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REVIEW ARTICLE

Behind the white uniform: global burden of workplace violence against nurses: a systematic review and meta-analysis

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ABSTRACT

Background: Workplace violence (WPV) is a pervasive occupational hazard in healthcare, with nurses particularly vulnerable due to their frontline role. In Saudi Arabia, fragmented evidence exists regarding WPV prevalence and risk factors. This systematic review and meta-analysis aimed to provide pooled estimates of WPV among nurses and identify associated determinants.

Methods: We conducted a systematic search of PubMed, Scopus, and Web of Science up to September 2025, following Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines. Eligible studies included cross-sectional or cohort designs reporting WPV prevalence or risk factors among nurses in Saudi Arabia. Data were extracted independently by two reviewers, and study quality was assessed using the Newcastle–Ottawa Scale. Pooled prevalence estimates were calculated in RStudio using the meta package with random-effects models. Heterogeneity was quantified using I^2, and publication bias was evaluated with DOI plots and Luis Furuya–Kanamori index.

Results: Nineteen studies comprising 8,754 nurses were included. The pooled prevalence of any WPV was 65% (95% confidence intervals: 55–74), with 25% reporting physical violence, 39% verbal violence, and 13% sexual violence. Only 41% of incidents were formally reported. Heterogeneity was high across outcomes (I^2 > 98%). Risk factors consistently associated with WPV included Saudi nationality, rotating or night shifts, longer professional tenure, and employment in high-risk departments such as psychiatry and emergency.

Conclusion: WPV is highly prevalent among nurses in Saudi Arabia, particularly in psychiatric and emergency settings. Findings highlight the urgent need for targeted institutional policies, reporting mechanisms, and protective interventions to safeguard nurses' wellbeing and strengthen healthcare system resilience.

Keywords: Workplace violence, abuse, harassment, nurses, Saudi Arabia.

Introduction

Workplace violence (WPV) is broadly defined as incidents of abuse, threats, or assault related to one's work. In healthcare settings, it includes a spectrum of aggressive behaviors – from verbal abuse and bullying to physical assault and sexual harassment – directed at staff by patients, families, or colleagues [1]. Leading public health agencies (e.g. WHO, NIOSH) emphasize that WPV can manifest as physical violence (assault, hitting, kicking, use of weapons, or other bodily force leading to injury), verbal/emotional violence (insults, threats, screaming, and intimidation), and sexual violence (harassment, unsolicited sexual advances or abuse, and gender-based threats, all of which have been reported in healthcare environments.)

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Globally, WPV in healthcare is alarmingly prevalent. Meta-analyses and systematic reviews report that a majority of healthcare workers experience some form of violence at work. For example, a large meta-analysis of 253 studies (331,544 participants) found that 61.9% of healthcare workers reported any WPV in the past year [2]. Physical violence alone was reported by 24.4% of workers, while 42.5% experienced non-physical aggression (primarily verbal abuse) [2]. In that study, verbal abuse was the most frequent subtype (57.6%), followed by threats (33.2%) and sexual harassment (12.4%) [2]. An umbrella review of systematic reviews similarly noted that overall WPV prevalence can be as high as 78.9% among healthcare professionals in some settings [3]. These findings are consistent across world regions, although with heterogeneity; WPV tends to be especially high in Asia and North America and in high-risk units (psychiatric wards, emergency departments) [2,3]. Nurses, who spend more time at patients' bedsides, are often among the most affected professional groups. For instance, the umbrella review highlights that "nurses working in psychiatric wards were the professionals most impacted"[3].

The consequences of WPV are profound for nursing staff and organizations. Victims can suffer physical injuries (bruises, fractures, stabbing) and serious psychological harm. Studies link WPV to elevated rates of post-traumatic stress symptoms, anxiety, depression, and substance use among nurses [4,5]. Repeated exposure causes cumulative stress and can lead to chronic burnout and job dissatisfaction. One review notes that nurses facing WPV frequently report feeling "powerless and unseen," with lasting emotional distress [5,6]. The Ethiopian review, for example, highlights that WPV leads to higher legal claims, compensation costs, and productivity losses [4]. Moreover, fear of violence can prompt nurses to leave the profession, exacerbating workforce shortages.

Regionally, data on WPV in healthcare (and in Saudi Arabia specifically) are more limited and fragmented. A survey in one region found ~60% of nurses had encountered violence [6]. However, individual study estimates vary widely (some as low as 26%, others near 90%[6]) depending on setting and methods. Importantly, the Saudi context also has unique features affecting WPV research and reporting. A narrative review of Saudi nursing literature notes that quantitative surveys of violence are "inflated" (emphasizing numbers), whereas qualitative insights are lacking[7]. Underreporting is a well-documented problem: cultural norms, organizational hierarchies, and fear of blame discourage nurses from formally reporting incidents [6]. For instance, one qualitative study found that many Saudi nurses view violence as "part of the job," and cite convoluted reporting processes and perceived indifference by management as barriers [6].

Given the high stakes and knowledge gaps, a systematic and quantitative synthesis of the evidence is needed. Conducting a systematic review and meta-analysis will address critical data deficiencies in the Arab context, clarify the magnitude of WPV among Saudi nurses, and identify local risk factors. This evidence base can guide policymakers and healthcare leaders in designing targeted prevention and support strategies (e.g., staffing policies, reporting systems, and training) tailored to the Saudi setting. We aim to rigorously estimate the prevalence of WPV against nurses in Saudi Arabia and to identify associated risk factors, by synthesizing all available and eligible studies. This meta-analysis will adhere to systematic methodology [Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines], critically evaluate study quality, and apply meta-analytic techniques to provide pooled estimates. Ultimately, the findings will inform interventions and policies to enhance nurse safety and healthcare system resilience in the region.

Methods

This systematic review and meta-analysis were conducted in accordance with the PRISMA statement guidelines [8].

Literature search and keywords

A comprehensive literature search was performed in PubMed, Scopus, and Web of Science for studies published up to September 2025. The search strategy used in the databases was: ("violence" OR " WPV" OR "aggression" OR "occupational violence" OR "abuse" OR "bullying" OR "mobbing" OR "harassment") AND ("nurse" OR "nurses" OR "nursing staff") AND ("Saudi Arabia" OR "Saudi" OR "Kingdom of Saudi Arabia".) Reference lists of included studies and relevant reviews were also screened to identify additional eligible publications.

