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REVIEW ARTICLE

Work-related burden and associated factors of musculoskeletal pain among nurses in Arab countries: a systematic review and meta-analysis

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ABSTRACT

Background: Musculoskeletal pain (MSP) represents a major occupational health problem among nurses due to the substantial physical and psychosocial demands of nursing practice. Although numerous studies from Arab countries have investigated MSP among nurses, pooled regional evidence remains limited. We aimed to comprehensively evaluate the burden of musculoskeletal disorders (MSDs) among nurses in Arab countries by estimating pooled prevalence across different anatomical sites and summarizing associated occupational, psychosocial, and individual risk factors.

Methods: A systematic review and meta-analysis was conducted according to Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines. PubMed, Scopus, and Web of Science were searched from inception until May 2026. Random-effects meta-analyses were performed to estimate pooled prevalence rates with 95% confidence intervals (CIs). Heterogeneity was assessed using the I^2 statistic, while publication bias was evaluated using Doi plots and the Luis Furuya–Kanamori index. Sensitivity analyses were conducted using a leave-one-out approach.

Results: Sixteen cross-sectional studies involving 3,467 nurses from seven Arab countries were included. Low back pain was the most prevalent musculoskeletal complaint, with a pooled prevalence of 69% (95% CI: 64%-73%), followed by upper back pain at 51% (95% CI: 43%-59%), shoulder pain at 48% (95% CI: 27%-69%), ankle/foot pain at 42% (95% CI: 37%-47%), neck pain at 38% (95% CI: 21%-57%), and knee pain at 34% (95% CI: 19%-51%). Substantial heterogeneity was observed across most analyses. Frequently reported associated factors included prolonged working hours, manual patient lifting, frequent patient handling, work-related stress, lack of physical activity, poor sleep quality, female sex, older age, higher body mass index, and longer nursing experience.

Conclusion: MSP is highly prevalent among nurses in Arab countries, particularly affecting the lower and upper back regions. The burden appears to be driven by a complex interaction of occupational, psychosocial, and individual risk factors. These findings highlight the urgent need for ergonomic interventions, safer patient-handling strategies, occupational health policies, and longitudinal regional research to reduce the burden of MSDs among nurses.

Keywords: Musculoskeletal pain, musculoskeletal disorders, nurses, low back pain, occupational health, Arab countries, prevalence, work-related musculoskeletal disorders, meta-analysis.

Introduction

Musculoskeletal disorders (MSDs) comprise a broad group of conditions affecting the body's musculoskeletal system—including muscles, joints, tendons, ligaments, nerves, cartilage and spinal structures [1]. In practice,

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MSDs manifest as pain, stiffness, or functional limitation in anatomical regions such as the low back, neck, shoulders, knees, and limbs. For example, World Health Organization notes that disorders of the lower back often arise from lifting or load-bearing, while upper-limb complaints (hands, wrists, elbows, shoulders, and neck) typically follow repetitive or sustained exertion [2]. In occupational contexts, MSDs that can be attributed to workplace exposures are termed work-related MSDs (WMSDs) [1]. In nursing, common WMSDs include non-specific low back pain, cervical/shoulder strains, and knee or limb pain from prolonged standing or awkward postures.

Musculoskeletal pain (MSP) is a major global health problem. Low back pain alone is the single leading cause of years lived with disability (YLD) worldwide [3]. In 2020, it was estimated that 619 million people had low back pain, representing about 7.7% of global disability (as measured by YLD) [3,4]. In aggregate, painful MSDs impose a vast burden: an estimated 1.71 billion people globally require rehabilitation for musculoskeletal conditions. These disorders are associated with substantial economic and social costs. For example, chronic low back pain contributes heavily to work absenteeism and productivity losses, imposing a "huge economic burden" on individuals and societies [3].

Within the healthcare sector, nurses are recognized as a particularly high-risk occupational group for MSDs. By the nature of their work, nurses perform frequent heavy lifting and patient transfers, push and pull equipment, stand for long periods, and maintain awkward or static postures during patient care [5]. These physical demands—combined with extended shifts, rotating schedules, and psychosocial stress—create an environment in which WMSDs are common. Indeed, one recent review notes that WMSDs "are currently the most common occupational injuries among nurses" [5].

Consistent with these exposures, international studies report extremely high prevalence of musculoskeletal symptoms among nurses. Systematic reviews of nurses worldwide have found that roughly 40%-90% of nurses report WMSDs during a 12-month period [5]. For instance, a 2025 meta-analysis of Asian nurses found an overall WMSD prevalence of 84.3% (95% CI: 81.1%-87.4%) [5]. The low back was the most affected site (58.4%), followed by neck (45.7%) and shoulder (43.0%). Similarly, meta-analyses in other regions have pooled prevalence near 87%-88% [6,7]. These high rates are echoed in country-level studies. In Saudi Arabia, for example, 85% of nurses at a tertiary hospital reported at least one musculoskeletal complaint in the past year, most commonly low back (65.7%), ankle/foot (41.5%) and shoulder pain [8]. A wide array of factors influences the likelihood of MSP in nurses. Sociodemographic characteristics such as increasing age, female sex, and higher body mass index have often been reported as risk factors in the nursing literature. For example, Attar [8] found that prolonged working hours (odds ratio [OR] ≈ 3.7) and being underweight (OR ≈ 2.7) were significantly associated with musculoskeletal symptoms in Saudi nurses, suggesting that both workload and personal health factors matter. Occupational factors are also critical: longer shifts, rotating schedules, unit of work (e.g., intensive care or surgery), frequent manual patient handling, inadequate staffing, and poor ergonomics each elevate MSP risk.

This context underscores the need for a comprehensive evidence synthesis. To our knowledge, no systematic review has yet pooled prevalence estimates or risk factors for MSP specifically among nurses in Arab countries. A regional meta-analysis would clarify the overall magnitude and anatomical distribution of pain, as well as the key correlates across diverse Arab settings. Therefore, the present study systematically reviews and meta-analyzes available data on MSP among nurses in Arab countries, with the aim of comprehensively evaluating the burden of MSDs among nurses in Arab countries by estimating pooled prevalence across different anatomical sites and summarizing associated occupational, psychosocial, and individual risk factors. By filling this gap, we seek to provide epidemiologically rigorous regional benchmarks that can inform occupational health policy and preventive strategies for nursing staff in the Arab world.

Methods

This systematic review and meta-analysis was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [9].

Literature search and keywords

A comprehensive literature search was performed in PubMed, Scopus, and Web of Science for studies published from inception up to May 2026. The search strategy used in the databases was (nurse*) AND (musculoskeletal pain OR musculoskeletal disorder* OR work-related musculoskeletal disorder* OR WMSD OR neck pain OR shoulder pain OR low back pain OR back pain) AND (Algeria OR Bahrain OR Comoros OR Djibouti OR Egypt OR Iraq OR Jordan OR Kuwait OR Lebanon OR Libya OR Mauritania OR Morocco OR Oman OR Palestine OR Qatar OR Saudi Arabia OR Somalia OR Sudan OR Syria OR Tunisia OR United Arab Emirates OR UAE OR Yemen)

Reference lists of included articles and relevant reviews were also screened to identify additional eligible publications.

