The Open Public Health Journal
DOI: 10.2174/0118749445371126082706 1451, 2026, 19, e187494453711
ISSN: 1874-9445
1
SYSTEMATIC REVIEW
OPEN ACCESS

Prevalence and Associated Factors of Needlestick and Sharps Injuries among Healthcare Workers in Saudi Arabia: A Systematic Review and Meta-analysis

Mohammed A. Alsuliman[1,*]

[1]*Department of Public Health, College of Health Sciences, Saudi Electronic University, Riyadh, Saudi Arabia*

Abstract:

Background: Needlestick and sharps injuries (NSIs) are a major occupational hazard for healthcare workers (HCWs) in Saudi Arabia, yet national-level data on their prevalence and associated factors remain limited.

Objectives: To estimate the pooled prevalence of NSIs among HCWs in Saudi Arabia and identify associated factors.

Methods: This systematic review and meta-analysis followed PRISMA 2020. Cross-sectional studies reporting NSI prevalence among HCWs in Saudi Arabia were retrieved from PubMed, EBSCOhost, Web of Science, and Google Scholar, and appraised with the JBI prevalence checklist. Prevalence was pooled using a random-effects Freeman-Tukey model, with a generalized linear mixed model as a sensitivity analysis and a 95% prediction interval. Subgroup analyses and meta-regression explored heterogeneity.

Results: Twenty-five studies (7,635 HCWs) were included. The pooled prevalence was 35.5% (95% CI: 23.9-48.0), with high heterogeneity (I^2 = 98.7%) and a prediction interval of 0-93.8%, indicating no single underlying rate; a generalized linear mixed model gave 34.6%. Prevalence was higher in males (48.2%) than females (32.7%) and in the Eastern region (83.6%, k = 2). Needles caused 76% of injuries, and about 35% were unreported.

Discussion: The pooled estimate should be interpreted as the center of a wide distribution rather than a national rate, given the persistent heterogeneity within subgroups. Estimates from single or few studies are exploratory. High underreporting and the predominance of needle injuries are modifiable prevention targets.

Conclusion: NSIs remain common but highly variable among Saudi HCWs. Standardized surveillance, safety-engineered devices, and targeted training are needed, alongside methodologically consistent prospective studies.

Keywords: Healthcare workers, Meta-analysis, Needlestick injuries, Prevalence, Saudi Arabia, Sharp injuries, Systematic review.

*Address correspondence to this author at the Department of Public Health, College of Health Sciences, Saudi Electronic University, 4552 Prince Mohammed Ibn Salman Ibn Abdulaziz Rd, 6867, Ar Rabi, Riyadh 13316, Saudi Arabia;
E-mail: m.alsuliman@seu.edu.sa

Cite as: Alsuliman M. Prevalence and Associated Factors of Needlestick and Sharps Injuries among Healthcare Workers in Saudi Arabia: A Systematic Review and Meta-analysis. Open Public Health J, 2026; 19: e187494453711.
http://dx.doi.org/10.2174/0118749445371126082706 1451

Received: March 15, 2026
Revised: July 27, 2026
Accepted: August 03, 2026
Published: August 31, 2026

1. INTRODUCTION

Needlestick and sharps injuries (NSIs) represent a significant occupational hazard for healthcare workers (HCWs) globally, carrying substantial risks of blood-borne pathogen transmission and psychological distress [1]. Globally, NSIs are among the most frequent work-related injuries among HCWs, with pooled prevalence estimates of approximately 43%-44.5% reported in international meta-analyses [2, 3]. NSIs account for a substantial share of occupational blood-borne infections, contributing to 39% of hepatitis C virus (HCV), 37% of hepatitis B virus (HBV), and 4.4% of human immunodeficiency virus (HIV) infections among HCWs; acute HBV infection affects about 5.3% of healthcare staff worldwide, and roughly 54% of HCWs in low- and middle-income countries carry latent tuberculosis infection [4-6]. The consequences of NSIs extend beyond physical harm, leading to psychological trauma, lost productivity, and increased financial burdens related to post-exposure prophylaxis [7]. With an average cost of approximately Int$747 per incident, NSIs represent a substantial yet potentially preventable financial burden on healthcare systems [8].

It is important to distinguish prevalence from incidence when interpreting the NSI literature. Incidence refers to the number of new injuries occurring over a defined period (*e.g.*, injuries per person-year), whereas prevalence-the focus of the present review-refers to the proportion of HCWs who report having experienced one or more NSIs within a specified recall period. Because most primary studies in this field are cross-sectional and report the latter, the present synthesis is framed around prevalence.

Under Vision 2030, Saudi Arabia's healthcare sector has expanded rapidly, employing more than 900,000 healthcare workers, yet reported NSI rates remain highly variable and largely confined to individual healthcare facilities [9, 10]. To date, no national systematic review has synthesized the available evidence, limiting insight into the true prevalence of NSIs, their regional distribution, and the factors associated with them. Despite existing safety initiatives, NSIs remain common, reflecting underreporting, insufficient training, and restricted access to safety-engineered devices. Accordingly, this review addresses the following question: what is the pooled prevalence of NSIs among HCWs in Saudi Arabia, and which demographic, occupational, and study-level factors are associated with variation in reported prevalence? By consolidating existing studies, this review aims to quantify the burden of NSIs, identify evidence gaps, and inform occupational-safety policy as the Saudi healthcare system continues to expand.

2. METHODS

This systematic review and meta-analysis were conducted and reported in accordance with the PRISMA 2020 guidelines (Supplementary Table **S1**). The review was not prospectively registered, as PROSPERO does not accept reviews of prevalence or incidence without an associated health outcome.

2.1. Eligibility Criteria

Studies were included if they met the following criteria: (1) reported the proportion of individuals who experienced any NSI event (one or more) within a specified recall period among HCWs in Saudi Arabia; (2) used a cross-sectional survey design; (3) were peer-reviewed publications in English; and (4) had full-text availability. Exclusion criteria were: (1) studies conducted outside Saudi Arabia; (2) retrospective reviews of clinical data, review articles, editorials, conference abstracts, or book chapters lacking primary data; (3) studies focusing solely on non-sharp occupational injuries (*e.g.*, musculoskeletal disorders); (4) non-human research; and (5) duplicate publications or studies with overlapping datasets.

2.2. Search Strategy and Information Sources

A comprehensive search was designed to identify relevant studies through PubMed, EBSCOhost, Web of Science, and Google Scholar. The search combined controlled vocabulary and free-text keywords related to NSIs, healthcare settings, and Saudi Arabia. Key search terms included: (“needlestick injuries” OR “needlestick injury” OR “needle-stick injuries” OR “sharp injury” OR “sharp injuries”) AND (“Saudi Arabia” OR “KSA”). The search was restricted to titles and abstracts, with no filters applied for study design. Full per-database search strings are provided in Supplementary Table **S2**. The most recent database search was conducted on 17 November 2025.

2.3. Study Selection, Data Extraction, and Quality Assessment

Study selection, data extraction, and quality assessment were performed independently and in duplicate by two reviewers (M.A.S. and a second reviewer acknowledged in the Acknowledgments), in line with the study protocol; any discrepancies were resolved by consensus. After duplicates were removed, titles were screened against the objectives and inclusion criteria, followed by abstract review to discard irrelevant reports. Finally, the full texts of eligible studies were examined, and the required information was captured in Microsoft Excel using a standardized extraction form. Extracted variables included author, year, data-collection duration, study design, setting, sample size, participant demographics, NSI prevalence, gender, reported NSIs, occupation, hospital ward, and device type.

The methodological quality of the included studies was assessed using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Studies Reporting Prevalence Data, which evaluates nine domains: the appropriateness of the sampling frame and sampling method, sample-size adequacy, description of subjects and setting, coverage of the analyzed sample, validity and reliability of NSI ascertainment, appropriateness of the statistical analysis, and adequacy of the response rate [11]. Each item was rated “yes,” “no,” “unclear,” or “not applicable.” Based on the number of items rated “yes,” studies were classified as high (7-9), moderate (5-6), or low (0-4) quality, with higher scores indicating lower risk of bias.

