

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



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Supplementary Table S1. PRISMA 2020 checklist.

Section / Topic	#	Checklist Item	Location / reported
TITLE			
Title	1	Identify the report as a systematic review.	Title
ABSTRACT			
Abstract	2	Structured summary.	Structured Abstract
INTRODUCTION			
Rationale	3	Describe the rationale in the context of existing knowledge.	Introduction, para 1-3
Objectives	4	Explicit statement of the objective(s)/question(s).	Introduction, final para (research question); Objectives
METHODS			
Eligibility criteria	5	Inclusion/exclusion criteria and grouping.	Methods 2.1
Information sources	6	All databases/sources and last search date.	Methods 2.2 (last searched 17 Nov 2025)
Search strategy	7	Full search strategies for all sources.	Methods 2.2; Supplementary Table S2
Selection process	8	Methods to decide inclusion (reviewers, independence).	Methods 2.3 (duplicate, independent; consensus)
Data collection process	9	Methods of data collection.	Methods 2.3
Data items	10	List/define outcomes and variables.	Methods 2.3; operational definitions
Study risk of bias	11	Methods to assess risk of bias (tool, independence).	Methods 2.3 (JBI Prevalence checklist); Suppl. Table S4
Effect measures	12	Effect measure(s) used.	Methods 2.4 (proportion/prevalence)
Synthesis methods	13	Synthesis, model, software, transformations, heterogeneity.	Methods 2.4 (random-effects, Freeman-Tukey, REML, GLMM, I2, R 4.5.1)
Reporting bias	14	Methods to assess reporting/publication bias.	Methods 2.4 (funnel plot, Peters test, trim-and-fill)
Certainty assessment	15	Methods to assess certainty of evidence.	Methods/Study Limitations (very low certainty)
RESULTS			
Study selection	16	Numbers screened/included/excluded with reasons.	Results 3.1; Figure 1 (PRISMA flow)
Study characteristics	17	Cite included studies and their characteristics.	Results 3.1; Suppl. Table S3
Risk of bias in studies	18	Risk-of-bias assessments for each study.	Results 3.1; Suppl. Table S4
Individual studies	19	Each study's summary statistics and estimate.	Figures 2-6
Results of syntheses	20	Pooled estimates, precision, heterogeneity, PI.	Results 3.2-3.4 (35.5%; 95% CI 23.9-48.0; I2=98.7%; PI 0.0-93.8%)

(Table S1) contd....

Section / Topic	#	Checklist Item	Location / reported
Reporting biases	21	Assessments of reporting/publication bias.	Results 3.2; Suppl. Figure S1
Certainty of evidence	22	Certainty of evidence for each outcome.	Study Limitations (very low certainty)
DISCUSSION			
Discussion	23	Interpret results; discuss limitations.	Discussion; Study Limitations
OTHER INFORMATION			
Registration & protocol	24	Registration information / protocol access / non-registration.	Methods 2: not prospectively registered (PROSPERO ineligible for prevalence reviews without a health outcome); a priori protocol prepared before data extraction and available from the author on request
Support	25	Financial/non-financial support and role of funders.	Funding (None)
Competing interests	26	Declare competing interests.	Conflict of Interest
Availability of data/code	27	Availability of data, code, materials.	Availability of Data and Materials; Supplementary material

Supplementary Table S2. Full search strategy by database.

The most recent search was conducted on 17 November 2025. No language or design filters were applied at the database level; searches were restricted to title/abstract fields. Records were combined and de-duplicated in a reference manager before screening. Embase, Scopus, and CINAHL were not searched as dedicated databases (acknowledged in the Study Limitations).