Eligibility criteria

Studies were eligible if they met the following criteria:

- Observational studies with a cross-sectional or any other observational design.
- Nursing staff (registered nurses, nurse practitioners, or specialized nurses) working in healthcare settings within the specified Arab countries.

- Studies that reported the prevalence of MSP (overall or localized to specific body parts) and/or evaluated related risk factors.

No language restrictions were applied.

Exclusion criteria

Exclusion criteria were

- Non-original works (e.g., reviews, commentaries, editorials, protocols, theses, and conference abstracts).
- Studies not specific to nurses (e.g., mixed healthcare workers without separate, extractable data for nursing personnel).
- Studies with insufficient or unclear data on the prevalence of MSP or its associated factors.

Study selection and data extraction

After removing duplicates, all records were imported into Rayyan software for blinded screening [10]. Two reviewers independently screened titles and abstracts according to the eligibility criteria, followed by full-text review of potentially relevant studies. Disagreements were resolved through discussion. Reference lists of included studies were also checked to capture additional eligible articles.

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

- **Study characteristics:** First author, year of publication, study design, country, sample size, and key findings.
- **Participant characteristics:** Age and gender.
- **Outcomes:** Anatomical-specific prevalence by body part (including low back pain [LBP], neck pain, shoulder pain, knee pain, upper back pain, wrist/hand pain, and ankle/foot pain), and risk factors.

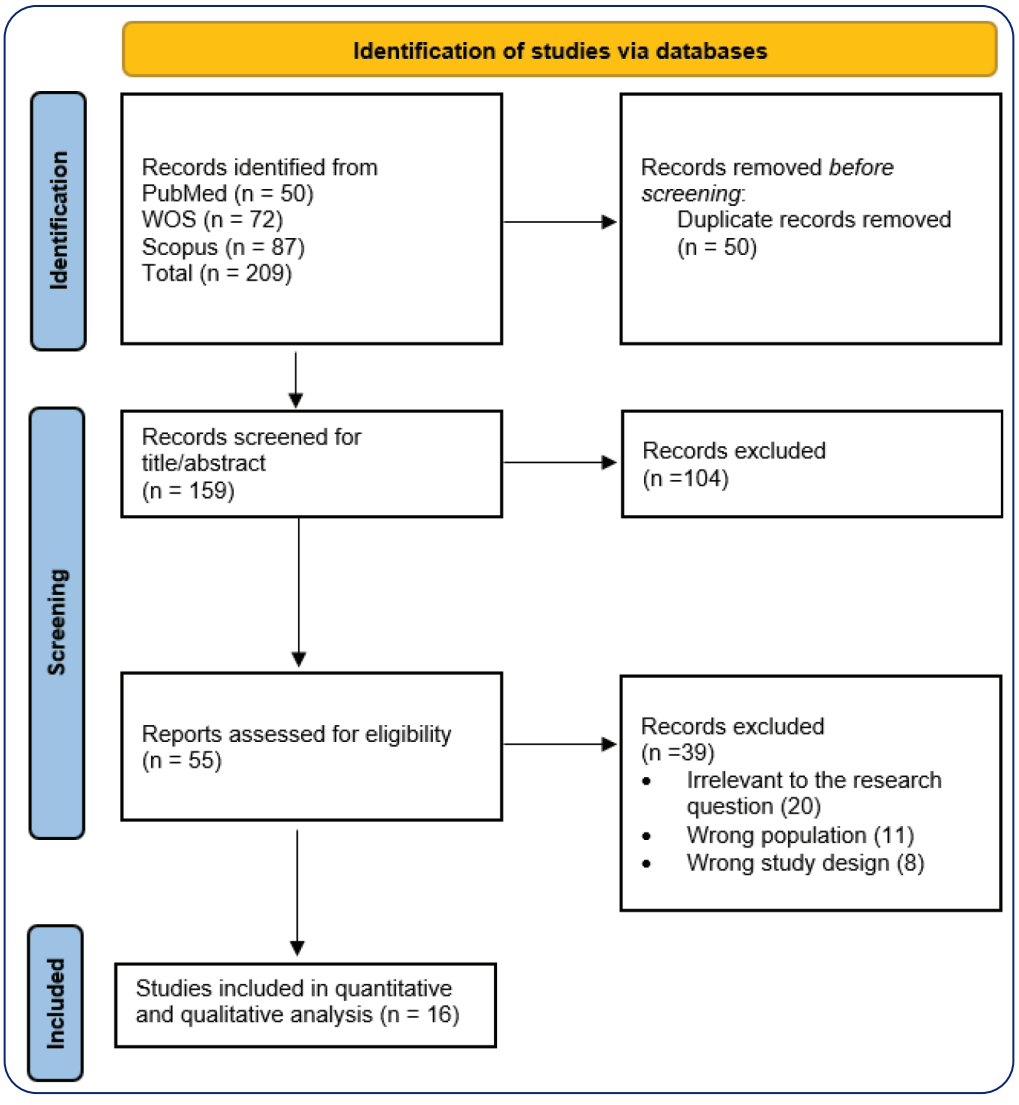

Figure 1. *PRISMA flowchart of study selection.*

Risk of bias assessment

The methodological quality of the included studies was independently evaluated by two reviewers using the National Heart, Lung, and Blood Institute (NHLBI) Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies [11]. This tool guides the assessment of internal validity across several domains, including the clarity of the research objective, definition and selection of the study population, participation rate, sample size justification, the validity and reliability of the MSP outcome measures, and the appropriate measurement and adjustment for potential confounding variables. Based on these criteria, each study was assigned an overall quality rating of "Good," "Fair," or "Poor." Discrepancies between reviewers were resolved through consensus.

Statistical analysis

All statistical analyses were conducted using RStudio (RStudio IDE, Posit Software, PBC, Boston, MA) with the "meta" package [12]. Pooled prevalence estimates were calculated using a random-effects model with corresponding 95% confidence intervals (CIs). Proportions were analyzed using the arcsine transformation implemented in the metaprop function and were back-transformed to the original prevalence scale for presentation. Studies were weighted using the inverse-variance method, and between-study variance (τ^2) was estimated using the DerSimonian–Laird method. Studies with zero events were handled using a continuity correction of 0.5. Heterogeneity among studies was quantified using the I^2 statistic and Cochran's Q test, with $I^2 \geq 50\%$ or $p < 0.10$ considered evidence of substantial heterogeneity.

Publication bias was assessed using the Luis Furuya–Kanamori (LFK) asymmetry index and the Doi plot [13]. A symmetrical Doi plot was interpreted as absence of bias, while asymmetry suggested possible bias. Based on the LFK index, values within ±1 indicate no asymmetry, between ±1 and ±2 indicate minor asymmetry, and values greater than ±2 suggest major asymmetry. The Doi plots and LFK indices were generated using the MetaXL add-in for Microsoft Excel [14].

Sensitivity analysis

Sensitivity analyses were conducted using a leave-one-out method to determine the influence of individual studies on the pooled prevalence estimates and to explore potential sources of heterogeneity.