HCWs were defined as individuals directly involved in patient care, including physicians, nurses, dentists, laboratory technicians, paramedics, and allied health professionals. To facilitate consistent interpretation across diverse roles, operational definitions were applied to key categories. The recall period was categorized as short-term (<=1 year, *e.g.*, last 6 or 12 months) or long-term (>1 year, including lifetime or "ever"). Dental professionals included dentists, dental assistants, dental hygienists, and dental interns. Needles referred to hollow-bore needles (*e.g.*, syringes, butterfly needles, insulin needles, IV catheters) and solid needles (*e.g.*, surgical and suture needles). Outpatient settings encompassed obstetrics and gynecology clinics, general medicine clinics, dental clinics, and vaccination centers. The "Others" category retained the original labels and definitions used in the included studies. The term "national" referred to data collected from two or more cities across different regions of Saudi Arabia.

2.4. Data Analysis

A proportional meta-analysis was performed using a random-effects model with the Freeman-Tukey double-arcsine transformation to stabilize variances across the wide range of observed proportions [12]. Between-study variance (tau-squared) was estimated by restricted maximum likelihood (REML). Results were displayed as forest plots with 95% confidence intervals (CIs), and a 95% prediction interval was calculated to represent the expected dispersion of true prevalence across settings. Because the double-arcsine back-transformation can be sensitive to variation in study size, a generalized linear mixed model (random-intercept logistic regression) was fitted as a sensitivity analysis to confirm robustness to the modeling approach. Heterogeneity was quantified using the I^2 statistic. Univariate meta-regression was used to explore potential sources of heterogeneity, including recall period, publication year, sample size, gender, and geographic region. Multivariable meta-regression was not undertaken because, with only 25 studies, such models would be overfitted and prone to spurious associations. Publication bias was assessed by visual inspection of the funnel plot and the Peters regression test [13]; a trim-and-fill analysis was performed as a sensitivity check. Given the extreme heterogeneity, funnel-plot asymmetry was interpreted with caution and not treated as definitive evidence of publication bias. The robustness of the pooled estimate was further examined using leave-one-out analysis and a Baujat plot [14, 15]. Subgroup meta-analyses were conducted by gender, geographic region, occupation, hospital ward, device type, and reporting status. Throughout, k denotes the number of studies contributing to a given pooled estimate; estimates based on a single study (k = 1) are reported as single-study point estimates rather than pooled values. All analyses were conducted in R version 4.5.1.

3. RESULTS

3.1. Study Characteristics

A total of 1,013 records were identified from four databases. After removing duplicates, 533 records were screened by title and abstract, and 56 reports were assessed for eligibility. Following full-text screening, 25 studies met the inclusion and exclusion criteria and were included in the review (Fig. **1**) [16-40]. The characteristics of the included studies are summarized in Supplementary Table **S3**. Quality assessment using the JBI checklist classified 17 studies (68%) as high quality and 8 (32%) as moderate quality; no study was rated low quality (Supplementary Table **S4**).

3.2. Meta-analysis of Prevalence

A random-effects meta-analysis estimated the pooled proportion of NSIs across 25 studies (N = 7,635) (Fig. **2**) [16-40]. The pooled prevalence was 35.5% (95% CI: 23.9-48.0), with very high heterogeneity (I^2 = 98.7%, tau-squared = 0.10). The 95% prediction interval spanned 0.0-93.8%, indicating that the true prevalence in any individual setting could fall almost anywhere across this range and that a single pooled value does not adequately summarize the evidence. The estimate was robust to the analytical approach: a generalized linear mixed model (random-intercept logistic regression) produced a comparable pooled prevalence of 34.6% (95% CI: 22.1-49.6). Visual inspection of the funnel plot and a significant Peters regression test (t(22) = 3.13, p = 0.0048) suggested asymmetry; however, under such extreme heterogeneity, asymmetry cannot be reliably distinguished from small-study effects or true between-study differences, and it should not be interpreted as definitive evidence of publication bias (Supplementary Fig. **S1**). A trim-and-fill analysis imputed additional studies but yielded an unstable adjusted estimate and was therefore not interpreted as a corrected prevalence. In the leave-one-out and Baujat analyses, the study by Saad *et al*. [39] was the most influential; nonetheless, its removal reduced the pooled estimate only modestly (to 32.0%, 95% CI: 22.3-42.5) and did not alter the overall conclusion, so results are presented for the full set of 25 studies (Supplementary Fig. **S2**; see Study Limitations).

3.3. Subgroup Meta-analysis

Subgroup analysis by recall period showed a higher pooled prevalence in studies using long-term or lifetime recall (42.9%) than in those using short-term recall (25.1%), although the difference was not statistically significant (Q = 2.76, p = 0.0966). Heterogeneity remained high across all models (I^2 > 97%) (Fig. **3**). Other subgroup analyses revealed varying prevalence across gender, region, occupation, device type, hospital ward, and reporting status. Men (k = 11) had a pooled prevalence of 48.2% (95% CI: 26.5-70.2), while women (k = 10) had a pooled prevalence of 32.7% (95% CI: 13.7-55.1) (Fig. **4**).

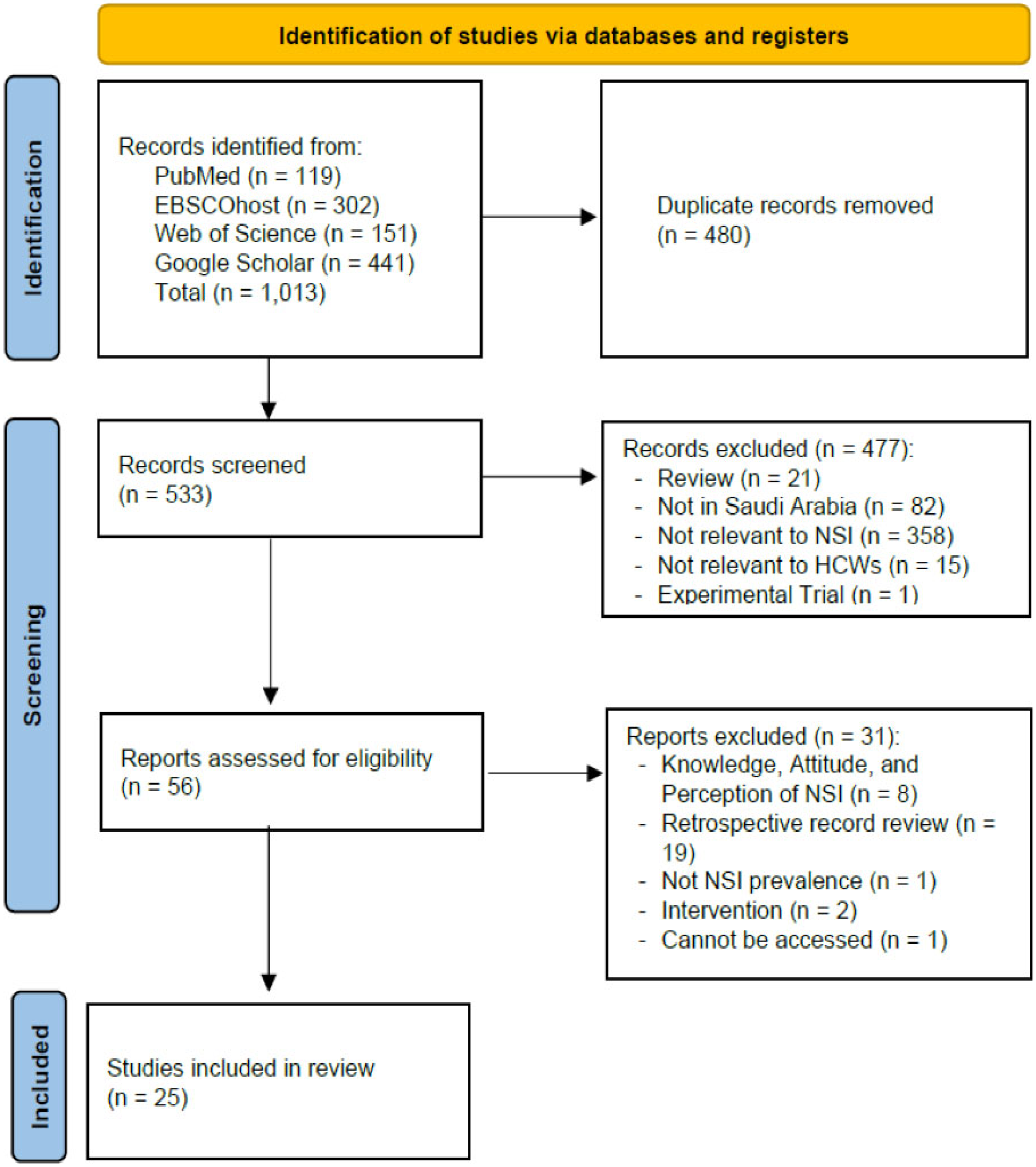

Fig. (1). PRISMA flow diagram of study selection for NSI prevalence among healthcare workers in Saudi Arabia.

