked days, thus excluding periods of absence due to vacation, sickness, unpaid and maternity leaves, and daily leaves, separately for each ward in which the HCW had worked during the year. This allowed us to accurately reconstruct the active work history of each worker for the years considered in a dynamic fashion (Figure S1, panel A, Supplementary material 1). For each ward and year (e.g., Ward 1 in 2016, Ward 1 in 2017, Ward 2 in 2016, and so on), we then summed the active time at work of all HCW employed in that ward during the given year to calculate the mean number of active workers per ward-year (Figure S1, panel B, Supplementary material 1). For each ward-year observation, the mean number of active workers is interpretable as the daily average over the given year of active workers in the given ward, and it corresponds to approximately 75–80% of the number of workers in the payroll archives on any single day of the year (Supplementary Table S1, Supplementary material 1). The mean number of active workers per ward-year was used as the denominator for calculating the work organisational factors.

For each ward and year, turnover was defined as the sum of new hires and work cessations, including internal transfers between hospital wards, divided by active workers. Downsizing was defined as the difference between work cessations and new hires, also divided by active workers; greater downsizing indicates a net loss of workers in the ward. The overtime indicator was calculated as (hours worked + hours of absence - hours due by contract), divided by active workers, and it was expressed as weekly hours per active worker per year. Finally, we calculated the average number of night shifts per active worker engaged in night shifts per year. Wards with at least two night shifts per month per active worker engaged in night shifts were flagged as having a regular night shift schedule. Finally, from the payroll archives, for each ward we computed the prevalence of female workers, the median age and the median work seniority on June 30th of each year.

#### Statistical analysis

We excluded very small (below 3.5 active workers per year; approximately 70 per year) ward-year observations, due to the instability of turnover and downsizing indicators in such small units. The final dataset included 223

wards in 2016, 228 wards in 2017, 235 wards in 2018, 233 wards in 2019, and 231 wards in 2020 and 2022. Due to the skewness of their distributions, we summarised the socio-demographic characteristics and work organisational factors by ward and year using medians and interquartile ranges, in the overall sample first, and then by number of yearly WPV episodes, categorised as 0, 1, and 2 or more.

We then analysed the association between work organisational factors and WPV rates via generalised linear models, with a log link function and assuming negative binomial distributions for the yearly WPV counts to account for the high frequency of wards with zero episodes. Given that the same wards were examined over multiple years, we used a model for repeated measures, specifying an unstructured correlation matrix. The number of active workers per year was used as an offset, while ward type (ED, psychiatric, other), the prevalence of women, median age and median seniority in the ward were covariates. We standardised continuous covariates and work organisational factors using year-specific means and standard deviations as we expected that the SARS-CoV-2 pandemic could have affected their yearly distribution. Hence, the results of the generalised linear models are reported as rate ratios (RRs) with 95% confidence intervals, representing the change in WPV rates for 1 standard deviation (SD) increase in the exposure variables from the year-specific mean.

We initially fitted separate models using data from 2016 to 2020 and from 2022 to assess potential changes in the associations due to modifications in the WPV incident reporting procedures [4]. We then fitted the models using all available years, further adjusting for a dichotomic study period indicator. The independent variables for these models were turnover, downsizing, weekly overtime and having a regular night shift schedule. We replicated the analyses in the subgroup of wards with a regular night shift schedule, adding to the model the

mean number of night shifts per active worker engaged in night shifts. Moreover, we added to this model the interaction between ward type and the work organisational factors that were significant in this analysis.

Finally, as a sensitivity analysis to confirm that turnover and downsizing are associated with WPV occurring later in time, we fitted a model using data from 2017 to 2019, with 1-year lagged turnover and downsizing as predictors, controlling for period, percentage of women, median age, and median seniority. We then compared the estimates obtained from this lagged model with those obtained from a cross-sectional model fitted using the same wards.

The  $\alpha$  level in all analyses was set at 0.05. The analyses were performed using SAS, version 9.4 (SAS Institute Inc., Cary, NC, USA; proc GENMOD for the generalised linear models).

## Results

The characteristics of the included wards per year are reported in Table 1. Throughout the study period, wards had a median of approximately 10 active workers per year, with approximately 80% being women and a median age of 49 years. Turnover and overtime peaked in 2020 and 2022, coinciding with the pandemic years. The proportion of wards with regular night shifts decreased from 45.3% in 2016 to 37.2% in 2022, with characteristics similar to those of the entire sample of wards; despite this, the mean number of night shifts remained stable over time (Table S2, Supplementary material 1).