PubMed (title/abstract)

("needlestick injuries"[tiab] OR "needlestick injury"[tiab] OR "needle-stick injuries"[tiab] OR "needle stick injury"[tiab] OR "sharp injuries"[tiab] OR "sharp injury"[tiab] OR "sharp injuries"[tiab] OR "sharp injury"[tiab] OR "sharp injuries"[tiab] OR "percutaneous injury"[tiab] OR "percutaneous injuries"[tiab]) AND ("Saudi Arabia"[tiab] OR "KSA"[tiab] OR Saudi[tiab])

Web of Science (Topic: TI/AB)

TS=((("needlestick injur*" OR "needle-stick injur*" OR "needle stick injur*" OR "sharp injur*" OR "sharp injur*" OR "percutaneous injur*") AND ("Saudi Arabia" OR "KSA" OR Saudi))

EBSCOhost (Academic Search; TI/AB)

(TI("needlestick injur*" OR "needle stick injur*" OR "sharp injur*" OR "sharp injur*" OR "percutaneous injur*") OR AB("needlestick injur*" OR "needle stick injur*" OR "sharp injur*" OR "sharp injur*" OR "sharp injur*" OR "sharp injur*" OR "percutaneous injur*")) AND (TI("Saudi Arabia" OR KSA OR Saudi) OR AB("Saudi Arabia" OR KSA OR Saudi))

Google Scholar (title screening; first 200 results by relevance)

("needlestick injuries" OR "needle stick injury" OR "sharp injuries" OR "sharp injuries") AND ("Saudi Arabia" OR KSA)

Note: For Google Scholar, the search was used as a supplementary, sensitivity-oriented source; titles of the first 200 results (sorted by relevance) were screened. The Boolean combination of the needlestick/sharps concept with the Saudi Arabia concept was applied consistently across all databases.

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

Study	Year	Data Collection	Setting	Region	Population	Recall Period	Sample Size	NSI Events	Quality (JBI)
Abalkhail <i>et al.</i> , 2022	2022	Oct-Nov 2021	Multiple hospitals and dental clinics, Saudi Arabia	National	Mixed HCWs	Last 12 months	361	80	High
Abdulmageed <i>et al.</i> , 2018	2018	Feb-May 2015	King Abdulaziz University Hospital, Jeddah	Western	Mixed HCWs	Lifetime	161	53	High
Al-Otaibi <i>et al.</i> , 2022	2022	-	Eastern Region hospitals	Eastern	Anesthesia staff	Lifetime	93	83	Moderate
Al-Qahtani <i>et al.</i> , 2021	2021	Sept-Dec 2017	Primary healthcare centers, Riyadh	Central	Nurses	Last 12 months	387	59	High
Al-Zahrani <i>et al.</i> , 2024	2024	Mar-June 2023	4 MOH hospitals, Dammam and Jeddah	National	Mixed HCWs	Last 12 months	502	42	High
Alajalin <i>et al.</i> , 2021	2021	June-Dec 2020	Multiple hospitals across Saudi Arabia	National	Surgical residents	Last 12 months	314	157	Moderate
Alam, 2002	2002	Jan 2002	Armed Forces Hospital, Sharourah	Southern	Nurses and paramedical staff	Lifetime	70	52	Moderate
Albeladi <i>et al.</i> , 2021	2021	-	Emergency department, 3 MOH hospitals, Al-Madinah	Western	Mixed HCWs	Lifetime	219	70	High