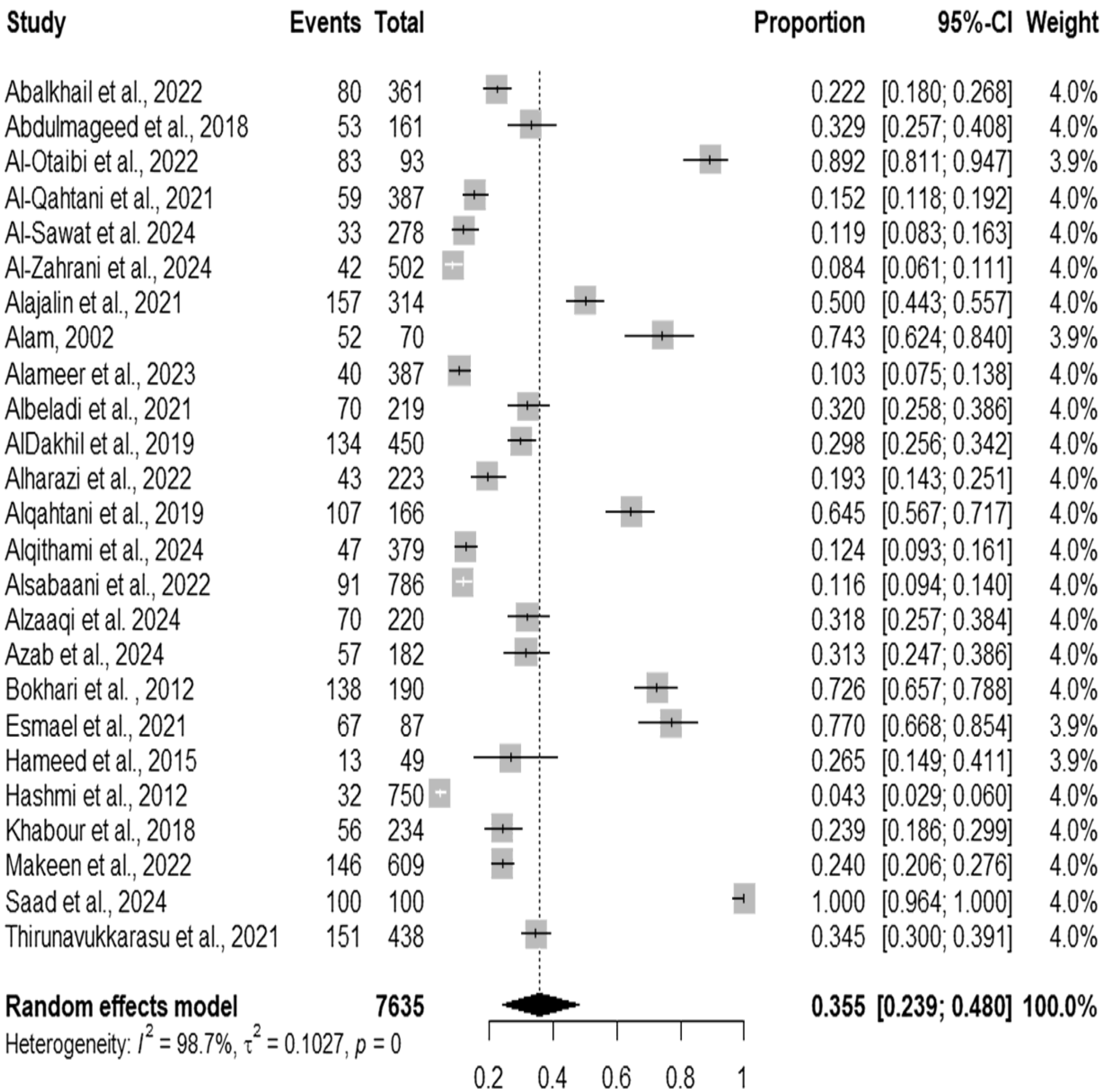

Fig. (2). Forest plot showing the pooled prevalence of needlestick and sharps injuries among healthcare workers in Saudi Arabia (k = 25 studies).

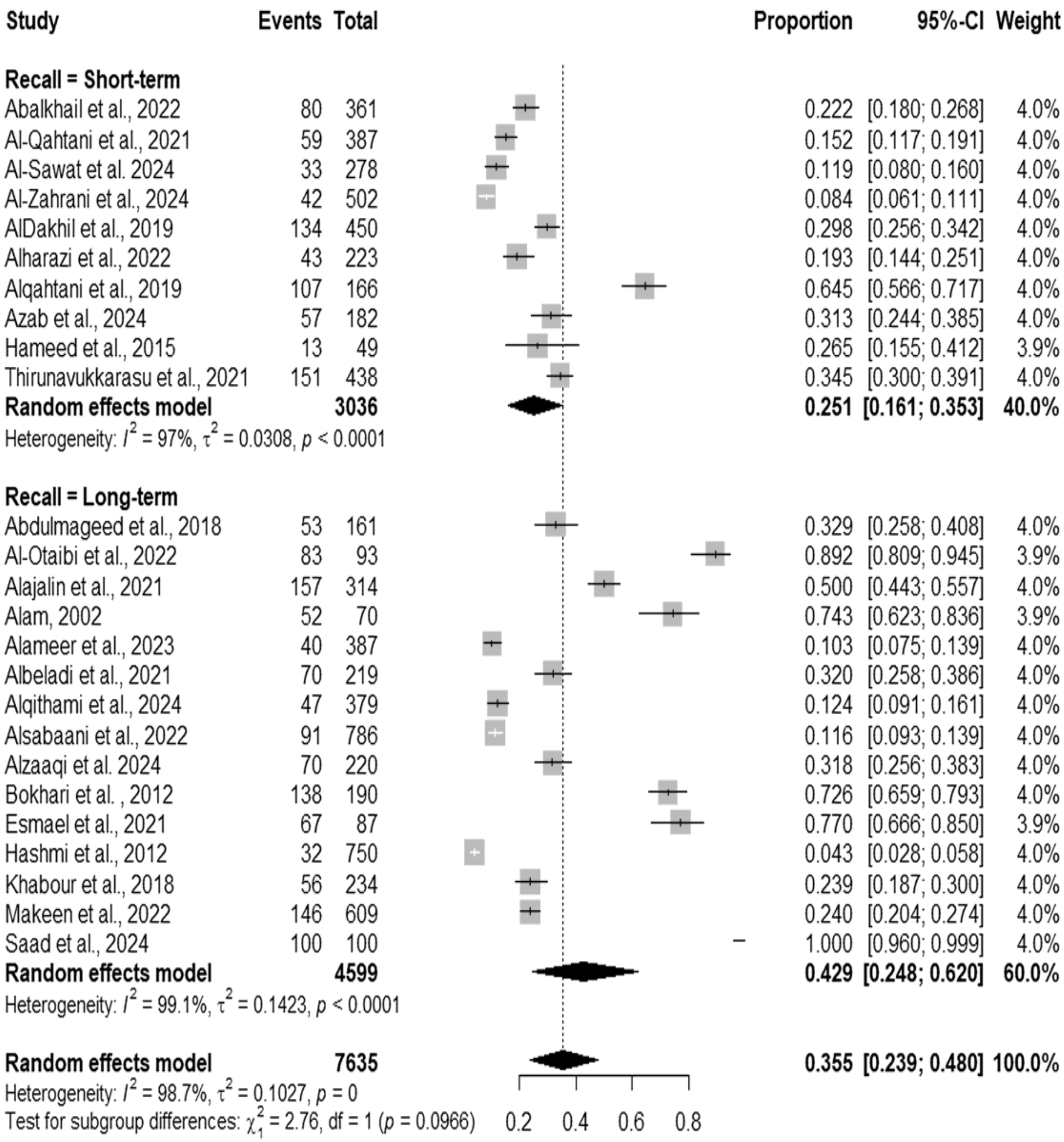

Fig. (3). Subgroup forest plot of pooled prevalence of NSIs among healthcare workers in Saudi Arabia by recall period.