Results

Literature search

The electronic database search yielded 209 records. After removal of duplicates, 159 records were screened by title and abstract and 55 full-text articles were assessed for eligibility. Following detailed evaluation, 16 cross-sectional studies were included in the systematic review and meta-analysis [8,15–29]. The study selection process is illustrated in the PRISMA flow diagram (Figure 1).

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

Study	Country	Design	Sample size	Age (years), mean (SD), and/or range	Sex (male), *n* (%)	Marital status, (single), *n* (%)	Key findings
Ali Alabdali [16]	Oman	Cross-sectional	236	35 (6.54)	50 (21.4)	57 (24.5)	66.8% Prevalence of LBP among nurses. LBP knowledge is significantly associated with lower disability.
Almhdawi et al.[20]	Jordan	Cross-sectional	245	35 (6)	97 (39.6)	59 (24.1)	Musculoskeletal pain was a significant predictor of worse health-related quality of life during COVID-19.
Al-Yafeai et al. [17]	UAE	Cross-sectional	250	≤30: 134 (53.6) >30: 116 (46.4)	8 (3.2)	98 (39.2)	Back pain (17.6%) and leg pain (11.6%) were the most prevalent physical hazards. Long tenure and senior rank increased risk.
Farah et al. [18]	Saudi Arabia	Cross-sectional	107	NR	NR	NR	Total LBP prevalence was 84.8%. Factors included lack of exercise, inadequate sleep, and female gender.
Zaitoon et al.[19]	Palestine	Cross-sectional	258	20–25: 66 (25.6) 26–30: 92 (35.7) 31–35: 89 (34.5) 36–40:11 (4.3)	130 (50.4)	89 (34.5)	Lifetime LBP prevalence reached 82%. 12-month prevalence was 78%.
Abolfotouh et al. [28]	Qatar	Cross-sectional	254	34.6 (7.8)	64 (25.2)	56 (22)	12-Month LBP prevalence was 54.3%. Predictors included lack of exercise and high psychological demand.

Study	Country	Design	Sample size	Age (years), mean (SD), and/or range	Sex (male), *n* (%)	Marital status, (single), *n* (%)	Key findings
Tariah et al. [25]	Saudi Arabia	Cross-sectional	94	<25: 4 (4.3) 26-30: 23 (24.5) 31-35: 36 (38.2) 36-40: 10 (10.6) 41-45: 11 (11.7) 46-50: 6 (6.4) >50: 4 (4.3)	2 (2.1)	NA	Among 94 nurses, the most commonly reported musculoskeletal discomfort during the past 12 months was low back pain (63.8%), followed by shoulder pain (50%) and upper back pain (48.9%).
Almaghrabi and Alsharif[22]	Saudi Arabia	Cross-sectional	234	<30: 45 (19.2) 30-40: 123 (52.6) >40: 66 (28.2)	31 (13.2)	54 (23.1)	Low back pain was highly prevalent among nurses, with cumulative, annual, and one-week prevalence rates of 82.9%, 85.5%, and 53.6%, respectively, and was significantly associated with manual patient lifting, particularly among surgical ward nurses, leading many to seek medical care, change working units, or require hospitalization.
Alshahrani [23]	Saudi Arabia	Cross-sectional	187	21-30: 83 (44.4) 31-40: 83 (44.4) 41-50: 16 (8.5) >50: 5 (2.7)	79 (42.2)	NR	Low back pain was reported by 74.8% of respondents and was significantly associated with gender, workplace, nature of work, and weekly direct patient contact hours.
Attar [8]	Saudi Arabia	Cross-sectional	200	34.6 (8.1)	9 (4.5)	NR	Approximately 85% of nurses reported at least one musculoskeletal symptom, most commonly in the lower back, ankles and feet, and shoulders, with prolonged working hours and being underweight significantly associated with symptom development.
Abuzeid Atta Elmannan et al. [21]	Saudi Arabia	Cross-sectional	323	20-30: 195 (60.4) 31-40: 99 (30.7) >40: 29 (9.0)	21(6.5)	NR	Low back pain had a prevalence of 65.6%, with 38.7% of affected participants seeking treatment, while age and type of ward were significantly associated with its occurrence.
Gaowgzeh [15]	Saudi Arabia	Cross-sectional	60	35.4	18 (30)	NR	Low back pain was the most predominant site of injury (51.2%), with most injuries ranging from mild to moderate severity.
Jradi et al. [24]	Saudi Arabia	Cross-sectional	427	20-30: 173 (42.2) 31-40: 163 (39.8) >40: 74 (18.1)	43 (10.5)	172 (41.9)	The prevalence of low back pain was 80%, and factors associated with it in univariate analysis included frequent lifting, work-related stress, lack of job satisfaction, work-related problems, and financial problems.
Shawashi et al. [29]	Jordan	Cross-sectional	150	<25: 65 (43.3) 25-39: 75 (50) >40: 10 (6.7)	53 (35.4)	88 (58.7)	Among nurses with back pain, about one-fifth reported it to administration, with the highest prevalence observed among critical care nurses, while dynamic factors contributed more commonly to back pain than static factors.
Sorour and El-Maksoud[27]	Egypt	Cross-sectional	58	27.9 (8.4)	18 (31)	NR	Neck, shoulder, and lower back pain were the most common musculoskeletal complaints among nurses, while higher job demand scores and greater severity of low back pain were independent predictors of burnout, and job demand independently predicted the number of musculoskeletal disorders.
Suliman [26]	Jordan	Cross-sectional	384	20-30: 201 (52.3) 31-40: 140 (36.5) 41-50: 42 (10.9) >50: 1 (0.3)	127 (33.1)	97 (25.3)	The 1-year prevalence of low back pain was 78.9%, and it was significantly associated with older age, female gender, being overweight, and longer nursing experience.

NR, not reported.

Study and population characteristics

A total of 16 studies were included in this systematic review and meta-analysis. All included studies utilized a cross-sectional design. The studies were conducted across seven Arab countries: Saudi Arabia (*n* = 8), Jordan (*n* = 3), Oman (*n* = 1), United Arab Emirates (*n* = 1), Palestine (*n* = 1), Qatar (*n* = 1), and Egypt (*n* = 1).

The cumulative sample size across all studies was 3,467 nurses. Individual study sample sizes ranged from 58 participants to 427 participants. The participants were primarily female. The most frequently reported outcome was the 12-month prevalence of LBP, with several studies also reporting on pain in other anatomical regions including the neck, shoulders, and extremities. Full study and participant details are presented in Table 1.

Quality assessment

The methodological quality of the 16 included studies was assessed using the NHLBI Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies.