Eligibility criteria

Studies were eligible if they met the following criteria:

1. Observational studies with a cross-sectional or cohort design.
2. Nurses working in healthcare facilities in Saudi Arabia, regardless of age, gender, or specialty.
3. Studies that reported the prevalence of WPV (any form, or specifically physical, verbal, or sexual) and/or risk factors associated with violence.

Exclusion criteria were:

1. Non-original works (e.g., reviews, commentaries, editorials, protocols, theses, conference abstracts).
2. Studies not specific to nurses (i.e., those reporting prevalence among mixed healthcare workers without subgroup data).
3. Studies with unclear or incomplete data on WPV prevalence or risk factors.

Study selection and data extraction

After removing duplicates, all records were uploaded into the Rayyan software [9] for blinded screening. Two reviewers independently screened titles and abstracts

against eligibility criteria, followed by full-text review of potentially relevant studies. Discrepancies were resolved through discussion. Reference lists of included studies were further examined to identify additional eligible reports.

Data extraction was performed independently by two authors using a standardized electronic form. Extracted information included:

- Study characteristics: first author, year of publication, design, setting, region, sample size, and response rate.
- Participant characteristics: mean age, gender distribution, department (e.g., emergency, psychiatry, general wards).
- Outcomes: prevalence of overall WPV and subtypes (physical, verbal, sexual), reporting behaviors, and identified risk factors (e.g., nationality, shift work, years of experience, resilience, department type).

Risk of bias assessment

The methodological quality of included studies was assessed independently by two reviewers using the Newcastle–Ottawa Scale (NOS) adapted for cross-sectional studies [10]. Domains assessed included sample representativeness, adequacy of sample size, ascertainment of WPV, and adjustment for confounders. Any disagreement was resolved by consensus.

Statistical analysis

All statistical analyses were performed using RStudio with the "meta package"[11]. Prevalence estimates from individual studies were pooled using a random-effects model. Results were presented as pooled prevalence with 95% confidence intervals (CIs). Between-study heterogeneity was quantified using the I^2 statistic and Cochran's Q test, with $I^2 \geq 50\%$ or $p < 0.10$ considered indicative of substantial heterogeneity [12]. The presence of publication bias was assessed using the Luis Furuya–Kanamori (LFK) asymmetry index and the Doi plot. Symmetry in the plot indicates no evidence of bias, whereas asymmetry suggests its presence. According to the LFK index, values within ±1 denote no asymmetry, values between ±1 and ±2 indicate minor asymmetry, and values exceeding ±2 reflect major asymmetry [13]. We conducted the publication bias analysis and generated Doi plots using the MetaXL add-in for Microsoft Excel [14].

Sensitivity analysis

Sensitivity analyses were performed using a leave-one-out approach to evaluate the influence of individual studies on the pooled prevalence estimates and explore possible sources of heterogeneity.

Results

Literature search

The electronic database search yielded 213 records. After removal of duplicates, 140 records were screened by title and abstract, and 42 articles were selected for full-text assessment. Following a detailed eligibility evaluation, 19 cross-sectional studies published between 2002 and 2025 were included in the systematic review and meta-analysis [15–33]. The study selection process is depicted in the PRISMA flow diagram, as shown in Figure 1.

Study and population characteristics

The included studies collectively enrolled 8,754 nurses working in diverse healthcare settings across Saudi Arabia. Sample sizes ranged from 159 to 2,819 participants. Nurses were recruited from primary care facilities, tertiary hospitals, psychiatric institutions, and emergency departments, with Riyadh and Jeddah being the most common study locations. Demographic data were variably reported. Where available, the mean participant age ranged from 30 to 38 years, with most nurses aged between 20 and 40 years. Several studies noted a predominance of female participants, though male representation reached up to 45% in some cohorts. Across settings, psychiatric and emergency departments consistently showed higher exposure to WPV. Underreporting incidents was a recurrent theme, with multiple studies citing cultural barriers, administrative inefficiencies, or fear of retaliation as deterrents to formal reporting. The studies and population characteristics are represented in **Table 1**.

Quality assessment

The methodological quality of the included cross-sectional studies was evaluated using the adapted NOS. As shown in Supplementary Table 1, the overall scores of the studies ranged from 4 to 8 out of 10, reflecting variability in study design and reporting. All studies scored well in outcome assessment and statistical analysis, while some demonstrated limitations in sample representativeness, sample size, and handling of non-respondents. Comparability, reflecting control for confounding factors, was adequately addressed in several studies, with a few achieving the maximum score. Overall, the majority of studies were rated as moderate to high quality, supporting the reliability of the evidence base for this review.

Meta-analysis

All types of WPV

The pooled prevalence of any WPV against nurses was [65%, 95% CI: 55–74], with high heterogeneity (I^2 = 98.2%, $p < 0.0001$), as shown in Figure 2A. Sensitivity analysis showed that no single exclusion of any study resolved the heterogeneity, as shown in Figure 2B. Publication bias assessment using DOI plots yielded an LFK index of −0.36, suggesting no asymmetry, as shown in Figure 3.

Physical violence

The pooled prevalence of physical violence was [25%, 95% CI: 11–42] (I^2 = 99.4%, $p < 0.0001$), as demonstrated in Figure 4A. Leave-one-out sensitivity analysis demonstrated that no single exclusion of any study