(Table S3) *contd....*

Study	Year	Data Collection	Setting	Region	Population	Recall Period	Sample Size	NSI Events	Quality (JBI)
AlDakhil <i>et al.</i> , 2019	2019	June-Sep 2017	8 random private dental clinics, Jeddah	Western	Dental assistants	Lifetime	450	134	High
Alharazi <i>et al.</i> , 2022	2022	-	King Abdulaziz University Hospital, Jeddah	Western	Nurses	Lifetime	223	43	High
Alqahtani <i>et al.</i> , 2019	2019	-	7 hospitals, Southern region	Southern	Surgical residents	Last 12 months	166	107	High
Alqithami <i>et al.</i> , 2024	2024	Feb-June 2024	6 governmental hospitals, Makkah	Western	Mixed HCWs	Last 6 months	379	47	High
Alsabaani <i>et al.</i> , 2022	2022	Aug 2019-Feb 2020	Primary, secondary, tertiary healthcare, Abha	Southern	Physicians and Nurses	Last 12 months	786	91	High
Bokhari <i>et al.</i> , 2012	2012	-	43 governmental and private dental centers, Asir	Southern	Dental professionals	Lifetime	190	138	Moderate
Esmael <i>et al.</i> , 2021	2021	-	King Fahd Military Complex and Red Crescent, Dhahran	Eastern	EMTs and paramedics	Lifetime	87	67	Moderate
Hameed <i>et al.</i> , 2015	2015	Oct-Nov 2012	General surgery dept, Auhod Hospital, Al-Madinah	Western	Mixed HCWs	Lifetime	49	13	Moderate
Hashmi <i>et al.</i> , 2012	2012	Jan-June 2012	Maternity and Children's Hospital, Najran	Southern	Mixed HCWs	Last 6 months	750	32	Moderate
Khabour <i>et al.</i> , 2018	2018	-	8 private and 10 governmental clinical laboratories, Al-Madinah	Western	Laboratory workers	Lifetime	234	56	High
Makeen <i>et al.</i> , 2022	2022	-	9 general hospitals, Jazan	Southern	Physicians and Nurses	Lifetime	609	146	High
Saad <i>et al.</i> , 2024	2024	Jan-Mar 2024	Armed Forces Hospital, Wadi Al Dawasir	Central	Physicians and Nurses	Last 12 months	100	100	Moderate
Alameer <i>et al.</i> , 2023	2023	Sep-Dec 2022	Dept of Preventive Medicine, MOH, Jeddah	Western	Mixed HCWs	Lifetime	387	40	High
Alzaaqi <i>et al.</i> , 2024	2024	Aug 2022-Nov 2023	Tertiary Care Hospital, Riyadh	Central	Mixed HCWs	Lifetime	220	70	High
Al-Sawat <i>et al.</i> , 2024	2024	Sep-Oct 2024	Taif University Hospital, Taif	Western	Medical students	Lifetime	278	33	High
Azab <i>et al.</i> , 2024	2024	Apr-July 2023	Umm Al-Qura University, Makkah	Western	Dental professionals	Past two years	182	57	High
Thirunavukkarasu <i>et al.</i> , 2021	2021	Apr-Sep 2021	Different healthcare facilities, Northern Border	Northern	Mixed HCWs	Last 12 months	438	151	High

Supplementary Table S4. Critical appraisal of the 25 included cross-sectional studies using the JBI critical appraisal checklist for studies reporting prevalence data.

Study (Author, Year)	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	'Yes' Count	Overall Quality
Abalkhail <i>et al.</i> , 2022	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	7	High
Abdulmageed <i>et al.</i> , 2018	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	8	High
Al-Otaibi <i>et al.</i> , 2022	Yes	Unclear	No	Yes	Yes	Yes	Yes	Yes	Unclear	6	Moderate
Al-Qahtani <i>et al.</i> , 2021	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	9	High
Al-Zahrani <i>et al.</i> , 2024	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	8	High
Alajalin <i>et al.</i> , 2021	Yes	No	Yes	Yes	Unclear	Yes	Yes	Yes	No	6	Moderate
Alam, 2002	Yes	No	No	Yes	No	Yes	Yes	Yes	No	5	Moderate
Albeladi <i>et al.</i> , 2021	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	9	High
AlDakhil <i>et al.</i> , 2019	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	9	High
Alharazi <i>et al.</i> , 2022	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	7	High
Alqahtani <i>et al.</i> , 2019	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	No	7	High
Alqithami <i>et al.</i> , 2024	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	8	High
Alsabaani <i>et al.</i> , 2022	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	8	High
Bokhari <i>et al.</i> , 2012	Yes	No	Yes	Yes	Yes	Unclear	Yes	Yes	No	6	Moderate
Esmael <i>et al.</i> , 2021	Yes	No	No	Yes	Yes	Unclear	Yes	Yes	Yes	6	Moderate
Hameed <i>et al.</i> , 2015	Yes	Yes	No	Yes	No	Yes	Yes	Yes	No	6	Moderate
Hashmi <i>et al.</i> , 2012	Yes	No	Yes	Yes	No	Yes	No	Yes	No	5	Moderate

(Table S4) contd.....