Table 2. *Quality assessment of the included studies.*

Study	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Quality
Alshahrani [23]	Y	Y	NR	Y	N	NA	NA	NA	Y	NA	Y	NR	NA	Y	Fair
Abolfotouh et al. [28]	Y	Y	NR	Y	N	NA	NA	NA	Y	NA	Y	NR	NA	Y	Fair
Tariah et al. [25]	Y	Y	NR	Y	N	NA	NA	NA	Y	NA	Y	NR	NA	Y	Fair
Almaghrabi and Alsharif [22]	Y	Y	NR	Y	N	NA	NA	NA	Y	NA	Y	NR	NA	Y	Fair
Attar [8]	Y	Y	NR	Y	N	NA	NA	NA	Y	NA	Y	NR	NA	Y	Fair
Abuzeid Atta Elmannan et al. [21]	Y	Y	NR	Y	N	NA	NA	NA	Y	NA	Y	NR	NA	Y	Fair
Gaowgzeh [15]	Y	Y	NR	Y	N	NA	NA	NA	Y	NA	Y	NR	NA	Y	Fair
Jradi et al. [24]	Y	Y	NR	Y	N	NA	NA	NA	Y	NA	Y	NR	NA	Y	Fair
Shawashi et al. [29]	Y	Y	NR	Y	N	NA	NA	NA	Y	NA	Y	NR	NA	N	Fair
Sorour and El-Maksoud [27]	Y	Y	NR	Y	N	NA	NA	NA	Y	NA	Y	NR	NA	Y	Fair
Suliman [26]	Y	Y	Y	Y	Y	NA	NA	NA	Y	NA	Y	NR	NA	Y	Good
Ali Alabdali [16]	Y	Y	NR	Y	N	NA	NA	NA	Y	NA	Y	NR	NA	Y	Fair
Almhdawi et al. [20]	Y	Y	NR	Y	N	NA	NA	NA	Y	NA	Y	NR	NA	Y	Fair
Al-Yafeai et al. [17]	Y	Y	NR	Y	N	NA	NA	NA	Y	NA	Y	NR	NA	Y	Fair
Farah et al. [18]	Y	Y	NR	Y	N	NA	NA	NA	Y	NA	Y	NR	NA	Y	Fair
Zaitoon et al. [19]	Y	Y	Y	Y	N	NA	NA	NA	Y	NA	Y	NR	NA	Y	Good

Y, yes; N, no; CD, cannot determine; NR, not reported; NA, not applicable.
NHLBI Tool for Observational Cohort and Cross-Sectional Studies.
Q1, Was the research question or objective in this paper clearly stated?
Q2, Was the study population clearly specified and defined?
Q3, Was the participation rate of eligible persons at least 50%?
Q4, Were all the subjects selected or recruited from the same or similar populations (including the same time period)? Were inclusion and exclusion criteria for being in the study pre-specified and applied uniformly to all participants?
Q5, Was a sample size justification, power description, or variance and effect estimates provided?
Q6, For the analyses in this paper, were the exposure(s) of interest measured prior to the outcome(s) being measured?
Q7, Was the timeframe sufficient so that one could reasonably expect to see an association between exposure and outcome if it existed?
Q8, For exposures that can vary in amount or level, did the study examine different levels of the exposure as related to the outcome?
Q9, Were the exposure measures (independent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?
Q10, Was the exposure(s) assessed more than once over time?
Q11, Were the outcome measures (dependent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?
Q12, Were the outcome assessors blinded to the exposure status of participants?
Q13, Was loss to follow-up after baseline 20% or less?
Q14, Were key potential confounding variables measured and adjusted statistically for their impact on the relationship between exposure(s) and outcome(s)?

Overall, two studies were rated as "Good" quality, while the remaining 14 were classified as "Fair." All included studies clearly defined their research objectives and study populations. Furthermore, 15 of 16 studies appropriately measured and adjusted for key potential confounding variables in their statistical analyses, with Shawashi [29] being the only exception. However, several methodological limitations were prevalent across literature. Quality assessment of the included studies is represented in Table 2.

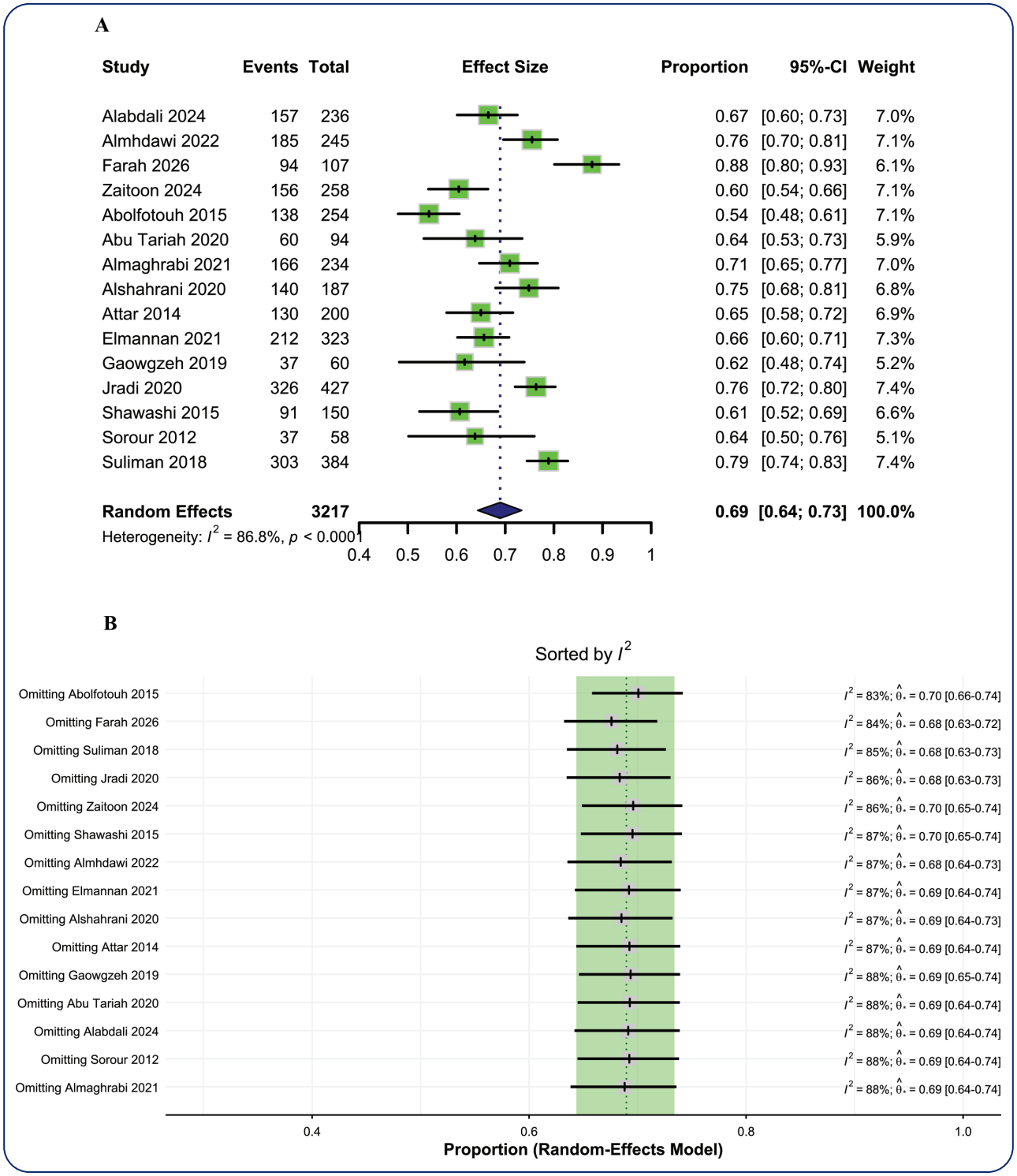

Figure 2. *(a) Prevalence of low back pain among nurses,* ***(b)*** *Leave-one-out analysis.*