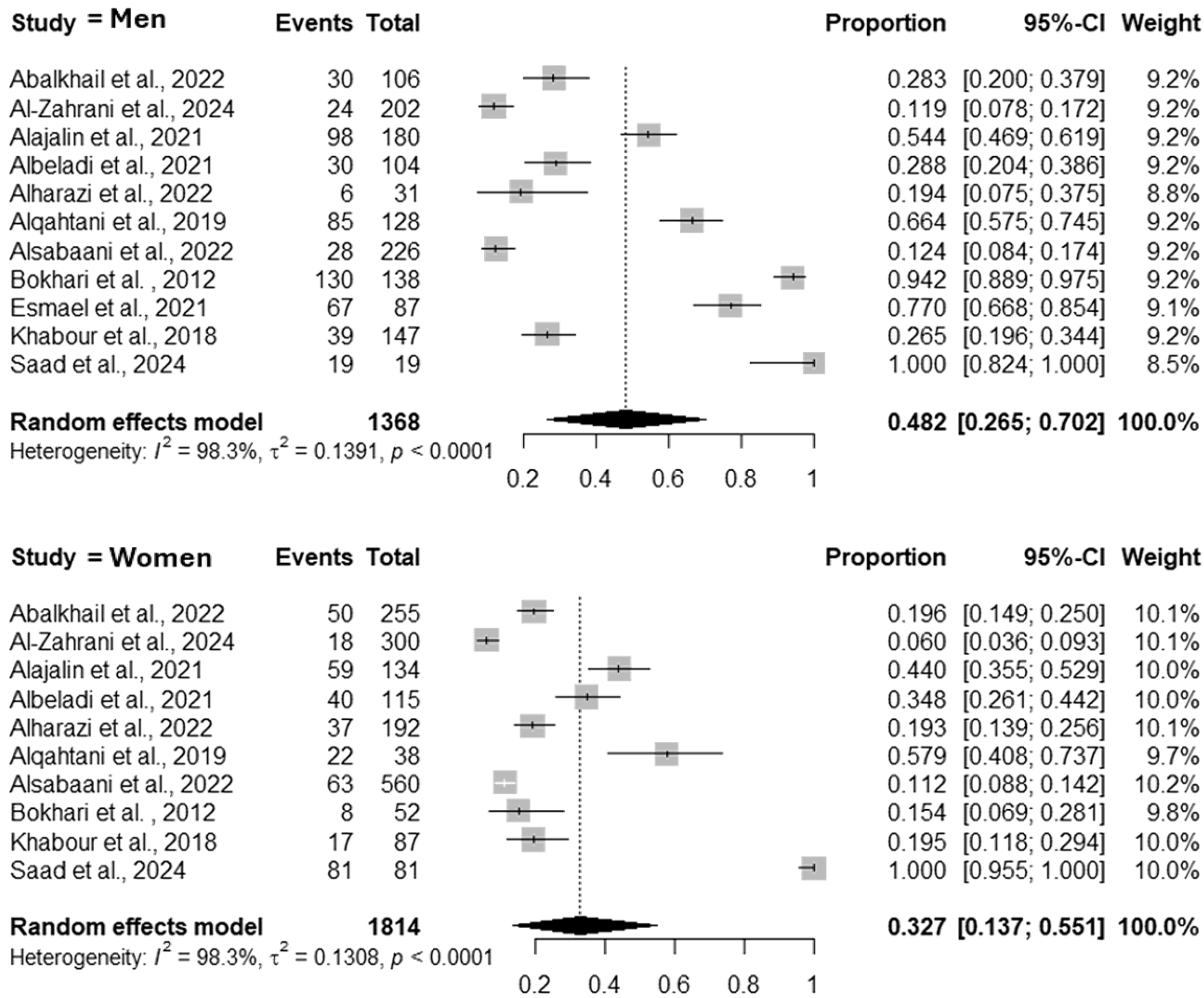

Fig. (4). Subgroup forest plot of pooled prevalence of NSIs among healthcare workers in Saudi Arabia by gender.

Regionally, the Eastern region showed the highest pooled prevalence (83.6%, 95% CI: 70.1-93.8; k = 2, N = 180), followed by the Central region (55.5%, 95% CI: 2.5-99.9; k = 3). The Southern region showed a prevalence of 38.9% (k = 6), while the National and Western regions had lower estimates at 24.9% (k = 3) and 22.1% (k = 10), respectively. The Northern region was represented by a single study (34.5%, 95% CI: 30.1-39.0; k = 1) and is therefore reported as a single-study point estimate rather than a pooled value (Fig. **5**). Because the Eastern and Northern estimates are based on only two and one studies, respectively, they should be interpreted with caution.

Among occupational groups, the highest values were observed for emergency medical technicians (77%) and residents (60%); however, the emergency medical technician estimate was derived from a single study (k = 1) and is reported as a single-study point estimate. Residents (k = 3) and dental professionals (36%, k = 4) followed, while nurses (k = 9) and physicians (k = 6) showed moderate values of 31% and 35%, respectively. Lower values were found among laboratory technicians, medical technicians, pharmacists (k = 1), and interns/students (Fig. **6a**). By hospital ward, the highest pooled values were in surgery/operating room (OR) settings (36%, k = 5) and inpatient wards (36%, k = 2), followed by emergency departments (34%, k = 6) and outpatient settings (25%); the intensive care unit (8%) and laboratory (10%) settings showed the lowest values (Fig. **6b**). Regarding device type, needle-related injuries predominated (76%, k = 9), whereas scalpels (5%), glassware (6%), and scissors (6%) accounted for smaller proportions; the blade, plasticware, and pipette categories were each based on a single study (Fig. **6c**). Among the 12 studies reporting on reporting behavior, an estimated 65% of injured HCWs reported their most recent NSI, while 35% did not (Fig. **6d**).

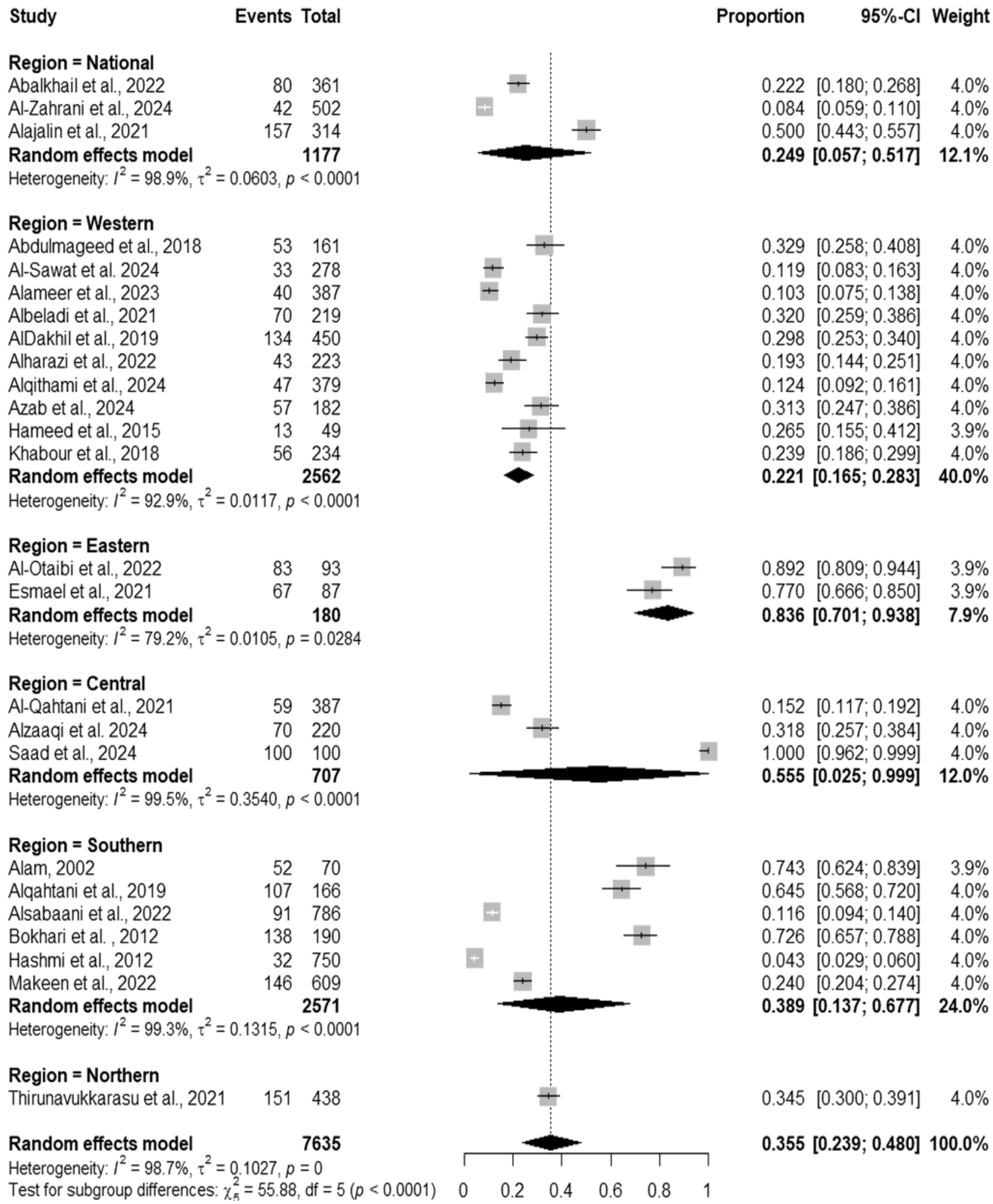

Fig. (5). Subgroup forest plot of pooled prevalence of NSIs among healthcare workers in Saudi Arabia by region.