Study (Author, Year)	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	'Yes' Count	Overall Quality
Khabour <i>et al.</i> , 2018	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	8	High
Makeen <i>et al.</i> , 2022	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	9	High
Saad <i>et al.</i> , 2024	Yes	No	No	Yes	Yes	No	No	Yes	Yes	5	Moderate
Alameer <i>et al.</i> , 2023	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	8	High
Alzaaqi <i>et al.</i> , 2024	Yes	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	7	High
Al-Sawat <i>et al.</i> , 2024	Yes	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	7	High
Azab <i>et al.</i> , 2024	Yes	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	7	High
Thirunavukkarasu <i>et al.</i> , 2021	Yes	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	7	High
Summary: High (7-9) = 17 (68%); Moderate (5-6) = 8 (32%); Low (0-4) = 0 (0%). N = 25 studies.											

- Q1.**Was the sample frame appropriate to address the target population? (Does the sampling frame truly represent the population you want to generalize to?)

Q2.Were study participants sampled in an appropriate way? (Probability sampling, census, or clearly justified non-probability sampling.)

Q3.Was the sample size adequate? (Was the sample large enough to estimate prevalence with acceptable precision?)

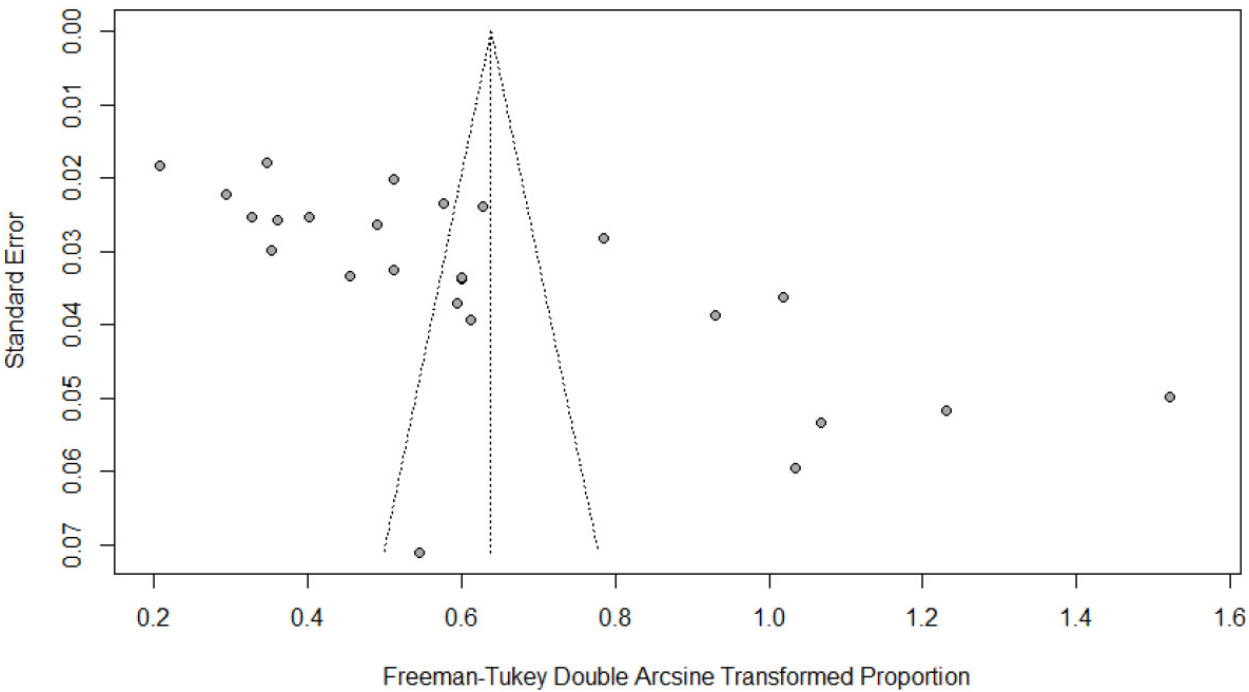
Q4.Were the study subjects and the setting described in detail? (Enough information to judge representativeness and context.)

Q5.Was the data analysis conducted with sufficient coverage of the identified sample? (High response rate, minimal missing data, or appropriate handling of missingness.)
- Q6.**Were valid methods used for the identification of the condition? (Was NSI defined clearly and measured using reliable/valid tools?)