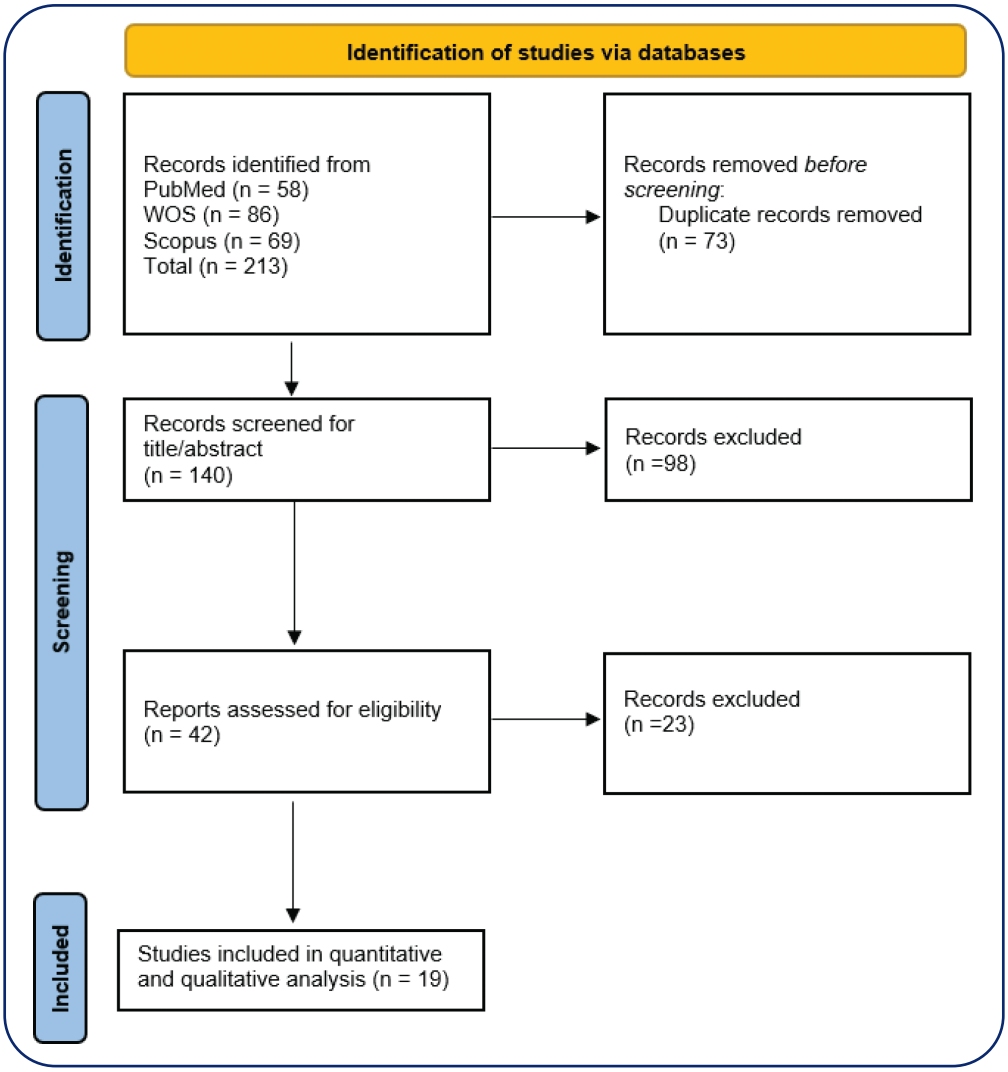

Figure 1. *PRISMA flowchart of study selection.*

resolved the heterogeneity, as demonstrated in Figure 4B. Moreover, Figure 5 shows that the DOI plot indicated an LFK index of 2.31, consistent with major asymmetry and possible small-study effects.

Verbal violence

The pooled prevalence of verbal violence was [39%, 95% CI: 23-57], with substantial heterogeneity (I^2 = 99.1%, $p < 0.0001$), as shown in Supplementary Figure 1A. Verbal abuse emerged as the most common form of WPV reported by nurses across all settings. Sensitivity analysis showed that no single exclusion of any study resolved the heterogeneity, as shown in Supplementary Figure 1B. The DOI plot, demonstrated in Supplementary Figure 2, yielded an LFK index of −0.53, indicating no asymmetry.

Sexual violence

Regarding sexual violence, the pooled prevalence, shown in Supplementary Figure 3A, was [13%, 95% CI: 1-32] (I^2 = 99.6%, p < 0.0001). Although lower than physical and verbal violence, it was reported across multiple regions and healthcare contexts. As represented in Supplementary Figure 3B, sensitivity analysis did not resolve the heterogeneity by the exclusion of any study. The DOI plot produced an LFK index of 1.55, suggesting minor asymmetry, as shown in Supplementary Figure 4.

Nurses reporting violence

With respect to the reporting of violence acts, the pooled prevalence was [41%, 95% CI: 19-65] (I^2 = 98.7%, $p < 0.0001$), as shown in Supplementary Figure 5A, indicating that nearly half of the violent incidents were formally reported. Sensitivity analysis showed that no study exclusion resolved the heterogeneity, as demonstrated in Supplementary Figure 5B. The DOI plot, shown in Supplementary Figure 6, indicated an LFK index of 0.33, consistent with no asymmetry.