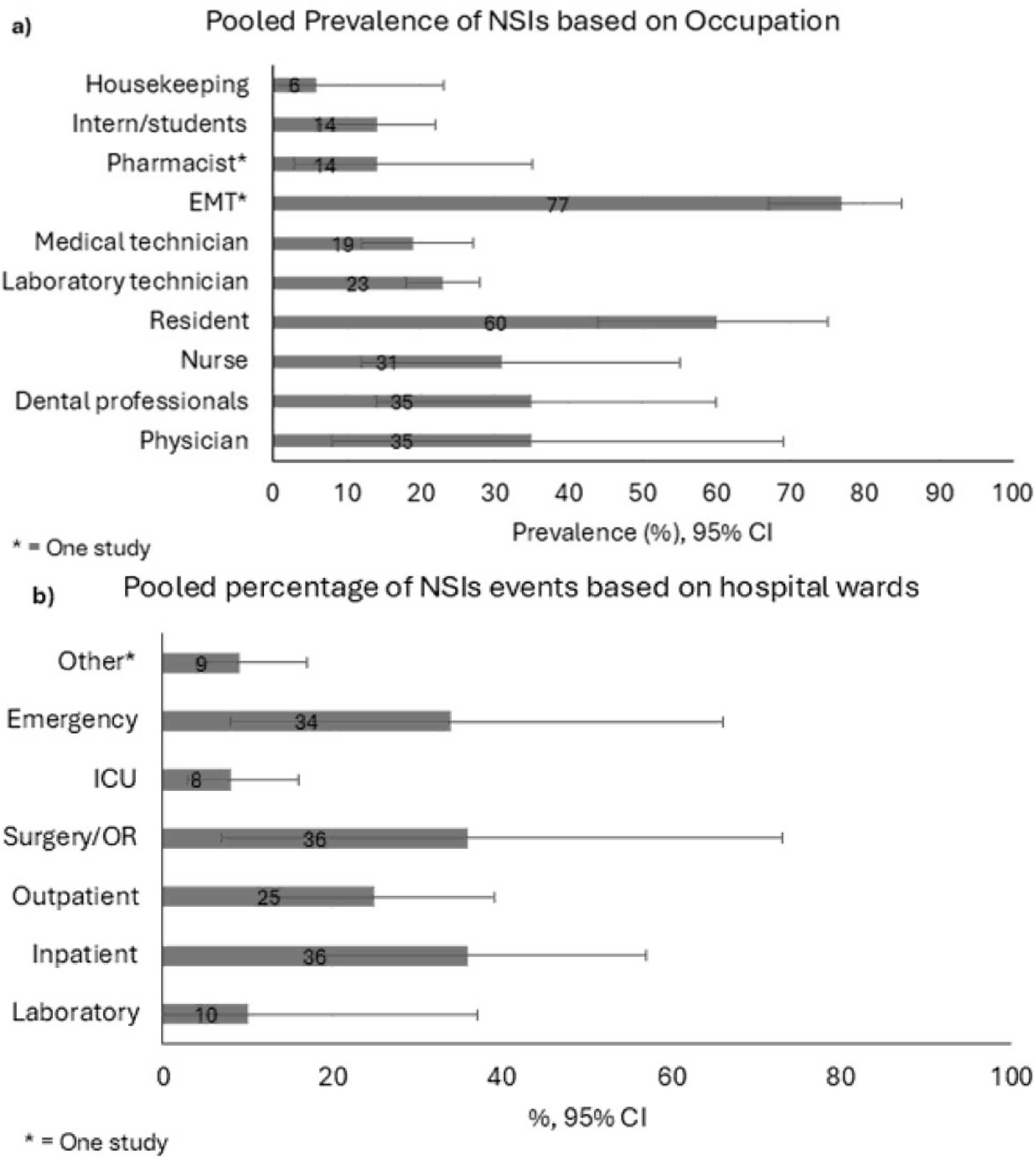
a)
Pooled Prevalence of NSIs based on Occupation
Housekeeping
Intern/students
Pharmacist*
EMT*
Medical technician
Laboratory technician
Resident
Nurse
Dental professionals
Physician
6
14
14
77
19
23
60
31
35
35
0 10 20 30 40 50 60 70 80 90 100
Prevalence (%), 95% CI
* = One study
b)
Pooled percentage of NSIs events based on hospital wards
Other*
Emergency
ICU
Surgery/OR
Outpatient
Inpatient
Laboratory
9
34
8
36
25
36
10
0 20 40 60 80 100
%, 95% CI
* = One study

Fig. 6 contd.....

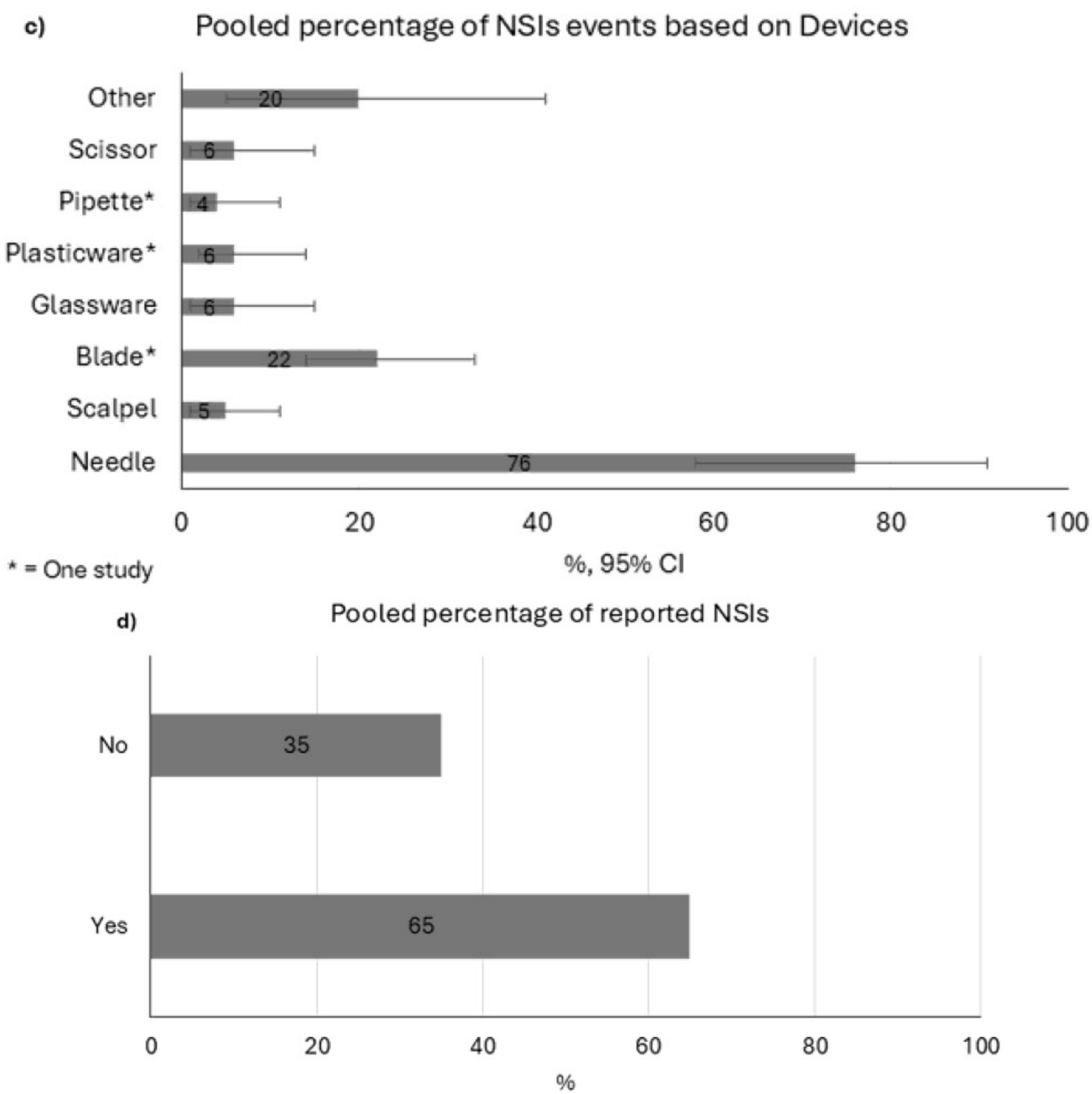

Fig. (6). Subgroup analysis of pooled prevalence of NSIs among healthcare workers in Saudi Arabia by (**a**) occupation, (**b**) hospital wards, (**c**) device type, and (**d**) reporting status.