During the period 2016–2020, 224 WPV episodes were registered, corresponding to a rate of 1.40 (95%CI: 1.23–1.60) per 100 active workers per year. In 2022, the number of reported episodes was 113, corresponding to a rate of 3.48 (95%CI: 2.90–4.17) per 100 active workers per year. In wards with a regular night shift schedule, the number of episodes during 2016–2022 and in 2022 was 136 and 96, corresponding to rates of 1.42 (95%CI:

**Table 1** Number of active workers, percentage of women, median age and hospital seniority, and work organisational factors in the investigated wards during the study years

	Year (number of wards)					
	2016 (n = 223)	2017 (n = 228)	2018 (n = 235)	2019 (n = 233)	2020 (n = 231)	2022 (n = 231)
Average number of active workers	10.5 [6.5, 18.3]	10.8 [6.3, 18.7]	10.6 [5.9, 18.1]	10.5 [6.0, 18.5]	10.1 [6.0, 17.9]	10 [5.6, 17.9]
Percentage of women	80.0 [66.2, 93.7]	80.6 [63.4, 92.4]	80.0 [63.1, 93.7]	80.0 [64.7, 93.3]	81.0 [64.3, 93.7]	80.0 [66.3, 94.0]
Median age	49.3 [46.1, 52.3]	49.8 [45.6, 53.1]	49.8 [45.7, 53.3]	49.8 [45.8, 53.3]	49.3 [44.4, 53.3]	48.9 [42.6, 53.7]
Median hospital seniority	18.1 [12.6, 23.8]	17.8 [11.7, 24.8]	17.5 [11.2, 24.8]	17.9 [10.8, 25.5]	14.5 [9.0, 23.4]	14.0 [5.9, 22.0]
Turnover, per 100 active workers	7.5 [0.0, 20.0]	25.6 [8.3, 51.5]	27.8 [13.2, 48.8]	14.7 [0.0, 28.3]	21.0 [9.2, 38.7]	48.8 [24.5, 87.1]
Downsizing, per 100 active workers	0.0 [0.0, 1.3]	0.0 [-9.5, 0.6]	0.0 [-4.1, 10.7]	0.0 [-7.0, 6.3]	0.0 [-11.3, 11.1]	0.0 [-11.3, 11.6]
Weekly overtime, per active worker	0.9 [0.4, 1.4]	0.9 [0.4, 1.4]	0.9 [0.4, 1.4]	1.0 [0.4, 1.4]	2.8 [1.3, 4.2]	1.7 [0.8, 2.9]
Number of wards with night shift scheduling <sup>a</sup> , n (%)	101 (45.3)	102 (44.7)	101 (43.0)	90 (38.6)	95 (41.1)	86 (37.2)

Note. Medians [interquartile ranges] are reported, unless otherwise specified

<sup>a</sup> defined as at least 2 night shifts per month per active worker engaged in night shifts

**Table 2** Associations between ward type, percentage of women, median age, hospital seniority, and work organisational factors with the rates of workplace violence episodes, by study years

	2016–2020 <sup>a</sup>		2022 <sup>b</sup>		2016–2020, 2022 <sup>c</sup>	
	RR	95% CI	RR	95% CI	RR	95% CI
Ward type – ED vs. Other wards	5.12	1.42–18.39	19.67	2.95–131.18	8.28	2.90–23.65
Ward type – Psychiatric vs. Other wards	20.86	5.18–84.02	5.44	1.32–22.50	15.95	4.95–51.43
Percentage of women	1.19	0.68–2.10	0.51	0.28–0.95	0.90	0.59–1.38
Median age	1.77	0.87–3.58	1.33	0.53–3.36	1.51	0.84–2.70
Median hospital seniority	0.51	0.27–0.97	0.85	0.32–2.24	0.61	0.35–1.08
Turnover	1.46	1.17–1.83	1.05	0.44–2.50	1.47	1.23–1.75
Downsizing	1.09	0.90–1.33	1.30	0.42–4.06	1.12	1.00–1.24
Weekly overtime	0.71	0.42–1.21	0.59	0.23–1.52	0.73	0.53–1.02
Night shift scheduling	1.03	0.44–2.37	1.00	0.31–3.28	0.97	0.49–1.93
Period – 2022 vs. 2016–2020	-	-	-	-	2.76	1.43–5.30

Note. Coefficients represent change in WPV rates for 1 SD increase from the year-specific mean. All coefficients are mutually adjusted. Abbreviations: WPV: Workplace Violence; RR: Rate ratio; CI: Confidence interval; ED: Emergency Department

<sup>a</sup> $n=1150$  ward-year observations, 224 WPV episodes, WPV rate: 1.04 (95%CI: 1.23–1.60) per 100 active workers per year