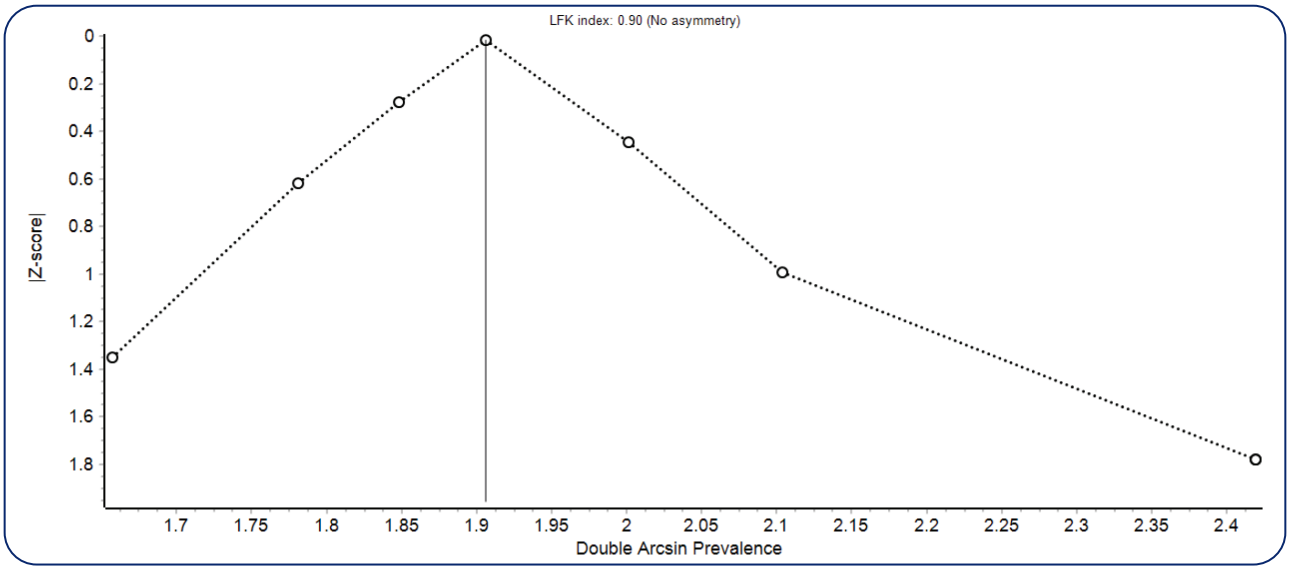

Figure 3. *Doi plot and LFK index for prevalence of low back pain among nurses.*

Meta-analysis

Prevalence of low back pain

The pooled prevalence of low back pain among nurses in Arab countries was 69% (95% CI: 64%-73%) (Figure 2a). Between-study heterogeneity was substantial (I^2 = 86.8%, p < 0.0001). Leave-one-out sensitivity analysis indicated that the exclusion of any single study did not materially alter the pooled estimate, with prevalence ranging between 68% and 70%, nor did it resolve the high heterogeneity (Figure 2b). Publication bias assessment using a Doi plot returned an LFK index of 0.90, indicating no asymmetry (Figure 3).

Prevalence of neck pain

The pooled prevalence of neck pain across the included studies was 38% (95% CI: 21%-57%) (Figure 4a). Considerable heterogeneity was observed (I^2 = 96.6%, p < 0.0001). Sensitivity analysis showed that the pooled estimate remained relatively stable, ranging from 32% to 44% upon individual study exclusion, with heterogeneity remaining high (Figure 4b). The Doi plot yielded an LFK index of 0.53, consistent with an absence of asymmetry (Figure 5).

Prevalence of shoulder pain

The pooled prevalence of shoulder pain among nurses was 48% (95% CI: 27-69%) (Figure 6a). Significant heterogeneity was present (I^2 = 93.3%, p < 0.0001). Leave-one-out sensitivity analysis demonstrated that the pooled prevalence fluctuated between 39% and 57%. Notably, the exclusion of Attar (2014) reduced the heterogeneity to I^2 = 72%, though it remained substantial (Figure 6).

Prevalence of wrist/hand pain

The pooled prevalence for MSP in the wrist and hand was 29% (95% CI: 8%-57%) (Figure 7a). Heterogeneity among the studies was high (I^2 = 95.9%, p < 0.0001). Sensitivity analysis indicated that the pooled estimate ranged from 21% to 41% depending on the study omitted. Similar to shoulder pain, the exclusion of Attar (2014) resulted in the lowest observed heterogeneity for this outcome (I^2 = 74%) (Figure 7b).

Prevalence of ankle and foot pain

The pooled prevalence of pain in the ankles and feet was 42% (95% CI: 37%-47%) (Figure 8a). There was no evidence of heterogeneity among the included studies (I^2 = 0.0%, p = 0.89). Sensitivity analysis confirmed the stability of this estimate, ranging from 41% to 43% (Figure 8b).

Prevalence of knee pain

The pooled prevalence of knee pain was 34% (95% CI: 19%-51%) (Figure 9a). High heterogeneity was detected (I^2 = 93.7%, p < 0.0001). Sensitivity analysis indicated that the pooled estimate varied from 28% to 39% depending on the study omitted, with heterogeneity remaining significant (Figure 9b).

Prevalence of hips, thighs, and buttocks pain

The pooled prevalence of pain in the hips, thighs, and buttocks was 27% (95% CI: 14%-41%) (Figure 10a). Substantial heterogeneity was found (I^2 = 86.2%, p = 0.0007). Sensitivity analysis showed the prevalence ranged between 22% and 34%, with the exclusion of Attar (2014) effectively eliminating the heterogeneity (I^2 = 0.0%) (Figure 10b).

Prevalence of elbow pain

The pooled prevalence of elbow pain was 12% (95% CI: 2%-27%) (Figure 11a). High heterogeneity was present (I^2 = 92.2%, p < 0.0001). Sensitivity analysis showed estimates ranging from 6% to 18%. The exclusion of Attar (2014) reduced the heterogeneity to I^2 = 79% (Figure 11b).