3.4. Meta-Regression

A series of univariate meta-regression models was fitted to identify moderators that might explain the observed heterogeneity. Sample size was a significant negative predictor of prevalence (beta = -0.0011, $p < 0.01$, $R^2 = 42.2\%$), indicating that smaller studies tended to report higher prevalence-consistent with a small-study effect and with the funnel-plot asymmetry noted above. Recall period was not a significant moderator ($p = 0.1488$), and publication year, gender, and geographic region likewise showed no significant associations. Because recall period was non-significant and some recall categories contained few studies, the corresponding forest plots are summarized rather than presented in full. All meta-regression analyses are exploratory and hypothesisgenerating, given the limited number of studies and the extreme residual heterogeneity.

4. DISCUSSION

NSIs remain a major safety concern for HCWs worldwide. This analysis is the first systematic review and meta-analysis dedicated to estimating the burden of NSIs among HCWs in Saudi Arabia. Twenty-five studies involving 7,635 individuals from different regions met the inclusion criteria [16-40]. The pooled prevalence was 35.5%, which is broadly comparable to, though slightly lower than, the 43% and 44.5% reported in global meta-analyses [2, 3]. However, the very wide prediction interval (0.0-93.8%) and extreme heterogeneity (I^2 = 98.7%) indicate that this pooled value should be read as the center of a broad distribution rather than as a single national prevalence; the true value in any given setting varies substantially with study population, healthcare setting, recall period, and region. Reassuringly, the estimate was robust to the analytical model, with a generalized linear mixed model producing a comparable value (34.6%).

The analysis suggested a small-study effect, whereby smaller studies reported higher prevalence. This pattern was supported by the meta-regression, in which sample size was a significant negative moderator, and is consistent with the funnel-plot asymmetry. Such asymmetry may reflect selective publication of higher-prevalence studies, methodological differences among smaller studies, or genuine between-study heterogeneity; under an I^2 of 98.7%, these explanations cannot be reliably separated, and the publication-bias diagnostics should therefore be interpreted with caution.

Subgroup analyses provided a more granular view of factors associated with NSIs, although all such comparisons are observational and should not be interpreted causally. Contrary to global literature suggesting higher NSI prevalence among women, the present analysis found consistently higher prevalence among men [2, 3]. This may reflect context-dependent differences in workforce composition, occupational roles, and reporting practices [41]; however, only 11 of the 25 studies reported male-specific and 10 female-specific data, limiting firm conclusions about gender-related risk.

Regional variation was pronounced but is largely explained by the composition of the underlying studies rather than by geography per se. The Eastern-region estimate (83.6%) rested on only two studies of anesthesia and emergency services staff groups, whose high-tempo, procedure-intensive duties plausibly elevate injury risk [42]. In the Central region, estimates ranged from 15% among nurses in a primary-care center to 100% in a single acute-care study [19, 39], illustrating how case-mix and setting drive apparent regional differences. Beyond case-mix, systemic factors likely contribute to regional variation, including differences in healthcare infrastructure and staffing levels, the availability and procurement of safety-engineered devices, the intensity of infection-prevention training, and the maturity of institutional occupational-safety and incident-reporting cultures. These remain hypotheses to be tested in standardized multiregional studies. Comparable national or Gulf-wide syntheses are currently lacking, which limits direct regional benchmarking and represents an avenue for future collaborative research.

Occupationally, the highest value was observed for emergency medical technicians (77%), exceeding the global estimate of about 24% for this group [43]; however, this estimate derived from a single study and should be regarded as preliminary [32]. Residents also reported a high value (60%), consistent with evidence that trainees have greater exposure to NSI risk [44, 45]. Physicians (35%) and nurses (31%) showed moderate values, within the global range of roughly 20%-56% [2, 3]. These patterns are consistent with high-tempo, procedure-intensive environments contributing to NSIs.

Needle-related injuries were the most common (76%), confirming that needles are the primary source of injury and underscoring the importance of safety-engineered devices [2, 3]. Comparatively high values in surgery/OR (36%) and emergency departments (34%) reflect the risks of urgent, invasive procedures performed under time pressure [46]. Notably, an estimated 35% of injured HCWs did not report their most recent NSI. This underreporting reflects varied barriers-including lack of time, fear of disciplinary consequences, and a perception that the injury is not serious enough to warrant reporting-and is a critical concern because it undermines surveillance and the timely provision of post-exposure prophylaxis [47].

5. STUDY LIMITATIONS

This review has several limitations. First, and most importantly, heterogeneity was extreme (I^2 = 98.7%) and persisted within subgroups, despite the use of the Freeman-Tukey transformation. As a result, the pooled estimate should be interpreted as the center of a wide distribution rather than a precise population rate; this variability reflects differences in sampling methods, measurement tools, NSI definitions, recall periods, and healthcare settings, and highlights the fragmented nature of NSI surveillance in Saudi Arabia. Second, several subgroup estimates were based on a single study or very few studies (*e.g.*, emergency medical technicians, the Northern and Eastern regions, and the blade, pipette, and plasticware device categories); these are exploratory and should not be regarded as stable pooled estimates.

Third, all included studies were cross-sectional and relied on self-reported data, introducing potential recall, social-desirability, and underreporting biases, as well as variability arising from different recall windows. The cross-sectional design also precluded causal inference, and the meta-regression was underpowered by the small number of studies. Fourth, the search was restricted to English-language publications indexed in four databases. Because peer-reviewed health research from Saudi Arabia is very rarely published in Arabic, few eligible studies are likely to have been missed on this basis; restricting to English also avoids the translation-related inconsistencies and potential bias that can arise when pooling studies reported in different languages. Nonetheless, studies indexed only in Embase, Scopus, or CINAHL, or those in which NSI data were embedded within broader occupational health surveys, may have been missed. The review was also not prospectively registered. Overall, the certainty of the pooled prevalence estimate should be regarded as very low, reflecting risk of bias in some studies, extreme inconsistency between studies, and imprecision.

Fifth, one study reported a prevalence of 100% (Saad *et al*. [39]) and was identified as the most influential in the sensitivity analyses. This value is anomalous and likely reflects the study's purposive (non-random) sampling, an instrument that did not include a “none” category for the number of injuries, and the authors' own description of the underlying prevalence as low. I nonetheless retained this study in the primary pooled estimate rather than removing it post hoc, for three reasons: it met all a priori eligibility criteria; the leave-one-out and Baujat analyses (Supplementary Fig. **S2**) showed that its exclusion reduced the pooled estimate only modestly, from 35.5% to 32.0% (95% CI: 22.3-42.5), without altering the overall conclusion of a high and highly heterogeneous prevalence; and selectively removing influential studies after the fact risks introducing selection bias into a prevalence synthesis. Its anomalous value is instead acknowledged as a documented source of heterogeneity, consistent with the sensitivity analyses reported in the supplementary material. Taken together, these limitations warrant cautious interpretation of the findings.

CONCLUSION

NSIs remain a serious occupational hazard among HCWs in Saudi Arabia, but the wide variation across studies precludes a single national prevalence estimate. The evidence nonetheless points to consistent, modifiable priorities: standardized NSI surveillance and reporting systems, broader adoption of safety-engineered devices, and targeted training for high-risk roles and settings. Because the current evidence base is cross-sectional and heterogeneous, these measures are best advanced alongside methodologically stronger research-prospective and longitudinal studies that track NSI rates before and after safety interventions, mixed-methods studies of the barriers to reporting, and economic analyses of the direct and indirect costs of NSIs in the Saudi financing context. Aligning such evidence-based interventions with the workforce-safety goals of Vision 2030 offers a realistic path to reducing NSI rates and strengthening healthcare-system resilience.