<sup>b</sup> $n=231$  ward-year observations, 113 WPV episodes, WPV rate: 3.48 (95%CI: 2.90–4.17) per 100 active workers per year

<sup>c</sup> $n=1381$  ward-year observations, 337 WPV episodes, WPV rate: 1.75 (95%CI: 1.57–1.94) per 100 active workers per year

**Table 3** Associations between work organisational factors and rates of workplace violence episodes in wards with night shift scheduling over the entire study period

	RR	95% CI
Ward type – ED vs. Other wards	4.97	1.83–13.51
Ward type – Psychiatric vs. Other wards	6.95	2.51–19.23
Percentage of women	0.87	0.53–1.44
Median age	2.96	1.94–4.49
Median hospital seniority	0.23	0.11–0.50
Turnover	1.64	1.40–1.92
Downsizing	1.21	1.04–1.40
Weekly overtime	1.24	0.75–2.06
Number of night shifts <sup>a</sup>	2.50	1.37–4.56
Period – 2022 vs. 2016–2020	2.96	1.30–6.73

Note. Coefficients represent change in WPV rates for each one standard deviation increase from the year-specific mean. All coefficients are mutually adjusted. The model was run using data from all available years (2016–2020 and 2022,  $n=575$  ward-year observations, 232 WPV episodes, WPV rate: 2.05 [95%CI: 1.08–2.32] per 100 active workers per year). Abbreviations: RR: Rate ratio. CI: Confidence interval, ED: Emergency Department

<sup>a</sup> Per active worker engaged in night shifts

1.20–1.68) and 5.42 (95%CI: 4.46–6.58) per 100 active workers per year, respectively.

Figure S2 (Supplementary material 1) shows the distribution of work organisational factors between ward-year observations with no episodes of WPV, one episode of violence and two or more episodes of violence across the entire study period, considering wards with regular night shift scheduling. Ward-year observations with one or two or more episodes of WPV had higher turnover rates (median=58.5 and 33.5, respectively) and number of night shifts (median=62.2 and 63.2, respectively), compared to wards with no WPV episodes (median turnover=29.4, median number of night shifts=57.6,  $p<.05$ ). The difference in turnover was observed across the entire study sample, along with a difference in the probability

of having a regular night shift schedule (Supplementary Table S3, Supplementary material 1).

#### Associations between work organisational factors and WPV rates

The results of the generalised linear models evaluating the associations between work organisational factors and rates of WPV episodes are reported in Table 2. ED wards and psychiatric wards presented higher WPV compared to the other wards. In 2016–2020, turnover was associated with increased WPV rates, whereas downsizing, weekly overtime and night shift scheduling showed no significant associations. In 2022, the association between turnover and WPV rates decreased, and the association between downsizing and WPV rates increased, although both effects were nonsignificant. Across the entire study period, higher turnover (RR, 95%CI: 1.47, 1.23–1.75) and downsizing (RR, 95%CI: 1.12, 1.00–1.24) were associated with increased WPV rates.

Table 3 reports the results of the analysis performed in the subgroup of wards with a regular night shift schedule. Over the entire study period, turnover (RR, 95%CI: 1.64, 1.40–1.92), downsizing (RR, 95%CI: 1.04–1.40), and the number of night shifts (RR, 95%CI: 2.50, 1.37–4.56) were associated with higher WPV rates.

In the models including the interaction terms (Table 4), the interaction between the mean number of night shifts and ward type was significant, indicating that the mean number of night shifts had a stronger association with WPV rates in psychiatric wards (RR, 95%CI: 8.73, 1.92–39.70) than in the ED or in the other wards. The association between downsizing and WPV was stronger in EDs (RR, 95%CI: 1.42, 0.76–2.68), whereas the association between turnover and WPV was stronger in the

**Table 4** Interactions between turnover, downsizing, number of night shifts and ward type in wards with night shift scheduling over the entire study period

	RR	95% CI	Interaction <i>p</i> -value
Turnover (ED)	0.77	0.42–1.41	0.16
Turnover (Psychiatric wards)	0.33	0.09–1.14	
Turnover (Other wards)	1.34	1.18–1.53	
Downsizing (ED)	1.42	0.76–2.68	0.09
Downsizing (Psychiatric wards)	0.32	0.10–1.02	
Downsizing (Other wards)	1.05	0.94–1.17	
Number of night shifts <sup>a</sup> (ED)	1.62	0.36–7.26	0.02
Number of night shifts <sup>a</sup> (Psychiatric wards)	8.73	1.92–39.70	
Number of night shifts <sup>a</sup> (Other wards)	1.36	0.70–2.63	

Note. Coefficients represent change in WPV rates for each one standard deviation increase from the year-specific mean. All coefficients are mutually adjusted. The models are also adjusted for period, weekly overtime, female percentage, median age, median seniority. The model was run using data from all available years (2016–2020 and 2022,  $n=575$  ward-year observations, 232 WPV episodes, WPV rate: 2.05 [95%CI: 1.08–2.32] per 100 active workers per year). Abbreviations: RR: Rate ratio. CI: Confidence interval, ED: Emergency Department

<sup>a</sup> Per active worker engaged in night shifts

other wards (RR, 95%CI: 1.34, 1.18–1.53). However, these interactions were not statistically significant.