Table 1. *Summary of the included study characteristics.*

Study (Author, Year)	Sample size (*n*)	Age, mean (SD)/ range *n* (%)	Sex, males n (%)	Design	Saudi location	Population / setting	Key finding
Algwaiz and Alghanim 2012 [19]	249	NA	NA	Cross-sectional	Riyadh	Nurses in two public hospitals in Riyadh city.	Nurses and physicians face high risks of violence, highlighting the need for awareness and preventive measures to ensure safer hospitals
Mohamed 2002 [15]	434	36.1 (7.97)	215 (91.5)	Cross-sectional	Riyadh	The study encompassed nurses in primary health care settings from five institutions: a university hospital, a Ministry of Health hospital, a private hospital, a mental health hospital, and a military hospital.	This study shows that violence against nurses is a significant public health concern, and strengthening hospital security could help reduce it
Basfr et al. 2019 [28]	310	20-29: 95 (30.6) 30-39: 158 (51) 40-49: 40 (12.9) 50-59: 17 (5.5)	142 (45.8)	Cross-sectional	Jeddah	Nurses at three main psychiatric hospitals located in the Western region of Saudi Arabia.	WPV among nurses in Saudi psychiatric hospitals is alarmingly high, underscoring the need for ongoing staff training and coordinated policies with law enforcement and prosecutors to manage violent patients
Harthi et al. 2020 [16]	175	NA	NA	Cross-sectional	Dammam	Emergency-department nurses at four public hospitals belonging to the Ministry of Health in Dammam, Saudi Arabia.	WPV is widespread in Saudi emergency departments, with verbal abuse being the most common form.
Al-Surimi et al. 2020 [17]	519	NA	NA	Cross-sectional	Riyadh	The study setting included four hospitals located across different geographical regions of Saudi Arabia	Workplace bullying can occur anytime in healthcare settings, with prevalence differing across occupations and significantly linked to gender, age, education, and nationality
Al-Shamlan et al. 2017 [27]	391	<30: 157 (40.2) 30-<40: 121 (30.9) ≥40: 113 (28.9)	42 (10.8)	Cross-sectional	Dammam	King Fahd Hospital of the University (KFHU) serves as a referral center for the entire Eastern Province, offering a wide range of services, including inpatient and outpatient care, emergency services, surgical operations, and various specialized medical services.	Verbal abuse is a major issue in KFHU, and many cases remain unreported despite established reporting procedures, posing a concern for decision-makers.
Alkorashy et al. 2016 [18]	370	31-39: (35.8) 26-30: (24.8)	25 (6.8)	Cross-sectional	Riyadh	This 860-bed university hospital, located in Riyadh, Saudi Arabia, employed a quota sampling approach that included bedside nurses as well as all head nurses and charge nurses.	Violence against nurses is highly prevalent in the studied Saudi university hospital, highlighting the need for administrators and policymakers to implement zero-tolerance policies and practical prevention measures.
Alsharari et al. 2022 [26]	849	20-30: 362 (42.6) 31-40: 411 (48.4) 41-50: 66 (7.8) 51-60: 10 (1.2)	275 (32.4)	Cross-sectional	Saudi Arabia (multicenter)	The respondents were emergency nurses from public hospitals across various administrative regions of Saudi Arabia. All nurses with at least one year of experience in the included hospitals were invited to participate.	Emergency nurses in Saudi Arabia face alarmingly high and underreported WPV, largely driven by heavy workloads, staffing shortages, weak visitor policies, unmet expectations, and unclear reporting procedures

(Continued)

Study (Author, Year)	Sample size (*n*)	Age, mean (SD)/ range *n* (%)	Sex, males n (%)	Design	Saudi location	Population / setting	Key finding
Sayed et al. 2022 [24]	369	34.18 (6.90)	9.5 (35)	Cross-sectional	Buraidah, Qassim.	The study population comprised all nurses employed in five hospitals in Buraidah, Qassim, including three public and two private sector institutions.	Nurses experience a high burden of verbal and physical abuse, often leaving them with distressing memories; yet over half do not report incidents, and only a few cases lead to managerial action
Syed et al. 2022 [25]	277	NA	NA	Cross-sectional	Riyadh	The study was carried out among healthcare workers at a tertiary care hospital in Riyadh, Saudi Arabia.	Workplace bullying was linked to age, gender, job, and nationality, posing serious concerns in healthcare by lowering job satisfaction, harming staff well-being, and increasing risks to patient safety.
Alamri et al. 2023 [33]	198	37.7 (6.6)	118 (59.6)	Cross-sectional	Jeddah	The study was conducted at the Erada and Mental Health Complex in Jeddah, Saudi Arabia, a 210-bed psychiatric facility comprising eight inpatient units.	The study underscored the severe psychological impact of violence on psychiatric nurses in Jeddah, Saudi Arabia
Abdulkarim and Subke 2023 [31]	159	NA	NA	Cross-sectional	Jeddah	Jeddah was divided into northern and southern regions, from which healthcare centers were randomly selected. Participants were then randomly chosen from each selected center.	About one-third of healthcare workers reported bullying, primarily from patients and managers, with higher rates linked to years of experience, managerial offenses, and exposure to or witnessing WPB
AlHassan et al. 2023 [22]	2819	NA	NA	Cross-sectional	Saudi Arabia (multicenter)	The study was conducted among healthcare providers registered with the Saudi Commission for Health Specialties (SCFHS) who had been employed in the health sector for more than one year.	Although sexual violence prevalence is low, it remains a risk for HCWs, particularly during night shifts and in roles involving direct patient contact, underscoring the need for targeted support, strategies, and policies
Alhassan et al. 2023 [23]	2819	NA	NA	Cross-sectional	Saudi Arabia (multicenter)	The study included all healthcare providers registered with the Saudi Commission for Health Specialties (SCFHS) who had been working in the health sector for more than one year.	Physical WPV rates in Saudi Arabia are lower than those reported internationally but still pose a risk, especially for HCWs on night shifts and in direct patient care.
Alharbi et al. 2024 [20]	416	20-30: 106 (25.5) 31-40: 244 (58.7) 41-50: 57 (13.7) >50: 9 (2.2)	96 (23.1)	Cross-sectional	Riyadh	The study recruited a cross-section of healthcare providers from five randomly selected hospitals in the Riyadh region.	Over half of nurses reported experiencing WPB, with middle-aged, highly educated, and experienced male nurses in specialty units being most affected
Alhalal 2024 [21]	340	36.72: (7.86)	All females	Cross-sectional	Riyadh	Hospital selection was based on accessibility and capacity. The first hospital admits approximately 30,000 inpatients and serves 500,000 outpatients annually, while the second medical center manages around 45,966 inpatients and 1,229,628 outpatients each year.	The study found that 67.6% of female nurses experienced WPV, most often in psychiatric units, reflecting their frontline role in patient care.

(Continued)

Study (Author, Year)	Sample size (*n*)	Age, mean (SD)/ range *n* (%)	Sex, males n (%)	Design	Saudi location	Population / setting	Key finding
Alenezi 2024 [29]	361	30.31 (NA)	276 (76.5)	Cross-sectional	Riyadh	The study was conducted at a large 530-bed inpatient psychiatric facility in Riyadh, Saudi Arabia. Eligible nurses of both genders were included if they had at least 1 year of professional experience and demonstrated a willingness to actively participate in the research	A substantial proportion of mental health nurses faced violence in hospital settings, with higher risk linked to non-Saudi nationality, rotating shifts, lower education, and reduced resilience.
Abu El-Kass et al. 2025 [30]	171	34.85 (4.74)	116 (67.8)	Cross-sectional	Al Qurayyat City	This study was conducted in Saudi Arabia at three sites: the Eradah Complex for Mental Health in Arar City, the Eradah Hospital for Mental Health in Al Jouf City, and the Mental Health Hospital in Al Qurayyat City.	Psychiatric nurses experienced high levels of verbal and physical WPV, which was significantly associated with reduced quality of life
Al Muharraq et al. 2022 [32]	347	20-30: 126 (36.3) 31-40: 175 (50.4) 41-50: 40 (11.5) >50: 6 (1.7)	78 (22.5)	Cross-sectional	Riyadh	The study was conducted at a medical city complex in Riyadh, Saudi Arabia, one of the largest and fastest-growing tertiary hospitals in the Middle East. The facility has a capacity of 1,200 beds and employs approximately 2,170 nurses from diverse national backgrounds.	The high prevalence of bullying and turnover intention indicates that exposure to workplace bullying increases nurses' likelihood of intending to leave their jobs.