AUTHOR’S CONTRIBUTIONS

As the sole author, I was responsible for the study conception and design, data analysis and interpretation, and preparation and approval of the manuscript. Study screening, data extraction, and quality appraisal were conducted independently and in duplicate by a second reviewer, who is acknowledged below and not involved in drafting the manuscript.

LIST OF ABBREVIATIONS

NSIs	=	Needlestick and sharps injuries
HCWs	=	Healthcare workers
CI	=	Confidence interval
EMTs	=	Emergency medical technicians
GLMM	=	Generalized linear mixed model
HBV	=	Hepatitis B virus
HCV	=	Hepatitis C virus
HIV	=	Human immunodeficiency virus
ICU	=	Intensive care unit
Int$	=	International dollar
IV	=	Intravenous
I^2	=	I-squared (measure of heterogeneity)
JBI	=	Joanna Briggs Institute
KSA	=	Kingdom of Saudi Arabia
OR	=	Operating room
PRISMA	=	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
PROSPERO	=	International Prospective Register of Systematic Reviews
R^2	=	Coefficient of determination
REML	=	Restricted maximum likelihood
SE	=	Standard error
tau-squared	=	Between-study variance
WHO	=	World Health Organization

CONSENT FOR PUBLICATION

Not applicable.

STANDARDS OF REPORTING

This research was conducted and reported in accordance with the PRISMA 2020 guidelines. The completed PRISMA 2020 checklist is provided as Supplementary Table S1.

AVAILABILITY OF DATA AND MATERIALS

All data used in this research were obtained from previously published studies. No new datasets were generated or analyzed.

FUNDING

None.

CONFLICT OF INTEREST

The author declares no conflict of interest, financial or otherwise.

ACKNOWLEDGEMENTS

I gratefully acknowledge the invaluable contribution of Dr. Mohammed Alkharaiji, Assistant Professor and

Director of the Health Sciences Research Center, Saudi Electronic University, who served as the second independent reviewer for study selection, data extraction, and quality appraisal.

SUPPLEMENTARY MATERIAL

Table S1: PRISMA 2020 checklist.

Table S2: Full per-database search strings.

Table S3: Characteristics of the included cross-sectional studies related to NSIs in Saudi Arabia.

Table S4: Critical appraisal of the included studies using the JBI Critical Appraisal Checklist for Studies Reporting Prevalence Data.

Figure S1: Funnel plot of NSI prevalence in Saudi Arabia.

Figure S2: Baujat plot and leave-one-out sensitivity analysis of high heterogeneity in NSI prevalence in Saudi Arabia.

REFERENCES

[1] Green B, Griffiths EC. Psychiatric consequences of needlestick injury. Occup Med (Lond) 2013; 63(3): 183-8. http://dx.doi.org/10.1093/occmed/kqt006 PMID: 23430785

[2] Bouya S, Balouchi A, Rafiemanesh H, *et al.* Global prevalence and device-related causes of needlestick injuries among healthcare workers: a systematic review and meta-analysis. Ann Glob Health 2020; 86(1): 35. http://dx.doi.org/10.5334/aogh.2698 PMID: 32346521

[3] Hosseinipalangi Z, Golmohammadi Z, Ghashghaee A, *et al.* Global, regional and national incidence and causes of needlestick injuries: A systematic review and meta-analysis. East Mediterr Health J 2022; 28(3): 233-41. http://dx.doi.org/10.26719/emhj.22.031 PMID: 35394056

[4] Prüss-Ustün A, Wolf J, Corvalán C, Bos R, Neira M. Preventing disease through healthy environments: A global assessment of the burden of disease from environmental risks. 2016. Available from https://iris.who.int/bitstream/handle/10665/204585/9789241565196_eng.pdf?sequence=1

[5] Mahamat G, Kenmoe S, Akazong EW, *et al.* Global prevalence of hepatitis B virus serological markers among healthcare workers: A systematic review and meta-analysis. World J Hepatol 2021; 13(9): 1190-202. http://dx.doi.org/10.4254/wjh.v13.i9.1190 PMID: 34630885

[6] Joshi R, Reingold AL, Menzies D, Pai M. Tuberculosis among health-care workers in low- and middle-income countries: a systematic review. PLoS Med 2006; 3(12): e494. http://dx.doi.org/10.1371/journal.pmed.0030494 PMID: 17194191

[7] Phillips EK, Conaway MR, Jagger JC. Percutaneous injuries before and after the Needlestick Safety and Prevention Act. N Engl J Med 2012; 366(7): 670-1. http://dx.doi.org/10.1056/NEJMc1110979 PMID: 22335760

[8] Mannocci A, De Carli G, Di Bari V, *et al.* How much do needlestick injuries cost? A systematic review of the economic evaluations of needlestick and sharps injuries among healthcare personnel. Infect Control Hosp Epidemiol 2016; 37(6): 635-46. http://dx.doi.org/10.1017/ice.2016.48 PMID: 27022671

[9] Memish ZA, Assiri AM, Eldalatony MM, Hathout HM. Benchmarking of percutaneous injuries at the Ministry of Health hospitals of Saudi Arabia in comparison with the United States hospitals participating in Exposure Prevention Information Network (EPINet™). Int J Occup Environ Med 2015; 6(1): 26-33. http://dx.doi.org/10.15171/ijoem.2015.467 PMID: 25588223

[10] Ministry of Health, Government of Saudi Arabia. Statistical yearbook. 2023. Available from https://www.moh.gov.sa/en/Ministry/Statistics/book/

[11] Munn Z, Moola S, Lisy K, Riitano D, Tufanaru C. Methodological guidance for systematic reviews of observational epidemiological studies reporting prevalence and cumulative incidence data. Int J Evid-Based Healthc 2015; 13(3): 147-53. http://dx.doi.org/10.1097/XEB.0000000000000054 PMID: 26317388

[12] Barendregt JJ, Doi SA, Lee YY, Norman RE, Vos T. Meta-analysis of prevalence. J Epidemiol Community Health 2013; 67(11): 974-8. http://dx.doi.org/10.1136/jech-2013-203104 PMID: 23963506

[13] Peters JL, Sutton AJ, Jones DR, Abrams KR, Rushton L. Comparison of two methods to detect citation bias in meta-analysis. JAMA 2006; 295(6): 676-80. http://dx.doi.org/10.1001/jama.295.6.676 PMID: 16467236

[14] Viechtbauer W. Conducting meta-analyses in R with the metafor package. J Stat Softw 2010; 36(3): 1-48. http://dx.doi.org/10.18637/jss.v036.i03

[15] Baujat B, Mahé C, Pignon JP, Hill C. A graphical method for exploring heterogeneity in meta-analyses: application to a meta-analysis of 65 trials. Stat Med 2002; 21(18): 2641-52. http://dx.doi.org/10.1002/sim.1221 PMID: 12228882

[16] Abalkhail A, Kabir R, Elmosaad YM, *et al.* Needle-stick and sharp injuries among hospital healthcare workers in Saudi Arabia: a cross-sectional survey. Int J Environ Res Public Health 2022; 19(10): 6342. http://dx.doi.org/10.3390/ijerph19106342 PMID: 35627878

[17] Abdulmageed SS, Alabbassi F, Alradi M, Alghanaim N, Banjar S, Alnakhli M. Assessment of occupational exposure to sharp injuries among health care workers in King Abdulaziz University Hospital. Int J Community Med Public Health 2018; 5(5): 1756-61. http://dx.doi.org/10.18203/2394-6040.ijcmph20181434

[18] Al-Otaibi A, Shaaib H, Jebakumar Z, AlMalki Y, Alshammari M. Factors associated with needle stick and sharp injuries among anesthesia staff in Eastern Region, Saudi Arabia. Int Med J 2022; 29: 8417-30.