The sensitivity analysis revealed that 1-year lagged turnover maintained a significant, although attenuated compared to turnover measured the same year, association with WPV (cross-sectional model: RR, 95%CI: 2.14, 1.58–2.90; 1-year lagged model: RR, 95%CI=1.35, 1.03–1.78). Downsizing exhibited similar associations in both models (cross-sectional model: RR, 95%CI: 1.19, 0.96–1.47; 1-year lagged model: RR, 95%CI: 1.18, 0.76–1.81).

## Discussion

In this study, we found that higher turnover and downsizing were associated with increased rates of WPV episodes across all wards, including EDs, in a large referral hospital. In addition, in wards with regular night shifts, turnover, downsizing and the mean number of night shifts per active worker were associated with WPV, with the impact of night shifts being greater in psychiatric wards.

Previous studies have investigated WPV as a predictor of turnover, but generally framed it as turnover intention (i.e., the self-reported likelihood or willingness to leave their current job) and employed cross-sectional designs that make it difficult to draw conclusions about the direction of the association [21, 22]. In line with other studies addressing its negative outcomes, our study adds to the literature suggesting that objectively-measured turnover (i.e., actual personnel movement) may be an organizational factor contributing to WPV. Indeed, previous studies have shown that turnover negatively affects HCWs both at the individual level, by impairing work

satisfaction and mental health [23, 24], and at the team level, by reducing team cohesion [23]. In addition, it has a negative impact on patients' health, reduces their satisfaction with care and increases their length of stay [25–27]. These factors likely contribute to the increased incidence of WPV, as they exacerbate stress and dissatisfaction not only for staff but also for patients and their relatives. Notably, this association persisted even when turnover from the year preceding the WPV episode was considered as a predictor. Our findings indicate that high turnover is associated with higher WPV rates independent of downsizing, suggesting that frequent personnel changes might be harmful in themselves, while downsizing appears to amplify them. In addition to reducing the number of staff available to manage difficult interactions with patients or relatives, downsizing may increase stress and dissatisfaction among HCWs by increasing their workload, lowering job satisfaction, and amplifying burn-out and psychological distress [28, 29]. This aspect might be particularly important in EDs because the reduction in personnel has a greater impact in settings with high patient fluxes, making it more challenging to manage interaction with patients and/or visitors with fewer HCWs available.

Turnover and downsizing are influenced by different underlying factors, but managerial interventions can and should effectively address them [30]. On the one hand, studies on risk factors for turnover intention show that low salary levels, a heavier workload, greater dissatisfaction with the organisation, a lack of training, and a higher bed-to-nurse ratio are associated with a greater intention to leave [31, 32]. On the other hand, studies on measures to reduce turnover and downsizing show that these can be mitigated by improving career prospects, increasing recognition, job satisfaction, team support and team relationships, and mitigating workplace bullying [16, 33, 34]. The results of our study suggest that establishing a more stable workforce (i.e., reducing turnover and downsizing), might represent a path for the prevention of WPV.

After taking into account ward type, we did not observe a difference in WPV rates between wards with regular night shifts and those without. However, in wards with regular night shifts, we found that, in addition to the effects of turnover and downsizing, the frequency of night shifts per worker engaged in night shifts is associated with the occurrence of WPV. This suggests that the issue may not be the presence of night shifts per se, but rather their frequency for individual active workers. Increased frequency of night shifts may lead to greater exposure to work periods with fewer staff and patients who are more likely to engage in aggressive behaviour (due, for instance, to their clinical conditions or a substance-related altered state), thereby increasing the probability of WPV [15, 35]. In addition, despite their

detrimental effects on physical health due to the disruption of circadian rhythms, night shifts also increase the perception of more demanding or constraining working conditions, disrupt sleep quality and exacerbate the risk of mental health issues, including depression and burnout [36–39]. These issues might reduce HCWs' psychological resources to effectively manage difficult interactions with patients. Therefore, distributing night shifts more evenly among workers might help preventing WPV.