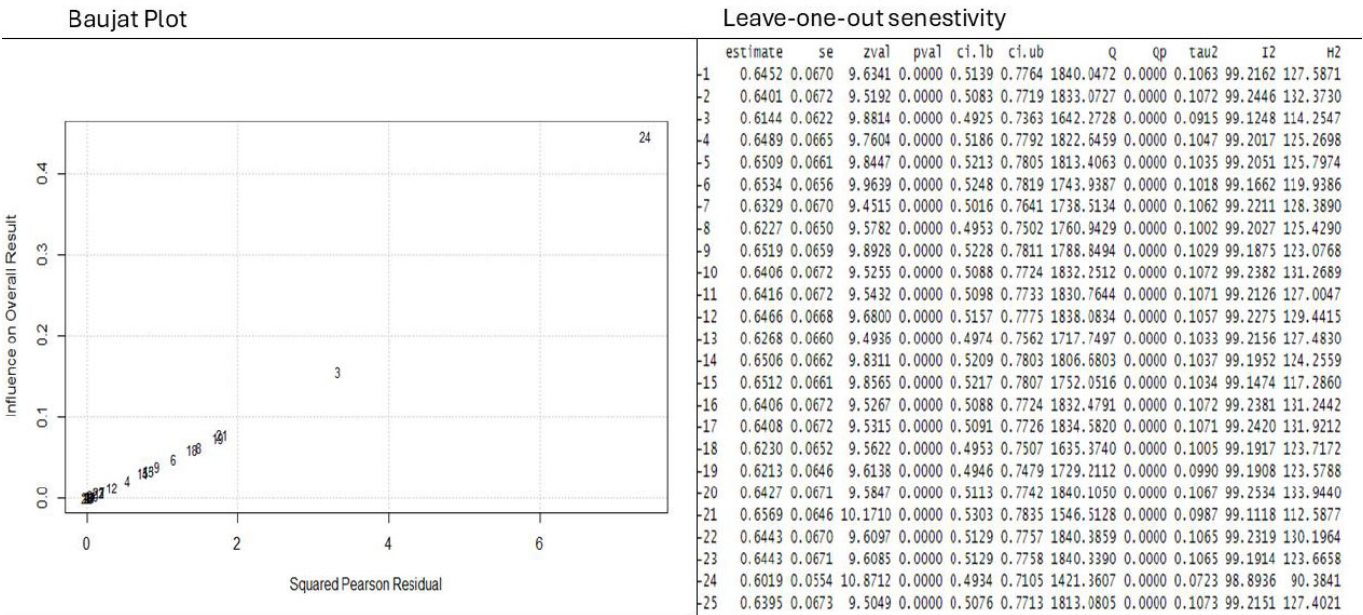
Q7.Was the condition measured in a standard, reliable way for all participants? (Consistent measurement across all participants.)

Q8.Was there appropriate statistical analysis? (Correct prevalence calculations, confidence intervals, subgroup analyses, *etc.*)

Q9.Was the response rate adequate, and if not, was the low response rate managed appropriately? (Reporting of response rate and handling of non-response bias.)



Supplementary Fig. (1). Funnel plot of NSI prevalence in Saudi Arabia. This funnel plot illustrates the distribution of studies reporting the prevalence of needlestick and sharps injuries (NSIs) among healthcare workers in Saudi Arabia. The plot is used to assess potential publication bias and small-study effects. Symmetry around the pooled effect estimate suggests low risk of publication bias, while asymmetry may indicate selective reporting or methodological heterogeneity. Each point represents an individual study, plotted by its effect size and standard error.



Supplementary Fig. (2). Baujat plot and leave-one-out sensitivity analysis of high heterogeneity in NSI prevalence in Saudi Arabia. This figure presents the sensitivity analysis conducted to explore sources of heterogeneity in the pooled prevalence of needlestick and sharps injuries (NSIs) among healthcare workers in Saudi Arabia. The Baujat plot (left panel) identifies Study No. 24 as a major contributor to both overall heterogeneity and effect size, as indicated by its position in the upper right quadrant. The leave-one-out analysis (right panel) demonstrates the robustness of the pooled estimate, with no single study exerting undue influence on the overall result. These findings support cautious interpretation of the meta-analytic summary due to persistently high heterogeneity ($I^2 > 98\%$).

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