[19] Al-Qahtani SM, Elzahrany YR, Alahmed MA, *et al.* Prevalence, underreporting and barriers of needle stick and sharps injuries (NSSIs) among nurses at primary healthcare centers, Riyadh, Saudi Arabia. Fam Med Prim Care Open Access 2021; 5(2): 167. http://dx.doi.org/10.29011/2688-7460.100067

[20] Al-Sawat A, Almutairi T, Almalki A, *et al.* Prevalence and knowledge regarding needle stick injuries among medical students at Taif University; a cross-sectional study. International Journal of Medicine in Developing Countries 2024; 8: 3148-55. http://dx.doi.org/10.24911/IJMDC.51-1733148861

[21] Al-Zahrani M, Berekaa M, Al-Warthan M, AlMulla A. Occupational exposure to sharp object injuries among healthcare workers in Dammam and Jeddah hospitals, Saudi Arabia. J Multidiscip Healthc 2024; 17: 5199-210. http://dx.doi.org/10.2147/JMDH.S473797 PMID: 39558928

[22] Alajalin AM, Almutairi NN, Alshammari SO, Alhazmi SW, Alkhalaf FS, Alhazmi AA. Prevalence of sharp injuries among residents of surgical specialties in Saudi Arabia. Med Sci 2021; 25: 3356-64.

[23] Alam M. Knowledge, attitude and practices among health care workers on needle-stick injuries. Ann Saudi Med 2002; 22(5-6): 396-9. http://dx.doi.org/10.5144/0256-4947.2002.396 PMID: 17146275

[24] Alameer DS, Noor Elahi IR. Prevalence and determinants of work-related injuries among healthcare workers in Jeddah, Saudi Arabia. Cureus 2023; 15(3): e36679. http://dx.doi.org/10.7759/cureus.36679 PMID: 37113352

[25] Albeladi OA, Almudaraa S, Alqusibri AA, Alqerafi NM, Alsenani YS, Abd-Ellatif EE. Needle stick injuries among health care workers in Al-Madinah Al-Munawara governmental hospitals in Saudi Arabia. Glob J Health Sci 2021; 13(11): 76-88. http://dx.doi.org/10.5539/gjhs.v13n11p76

[26] AlDakhil L, Yenugadhati N, Al-Seraihi O, Al-Zoughool M. Prevalence and associated factors for needlestick and sharp injuries (NSIs) among dental assistants in Jeddah, Saudi Arabia.

Environ Health Prev Med 2019; 24(1): 60.
http://dx.doi.org/10.1186/s12199-019-0815-7 PMID: 31601166

[27] Alharazi R, Almutary H, Felemban O, *et al.* Prevalence of needle stick injuries among nurses in Jeddah, Saudi Arabia. Nursing (Auckl) 2022; 12: 235-46.
http://dx.doi.org/10.2147/NRR.S376343

[28] Alqahtani SMA, Al-Shehri SH, Alshehri TK, Al-Zahrani SS, Alqahtani SM. The prevalence of sharp injuries in the operative room among surgical residents and their behavior to them in the southern region of Saudi Arabia. Saudi Surgical Journal 2019; 7(3): 113-8.
http://dx.doi.org/10.4103/ssj.ssj_1_19 PMID: 28685477

[29] Alqithami MA, ALsadi A, Tashkandi M, Gaafar R. Identifying work-related injuries among healthcare workers in Makkah hospitals, Saudi Arabia: A cross-sectional study in 2024. Cureus 2024; 16(8): e67323.
http://dx.doi.org/10.7759/cureus.67323 PMID: 39165615

[30] Alsabaani A, Alqahtani NSS, Alqahtani SSS, *et al.* Incidence, knowledge, attitude and practice toward needle stick injury among health care workers in Abha City, Saudi Arabia. Front Public Health 2022; 10: 771190.
http://dx.doi.org/10.3389/fpubh.2022.771190 PMID: 35237546

[31] Alzaaqi A, Alruwaili T, Almesned M. Incidence, knowledge, attitude and practice of healthcare workers regarding needle stick injuries at a tertiary care hospital in Riyadh, Saudi Arabia. Saudi J Med Pharm Sci 2024; 10(6): 357-68.
http://dx.doi.org/10.36348/sjmps.2024.v10i06.006

[32] Azab E, Afifi IK. Awareness and reporting of sharps injuries: A study involving dental students, trainees, and assistants in a dental teaching hospital in Saudi Arabia. Cureus 2024; 16(1): e52843.
http://dx.doi.org/10.7759/cureus.52843 PMID: 38268990

[33] Bokhari K, Shariff M, Wahab M, Togoo R, Hady Y, Hassan Y. Accidental occupational exposures among dental healthcare workers in Asir Region, Saudi Arabia. J Orofac Res 2012; 2: 5-8.

[34] Sami Fawzy , Hany Hosny , Anas Alnasser . Work related injuries sustained by emergency medical technicians and paramedics in Saudi Arabia. International Journal of Pharmacometrics and Integrated Biosciences 2021; 6(1): 14-20.
http://dx.doi.org/10.26452/ijpib.v6i1.1408

[35] Hameed N, Salman A, Lafi M, *et al.* Needle stick injuries among healthcare workers in a governmental hospital, Medina, Saudi Arabia 2012. Int J Acad Sci Res 2015; 3: 27-36.

[36] Hashmi A, Al Reesh S, Indah L. Prevalence of needle-stick and sharps injuries among healthcare workers, Najran, Saudi Arabia. Epidemiol Open Access 2012; 2(2)117
http://dx.doi.org/10.4172/2161-1165.1000117

[37] Khabour OF, Al Ali KH, Mahallawi WH. Occupational infection and needle stick injury among clinical laboratory workers in Al-Madinah city, Saudi Arabia. J Occup Med Toxicol 2018; 13(1): 15.
http://dx.doi.org/10.1186/s12995-018-0198-5 PMID: 29942343

[38] Makeen AM, Alharbi AA, Mahfouz MS, *et al.* Needlestick and sharps injuries among secondary and tertiary healthcare workers, Saudi Arabia. Nurs Open 2022; 9(1): 816-23.
http://dx.doi.org/10.1002/nop2.1136 PMID: 34806326

[39] Saad AE, Jasli N. Prevalence and factors contributing to needle stick injuries among healthcare workers at acute care hospital in Central Saudi Arabia. Med Sci 2024; 28(150): e118ms3428.
http://dx.doi.org/10.54905/disssi.v28i150.e118ms3428

[40] Thirunavukkarasu A, Alrawaili KAH, Al-Hazmi AH, *et al.* Prevalence and risk factors of occupational health hazards among health care workers of Northern Saudi Arabia: a multicenter study. Int J Environ Res Public Health 2021; 18(21): 11489.
http://dx.doi.org/10.3390/ijerph182111489 PMID: 34770004

[41] Leigh JP, Wiatrowski WJ, Gillen M, Steenland NK. Characteristics of persons and jobs with needlestick injuries in a national data set. Am J Infect Control 2008; 36(6): 414-20.
http://dx.doi.org/10.1016/j.ajic.2007.07.020 PMID: 18675147

[42] Borna R, Rahimian R, Natalie Koons BS, Grogan TR, Umar S, Turner J. Needlestick injuries among anesthesia providers from a large US academic center: A 10-year retrospective analysis. J Clin Anesth 2022; 80: 110885.
http://dx.doi.org/10.1016/j.jclinane.2022.110885 PMID: 35644082

[43] Sahebi A, Tahernejad S, Rezaei E, Shahmahmoudi F, Pirhadi S, Tahernejad A. Needle stick injuries among emergency medical services personnel: a systematic review and meta-analysis. BMC Nurs 2025; 24(1): 697.
http://dx.doi.org/10.1186/s12912-025-03399-w PMID: 40598144

[44] Sethi N, Evans D, Murray A. Needlestick occurrences and reporting among residents in the operative setting. J Surg Educ 2020; 77(6): 1542-51.
http://dx.doi.org/10.1016/j.jsurg.2020.05.014 PMID: 32505669

[45] Choi LY, Torres R, Syed S, *et al.* Sharps and needlestick injuries among medical students, surgical residents, faculty, and operating room staff at a single academic institution. J Surg Educ 2017; 74(1): 131-6.
http://dx.doi.org/10.1016/j.jsurg.2016.06.003 PMID: 27397414

[46] Himmelreich H, Rabenau HF, Rindermann M, *et al.* The management of needlestick injuries. Dtsch Arztebl Int 2013; 110(5): 61-7.
http://dx.doi.org/10.3238/arztebl.2013.0061 PMID: 23437024

[47] Behzadmehr R, Balouchi A, Hesaraki M, *et al.* Prevalence and causes of unreported needle stick injuries among health care workers: a systematic review and meta-analysis. Rev Environ Health 2021; 38(1): 111-23.
http://dx.doi.org/10.1515/reveh-2021-0148 PMID: 34913621