KFHU: King Fahd Hospital of the University; SCFHS: Saudi Commission for Health Specialties; HCWs: Healthcare workers; WPV: Workplace violence; WPB: Workplace bullying; NA: Not available

Risk factors and predictors of violence

Several studies conducted in Saudi Arabia have identified significant factors associated with WPV against nurses. Alenezi [29] reported that nationality, education, work rotation, and resilience were independent predictors. Compared with Saudi nurses, non-Saudi nurses were less likely to experience WPV [Odds ratio (OR) = 0.55; 95% CI: 0.32-0.95]. Educational level also played a role, with nurses holding secondary school certificates (OR = 3.79; 95% CI: 1.30-11.02), technical institute diplomas (OR = 3.94; 95% CI: 1.08-14.40), or bachelor's degrees (OR = 2.92; 95% CI: 1.03-8.21) being more vulnerable. In addition, rotational work schedules increased the risk (OR = 2.41; 95% CI: 1.15-5.05), whereas resilience had a protective effect (OR = 0.92; 95% CI: 0.89-0.95). Basfr et al. [28] further noted that WPV incidents occurred more frequently during evening shifts (OR = 2.91; 95% CI: 1.19-7.09), with patients (OR = 2.99; 95% CI: 1.26-7.08) and their relatives (OR = 0.29; 95% CI: 0.11-0.74) identified as the main perpetrators. Similarly, Alsharari et al. [26] found that longer tenure in emergency departments substantially elevated the risk, with nurses working 6-10 years [adjusted odds ratio (aOR) = 3.1; 95% CI: 1.8-5.4] or more than 10 years (aOR = 10.9; 95% CI: 3.8-31.1) being especially vulnerable. Moreover, not feeling safe in the workplace independently increased the likelihood of violence (aOR = 2.8; 95% CI: 1.9-4.3). These findings underscore the multifactorial nature of WPV in Saudi healthcare settings, highlighting the role of individual characteristics, work conditions, and perceived safety.

Discussion

Our meta-analysis synthesized data from all available studies of WPV against nurses in Saudi Arabia to estimate overall prevalence and associated risk trends. We found that WPV is alarmingly common: the pooled prevalence of any WPV was 65% (95% CI 55-74) among Saudi nurses. When disaggregated, the pooled rates were approximately 25% for physical violence, 39% for verbal violence, and 13% for sexual violence. Verbal abuse clearly predominated over physical or sexual forms. About 41% of nurses reported formally documenting the incidents, suggesting substantial under-reporting. These figures reaffirm a grave occupational hazard in Saudi healthcare.

Individual Saudi studies highlight several consistent risk patterns. For example, Alenezi [29] found that Saudi nurses reported more WPV than expatriate nurses (non-Saudi nationality was associated with a significantly lower odds of violence). Shift work also mattered: rotating or night shifts conferred roughly double the risk compared to fixed daytime schedules. Educational level showed mixed effects – in Alenezi's study, nurses with diploma or bachelor's degrees reported more violence than those with higher degrees – possibly reflecting job role or reporting behaviour [29]. The work setting was pivotal. In psychiatric hospitals, Basfr et al. [28] observed an extremely high WPV prevalence (90.3% of