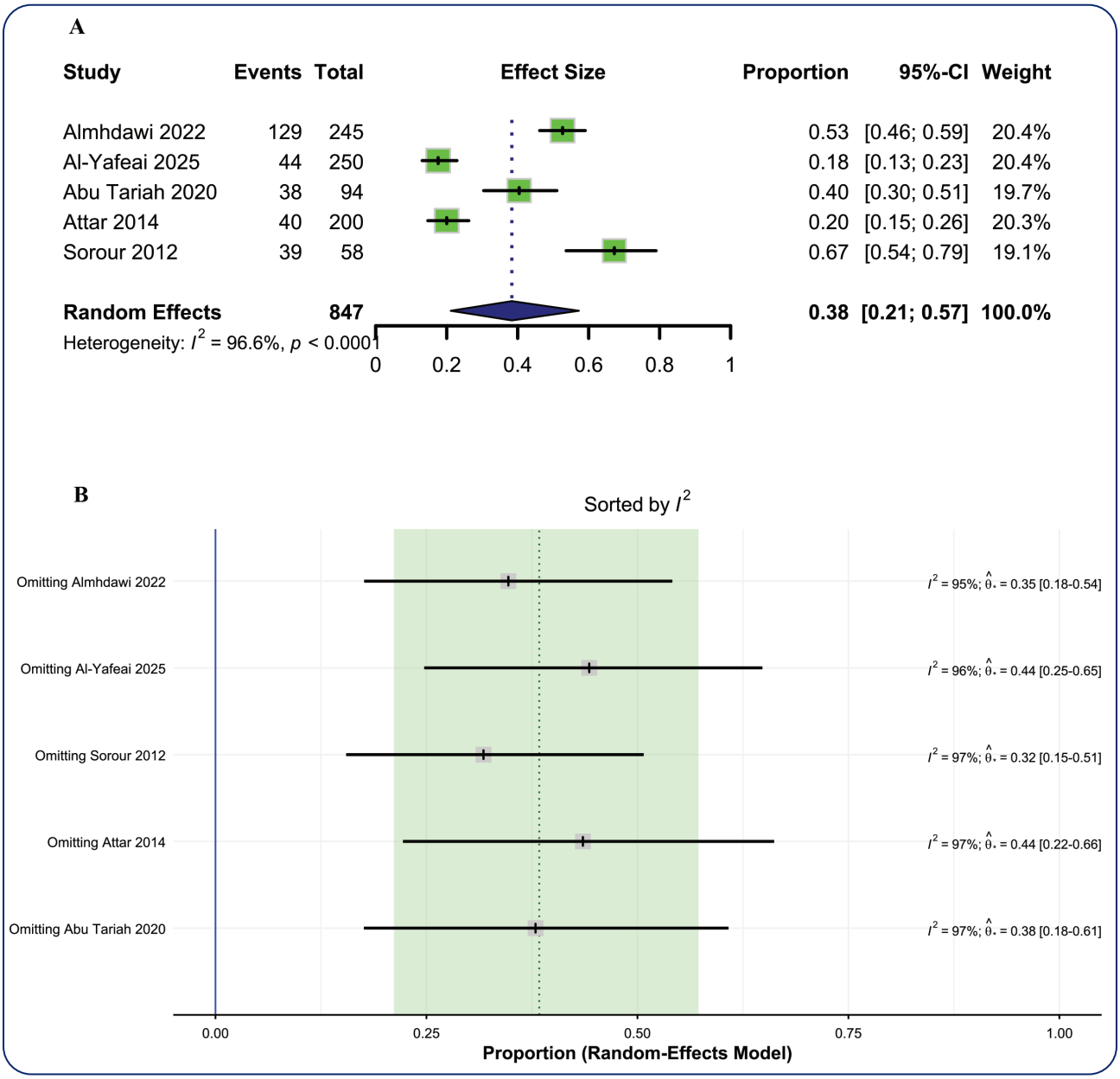

Figure 4. *(a) Prevalence of neck pain among nurses, (b) leave-one-out analysis.*

Prevalence of upper back pain

The pooled prevalence of upper back pain among nurses was 51% (95% CI: 43%-59%) (Figure 12). No heterogeneity was observed for this outcome (I^2 = 0.0%, p = 0.45).

Factors associated with musculoskeletal pain

The included studies identified a broad range of individual, professional, and psychosocial risk factors significantly associated with MSP, particularly LBP, among nurses. Zaitoon et al. [19] reported that education level was a significant factor, with 70% of nurses suffering from LBP holding a bachelor's degree. Almhdawi et al. [20] highlighted the impact of pain on overall well-being, finding that MSP, depression, and family financial burdens were significantly associated with lower health-related quality of Life (HRQoL), while better sleep quality served as a significant predictor of higher HRQoL. In the study by Abolfotouh et al. [28], several factors were initially linked to LBP, including being female, having arthritis, performing office work, and working 12-hour shifts; however, after multivariate adjustment, the primary significant predictors were identified as office work, exposure to physical stress, and a lack of regular exercise, specifically noting that running for more than 15 minutes per day acted as a protective factor.