The association between the frequency of night shifts and WPV appeared stronger in psychiatric wards. Although estimates of WPV rates across different shift times vary among studies, and comparisons are complicated by differing denominators, such as fewer visitors, patients, and healthcare workers during night shifts, previous research has shown that the number of WPV episodes in psychiatric wards is relatively evenly distributed between day and night shifts [40]. Therefore, it remains uncertain whether the observed association in psychiatric wards is due to increased exposure to patients in altered states at night. Another potential explanation could involve reduced HCW resources during night shifts in psychiatric wards, which can lead to increased fatigue and decreased job control, factors that have been recognised as critical in increasing the likelihood of being assaulted [41]. This suggests that addressing patient factors alone, such as the use of pharmacological interventions to reduce night-time agitation, may not be sufficient. To better manage the risks of WPV, providing HCWs on night shifts in psychiatric wards with comprehensive support, such as adequate staffing, training on handling WPV and supportive interventions, might be equally important.

The main strength of this study lies in its use of objective data through a methodology that accounts for the actual active workforce, thus avoiding recall bias and providing a more accurate assessment of work constraints. A limitation of this study is that, while we examined how organisational factors influence WPV, bidirectional relationships between these factors cannot be ruled out, in particular for turnover and downsizing. Although our sensitivity analysis showed that the observed relationships persisted even when using 1-year lagged predictors, further studies with longitudinal designs are needed to clarify which direction of causality is stronger. Second, since this study aggregates data at the ward level, the observed associations between work organisational factors and WPV should not be interpreted as direct causal relationships at the individual worker level to avoid the risk of ecological fallacy. Third, our outcome measures are based on the reported incidence of violence, which is known to be lower than the actual occurrence [42]. However, it should be noted that the new reporting method implemented in the study hospital has

significantly reduced underreporting [4], and the associations between work organisational factors and WPV remained substantially consistent both before and after its implementation. Finally, as the study was conducted with data from hospitals of a single institution, the results should be validated in different contexts to confirm their generalizability.

## Conclusions

In conclusion, in this study we found that objectively-measured work organisational factors, in particular turnover, downsizing and frequent night shifts, are associated with the occurrence of WPV episodes against healthcare workers. To mitigate WPV, ward-type tailored priorities should be given to improving workforce retention, for example by focusing on improving career prospects, workers' recognition, job satisfaction, team support and team relationships. Additionally, efforts should be made to ensure a more balanced distribution of night shifts across HCWs, particularly in psychiatric wards. Providing comprehensive support to workers in wards with frequent night shifts, through mental health support services (e.g., counselling services, stress management programs, and peer support groups), adequate staffing, and strategies to mitigate fatigue and burnout is important for preventing WPV. Our results align with the WHO/ILO Framework guidelines for addressing workplace violence [43] and with the ILO Violence and Harassment Convention, which highlights that promoting decent work is an essential strategy to prevent WPV occurrence and mitigate the public health threat it poses [44].

## Abbreviations

CI	Confidence interval
ED	Emergency Departments
HCW	Healthcare worker
RR	Rate ratio
SD	Standard deviation
WPV	Workplace Violence

## Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12889-024-20898-8>.

Supplementary Material 1

## Acknowledgements

We would like to thank the risk management team at ASST Sette Laghi for their support in the DEVoS project, and the hospital management for having provided the administrative data on the healthcare workers for the present study.

## Author contributions

GV and MMF contributed to the conceptualization and design of the study, are the principal investigators of the Determinanti Violenze Operatori Sanitari (DeVOS) project, supervised data analysis, interpreted the results and contributed in writing the manuscript. EMG contributed in developing the data analysis strategy, analysed and interpreted the data, drafted the first version of the manuscript and edited it. HF was responsible for the literature

review and revised the manuscript. MG, BP, RB and NM critically reviewed the paper. The authors read and approved the final manuscript.

### Funding

This study was supported by a grant provided by the Italian Workers Compensations Authority (INAIL; Bando BRIC 2019 - ID29A). The funder had no role in the conceptualization, design, data collection, analysis, interpretation of results, or writing of the manuscript. HF is supported by a scholarship provided by the University of Insubria.

### Data availability

The data underlying this article cannot be shared publicly due to privacy reasons but are available from the corresponding author on reasonable request.

### Declarations

#### Ethics approval and consent to participate

The DeVOS project received approval by the Ethical Committee of Insubria (ID 82/2021). Participants signed an informed consent.

#### Competing interests

The authors declare no competing interests.

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Received: 10 October 2024 / Accepted: 28 November 2024

Published online: 04 December 2024

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