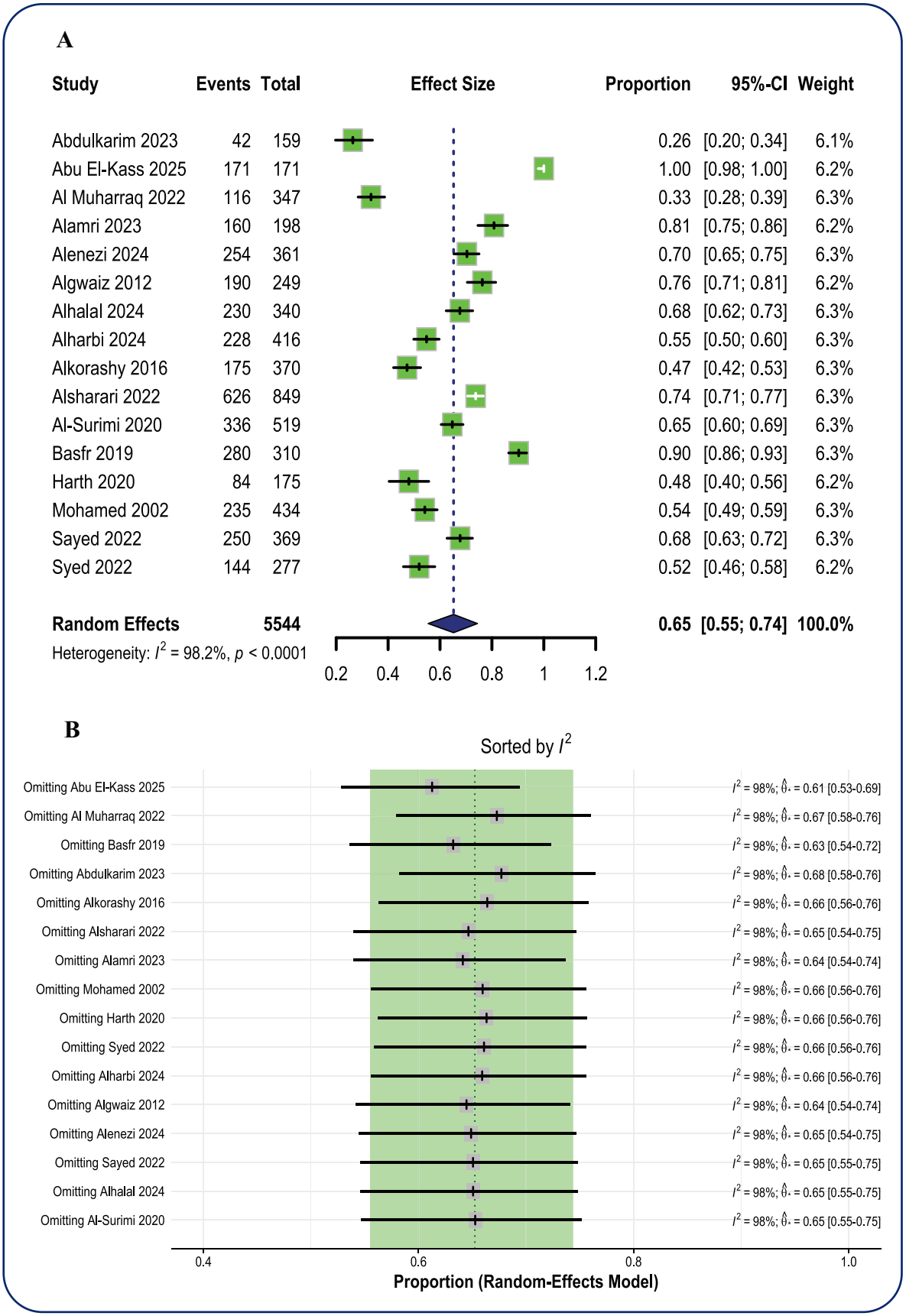

Figure 2. *A) Prevalence of all types of violence against nurses in Saudi Arabia, B) Leave-one-out analysis.*

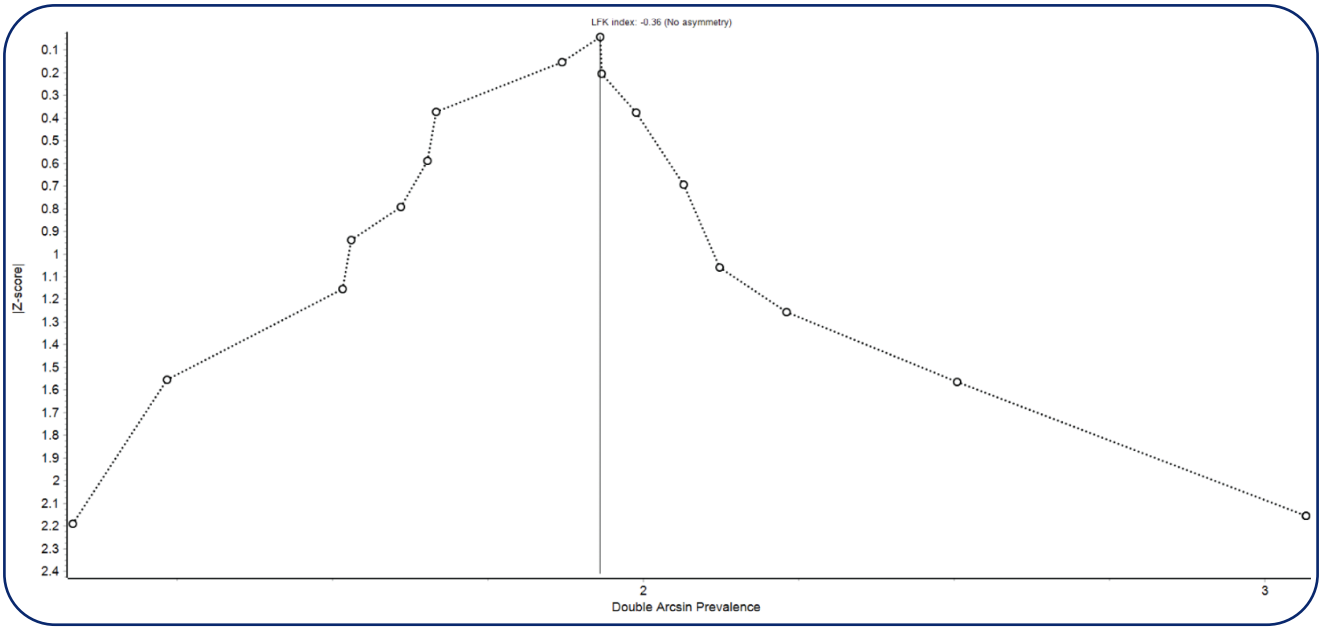

Figure 3. *Doi plot and LFK index for all types of violence against nurses in Saudi Arabia.*

nurses) [28]. Surprisingly, more assaults occurred during morning shifts than evening shifts (58.4% *vs.* 42.3%), and patients themselves were the main aggressors (81.3%). By contrast, in emergency departments, Alsharari et al. [26] found 73.7% of nurses experienced violence, with most events in the afternoon (70.8%) and family members of patients as the chief perpetrators (88.3%). These differences likely reflect operational workflows and visitor patterns in each setting. Experience level also influenced risk: one multicenter study reported that nurses with 6–10 or >10 years of emergency experience had several-fold higher odds of violence than newcomers (statistically significant) [26], suggesting both exposure accumulation and perhaps reporting awareness increase with tenure. Taken together, the Saudi evidence paints a multifactorial picture: WPV is more likely among Saudi nationals, those on rotating or long shifts, and in high-intensity departments (psychiatry, emergency), and is predominantly verbal aggression often initiated by patients or their families. Many of these findings qualitatively support the overall meta-analytic trends, even if formal pooled ORs were not calculated.

The extremely high heterogeneity in our pooled estimates ($I^2 > 98\%$) demands careful interpretation. Such heterogeneity is expected when combining diverse cross-sectional studies. Methodological variations – including sampling frames (hospital type, region), study period, instruments for measuring violence, and recall intervals – can all inflate heterogeneity. For example, some studies surveyed lifetime violence while others used 1-year recall; some used validated WHO questionnaires, others simpler self-reports. Contextual factors (e.g., public awareness campaigns, security policies, cultural norms about reporting violence) may also differ between hospitals and regions, further diversifying results. In our analysis, we used random-effects models to accommodate this variance, and conducted sensitivity analyses (leave-one-out), which showed no single study overly influenced the pooled prevalence. Nevertheless, I^2 remains very high, mirroring similar findings in related literature. Other meta-analyses of healthcare workers' violence have reported comparably large I^2 statistics (approaching 99%) [34]. Thus, methodological and contextual heterogeneity among the Saudi studies – not sampling error – is the main driver of our statistical dispersion, and our pooled estimates should be viewed as broad summaries rather than precise predictions for any single hospital.