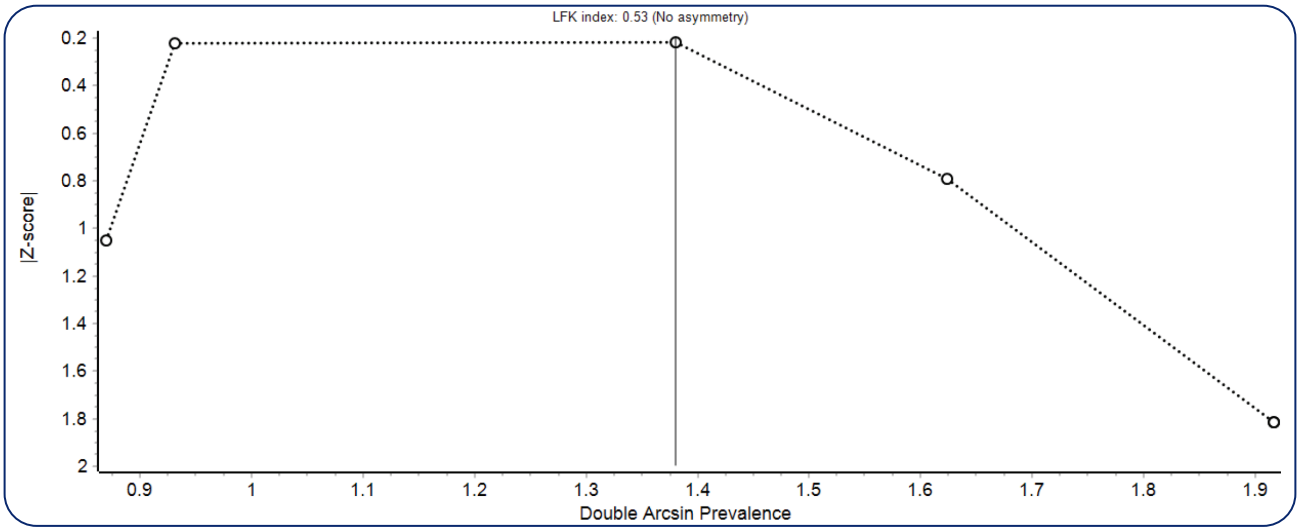

Figure 5. *Doi plot and LFK index for prevalence of neck pain among nurses.*

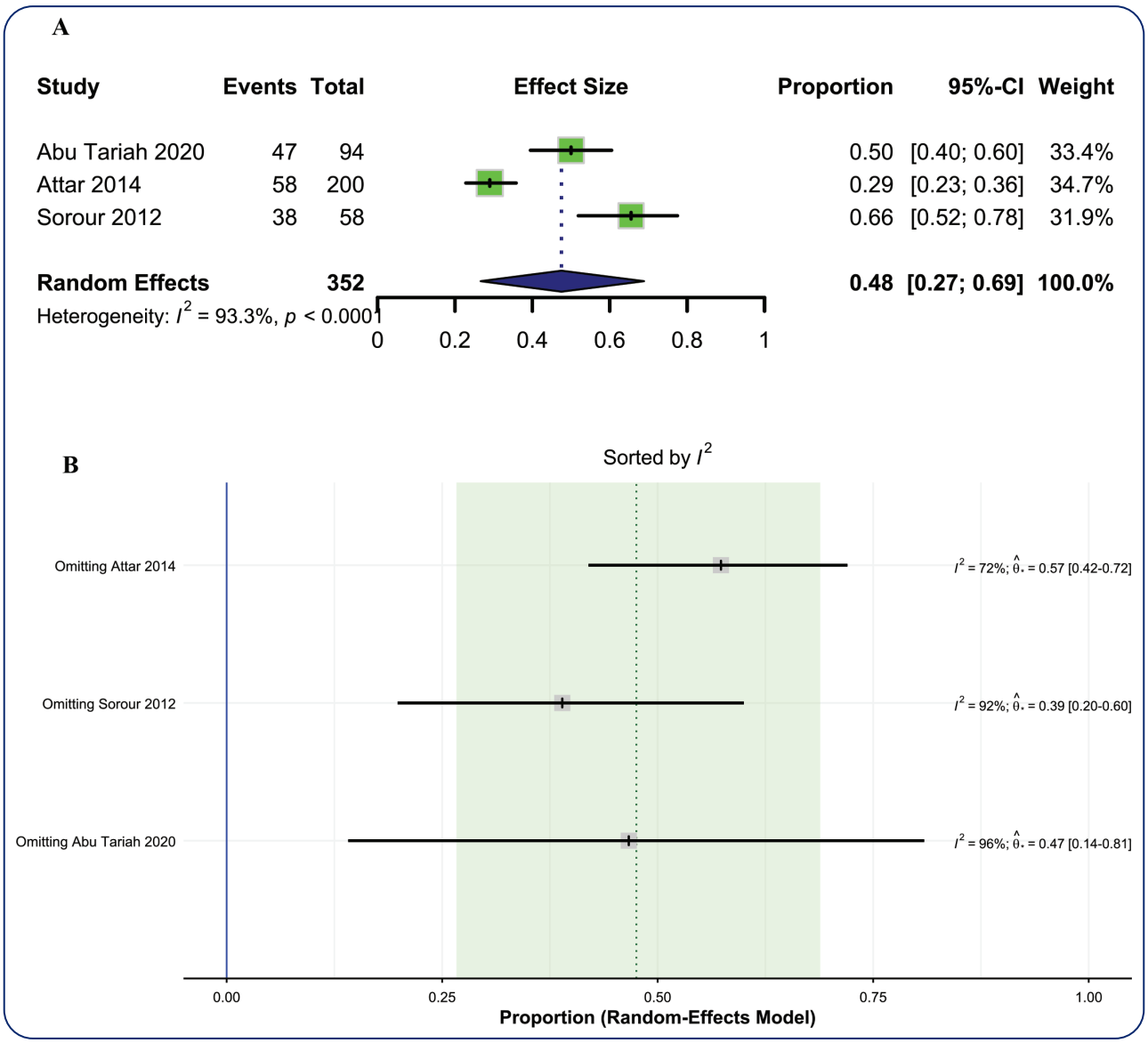

Figure 6. *(a) Prevalence of shoulder pain among nurses, (b) Leave-one-out analysis*

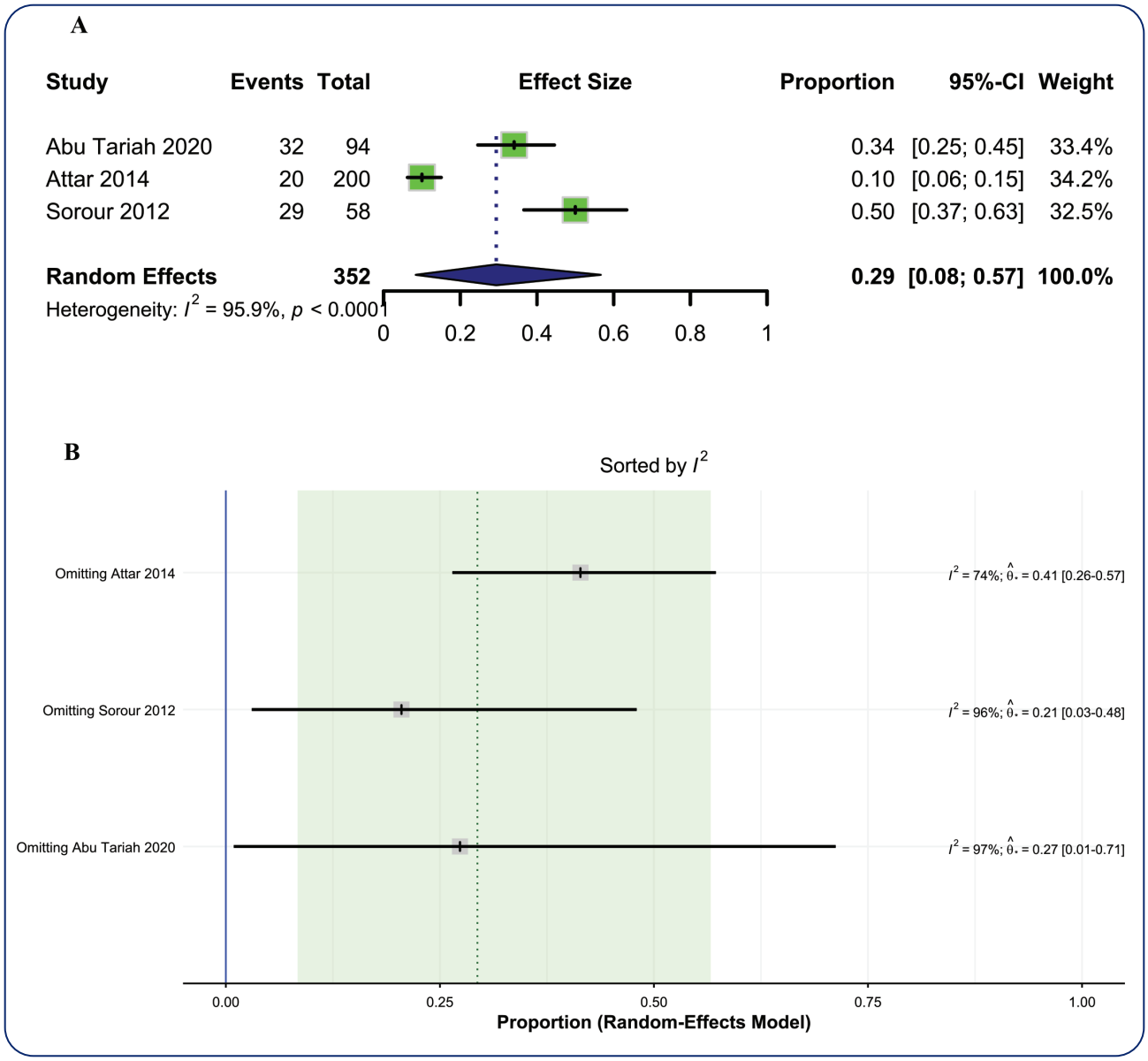

Figure 7. *(a) Prevalence of wrist/hand pain among nurses, (b) leave-one-out analysis*