It is instructive to compare these results with evidence from other Arab countries and other health professions. Though our focus was nurses, studies of physicians and mixed healthcare staff in the region show similarly high violence exposure. For instance, a large Jordanian survey of doctors found 63.1% had experienced some WPV in the past year [35], a prevalence almost identical to that among Saudi nurses. In that study, male doctors and those in government hospitals reported the most assaults, echoing our finding that high-intensity public settings incur higher WPV. Likewise, a Lebanese review reported 62% of nurses had suffered verbal abuse and 10% physical violence in 1 year [36], underscoring that verbal aggression is the dominant form across Arab healthcare settings. These parallels suggest common regional factors – for example, patient-family expectations or health system strains – that transcend specific professions.

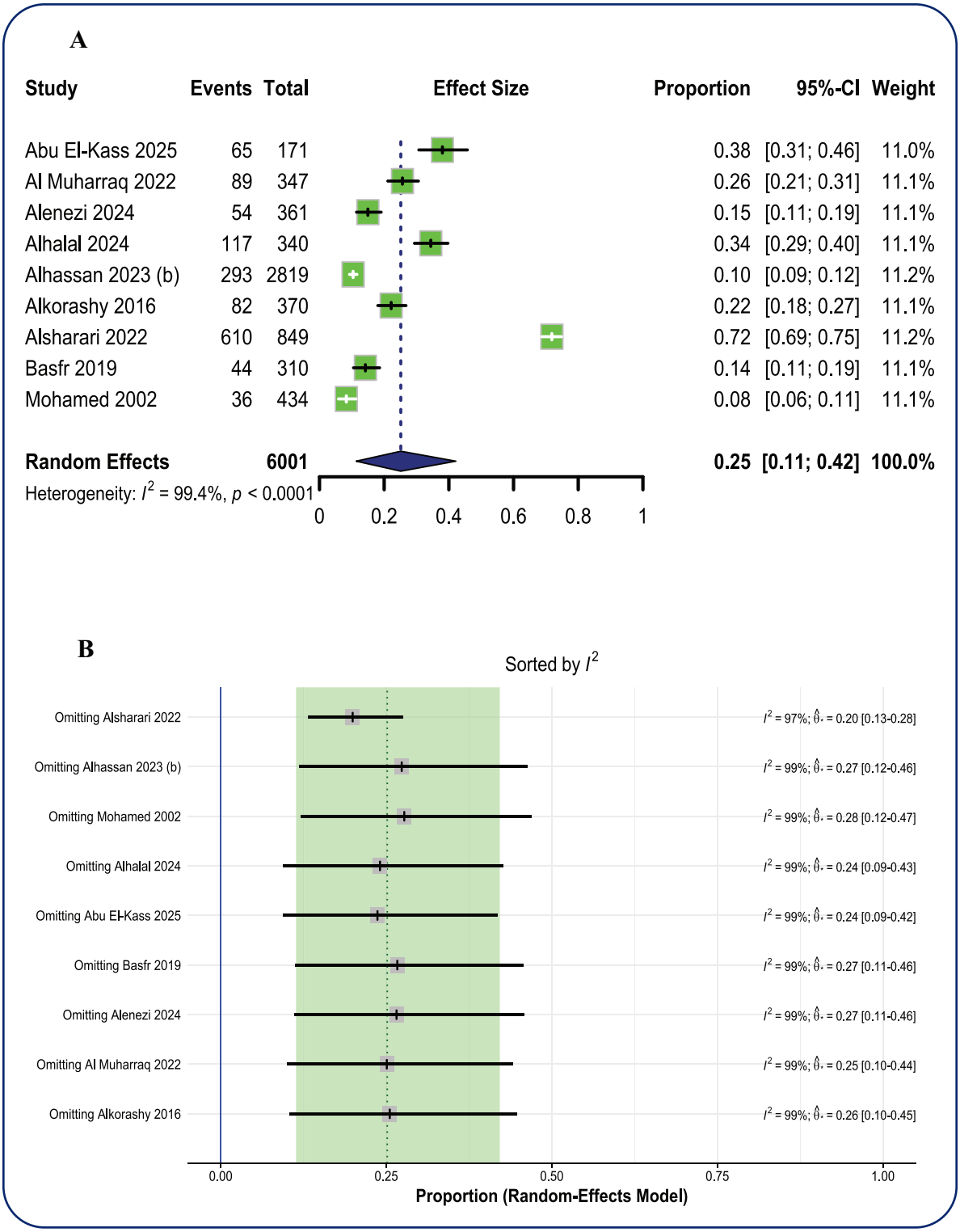

Figure 4. *A) Prevalence of physical violence against nurses in Saudi Arabia, B) Leave-one-out analysis.*

In the global context, our findings align with international patterns of nurse-targeted violence, though absolute levels vary by region. A recent umbrella review of meta-analyses reported a 58.7% overall prevalence of any WPV among healthcare workers worldwide [37], with verbal abuse (66.8%) far exceeding physical assault (20.8%) – very similar to our Saudi pattern. Asian and Middle Eastern settings often report the highest rates: for example, a Chinese meta-analysis found a 12-month WPV incidence of 71% in nurses [38]. In contrast, high-

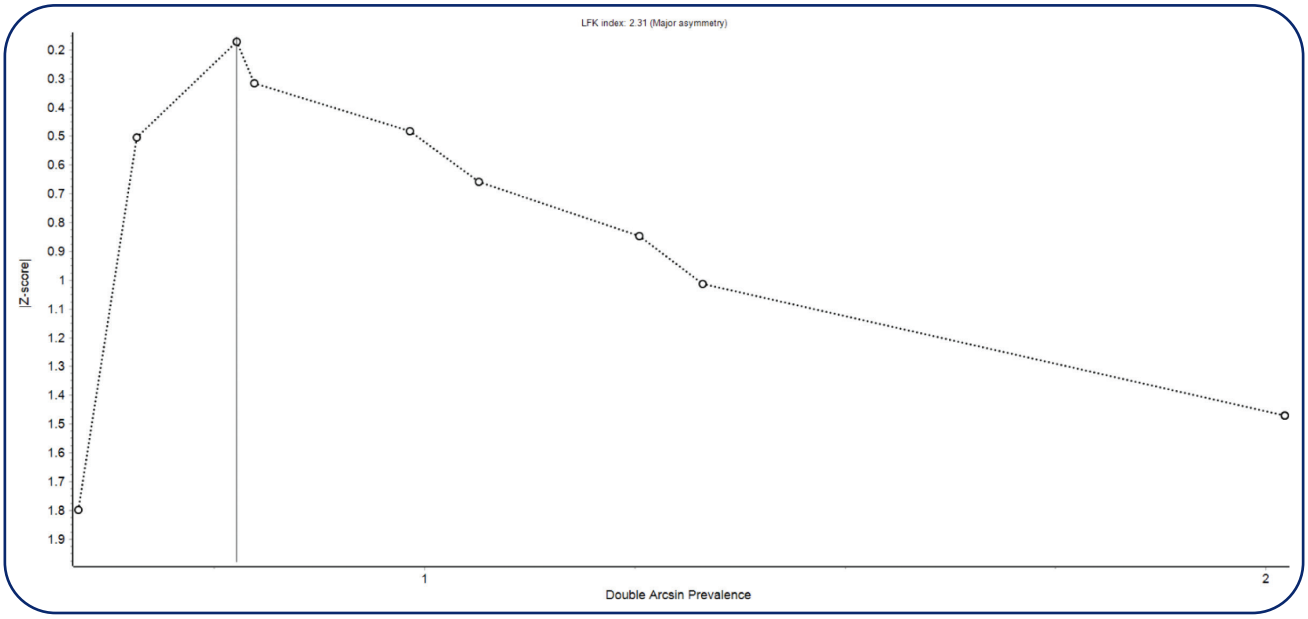

Figure 5. *Doi plot and LFK index for physical violence against nurses in Saudi Arabia.*

income countries tend to be lower: a recent US meta-estimate gave about 43% prevalence in nurses [39]. These differences may reflect factors such as stronger staffing and security measures in wealthier systems, or varying cultural thresholds for reporting. Unique local influences – for example, legal protections for healthcare workers or patient-practitioner gender dynamics – may modulate national prevalence, but the Saudi rates of 65% overall (with 39% verbal) fall broadly within the range seen worldwide. The bottom line is that, much like their international peers, Saudi nurses confront workplace aggression at very high rates, and the risk profiles (emergency settings, night shifts, and so on) are similar to those identified in overseas studies.

This meta-analysis has notable strengths. We followed established systematic review protocols (PRISMA), conducting a wide-ranging search (including Arabic sources and reference lists) to capture all relevant Saudi studies. Two reviewers independently screened studies and abstracted data, and we assessed study quality (using NOS) to ensure methodological rigor. Our use of random-effects meta-analytic models is appropriate given study diversity, and we performed sensitivity analyses to test the robustness of findings. We also evaluated publication bias via DOI plots and LFK indices – finding no significant asymmetry for overall WPV or verbal incidents (though physical violence showed some small-study effect). We also acknowledge limitations. Definitions of "WPV" varied between studies (some included threats or bullying, others only physical assaults), and recall periods ranged (e.g., past year *vs.* career), so direct comparability is imperfect. Finally, our findings rely on self-reported exposure, which can underestimate true incidence (due to stigma or forgetfulness) or over-estimate it (if more-violent events are more memorable). Despite these limitations, the consistency of alarmingly high rates across studies is undeniable.

These results carry clear practical implications for healthcare leaders and policymakers. The fact that roughly two-thirds of nurses endure violence – and that only about half report it – indicates urgent action is needed. Hospital administrators in Saudi Arabia should strengthen incident reporting systems (making them user-friendly and without fear of repercussion) and ensure consistency in zero-tolerance policies. Training programs on de-escalation and worker resilience may mitigate some risk. Given the elevated risk in specific settings, targeted measures are warranted in emergency and psychiatric units (such as increased security presence or visitor restrictions during peak hours). Leadership should also address modifiable factors like staffing levels and waiting times, which often spark patient frustration. At the national level, reinforcing legal protections for assault on healthcare workers (and publicizing penalties) could deter potential perpetrators. The Saudi context is not unique – many Gulf and Middle Eastern health systems have similar workforce compositions and patient populations – so the lessons here are broadly relevant. Ultimately, improving workplace safety will protect nurses' well-being, reduce turnover, and ensure better patient care across the region.

Conclusion

This systematic review and meta-analysis demonstrates that WPV is a widespread and pressing problem for nurses in Saudi Arabia, with two-thirds experiencing

some form of abuse. Verbal violence predominates, while underreporting remains a critical barrier to effective intervention. The identified risk factors – shift patterns, work setting, nationality, and years of experience – underscore the multifactorial drivers of WPV. These findings emphasize the need for comprehensive preventive strategies, including zero-tolerance policies, streamlined reporting systems, staff support programs, and targeted security in high-risk units. Addressing WPV is essential to protect nurses, enhance job satisfaction, and maintain safe, resilient healthcare services.

List of Abbreviations

aOR	Adjusted odds ratio
CI	Confidence interval
HCWs	Healthcare workers
KFHU	King Fahd Hospital of the University
LFK	Luis Furuya–Kanamori index
NA	Not available
NOS	Newcastle–Ottawa Scale
OR	Odds ratio
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
SCFHS	Saudi commission for health specialties
WPB	Workplace bullying
WPV	Workplace violence

Conflict of interest

The authors declare that they have no competing interests.

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Our manuscript was not applied to human beings and thus requires no ethical approval.

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All data generated or analyzed during this study are included in this published article [and its supplementary material file].

Authors' contributions

The authors meet the criteria for authorship as recommended by the International Committee of Medical Journal Editors (ICMJE).

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Supplementary content (if any) is available online.

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