Almaghrabi et al. [22] observed that while sociodemographic characteristics such as age, gender, and education, as well as medical comorbidities such as diabetes and hypertension, had no significant relationship with LBP prevalence, manual patient lifting was a critical risk factor. Specifically, nurses involved in manual lifting had an 87.2% chance of developing LBP compared to 66.7% for those who did not. Attar et al. [8] further quantified professional risks, noting that nurses working more than 10 hours per day and those who were underweight were at significantly higher risk for WMSDs. This study also found that workplace department played a role, with the highest risk of LBP observed in the Surgical Department and the lowest in Obstetrics and Gynecology. Finally, Jradi et al. [24] utilized a multivariate model to confirm that frequent lifting of patients or objects at least five times per shift, high levels of work-related stress, and a lack of job satisfaction remained the most robust independent predictors of LBP.

Discussion

Our meta-analysis confirms an exceptionally high burden of MSP among Arab nurses, particularly affecting the low back (pooled prevalence 69%) and upper back (51%), with substantial pain also reported in the shoulder (48%) and lower extremities (e.g., ankle/foot 42%, knee 34%). These findings underscore a multifactorial etiology. Nurses' heavy physical workload—including frequent patient lifting, prolonged standing and awkward postures—is compounded

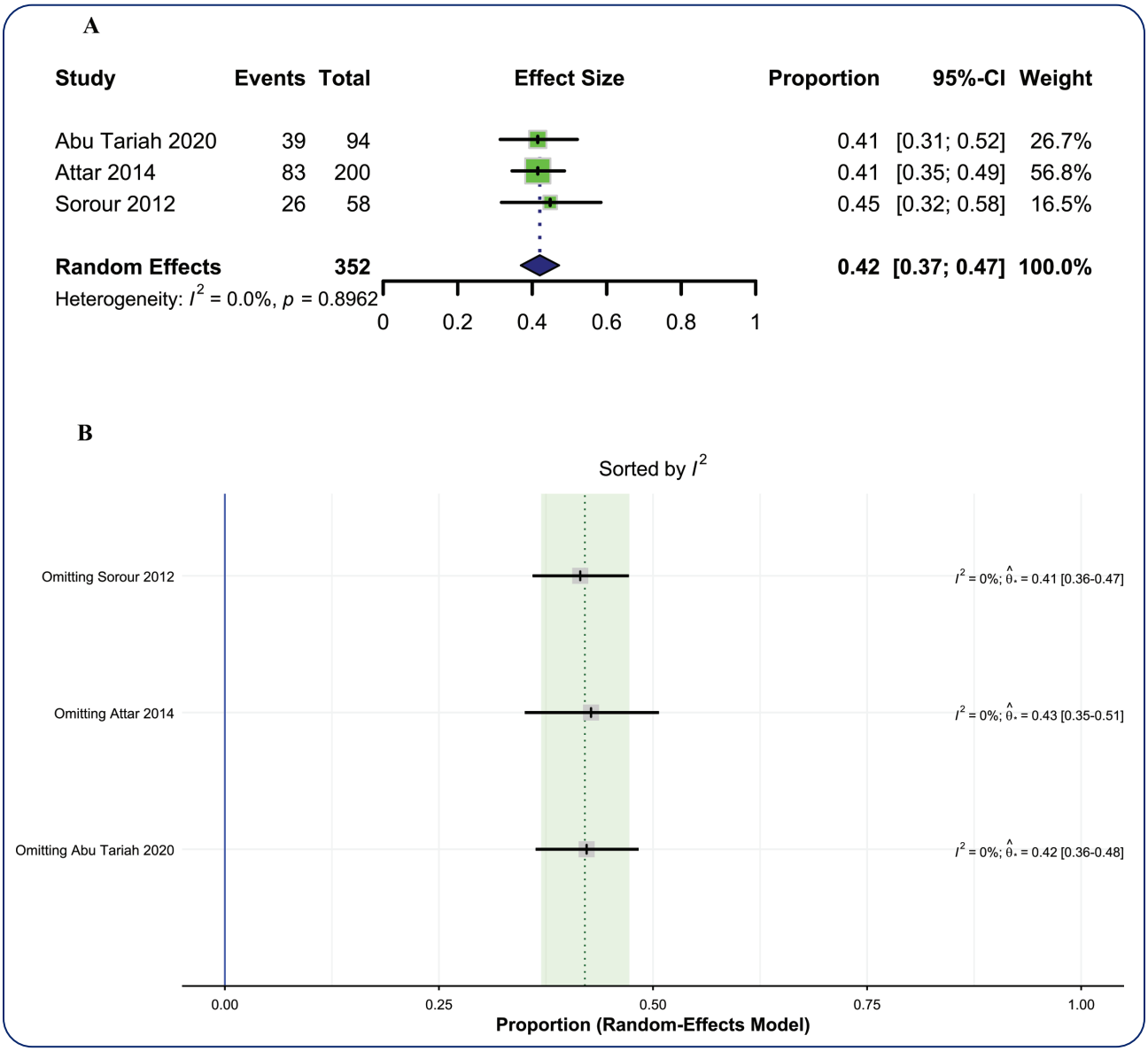

Figure 8. *(a) Prevalence of ankle/foot pain among nurses, (b) leave-one-out analysis.*

by psychosocial strain (high job stress, fatigue) and institutional pressures (long shifts, staffing shortages). Indeed, work in nursing routinely involves manual transfer of patients and repetitive tasks, factors shown to drive back, shoulder, and limb pain [30]. Our results thus reflect the complex interplay of individual (age, sex, and body mass index), occupational (hours worked, lifting demands, shift schedules) and psychosocial (stress, job dissatisfaction) factors documented in the literature. The concurrent presence of these risk factors likely amplifies vulnerability; for example, rotating shift work and excessive overtime combine with ergonomic deficits (e.g., lack of lifting equipment) to increase strain on the spine and extremities.

Heterogeneity across studies was marked in nearly all body sites (most I^2 values >80%), except for upper back and ankle/foot pain, for which between-study variance was negligible. This heterogeneity partly reflects methodological differences but also genuine clinical and systemic diversity. Our leave-one-out sensitivity analyses pointed to a single influential study (Attar [8]) as a driver of inconsistency: excluding that study reduced heterogeneity for shoulder pain to I^2 =72% (down from 93.3%) and for wrist/hand pain to I^2 =74%, and eliminated it entirely for hip/thigh/buttock pain (I^2 = 0%). Such findings suggest that particular study contexts can skew pooled estimates. Plausible explanations include variation in healthcare settings (for instance, some hospitals may lack mechanical patient lifts or enforce longer nurse shifts than others), differing nurse-to-patient ratios, and the mix of clinical departments sampled (e.g., high-intensity units like ICUs versus general wards). Cultural and institutional

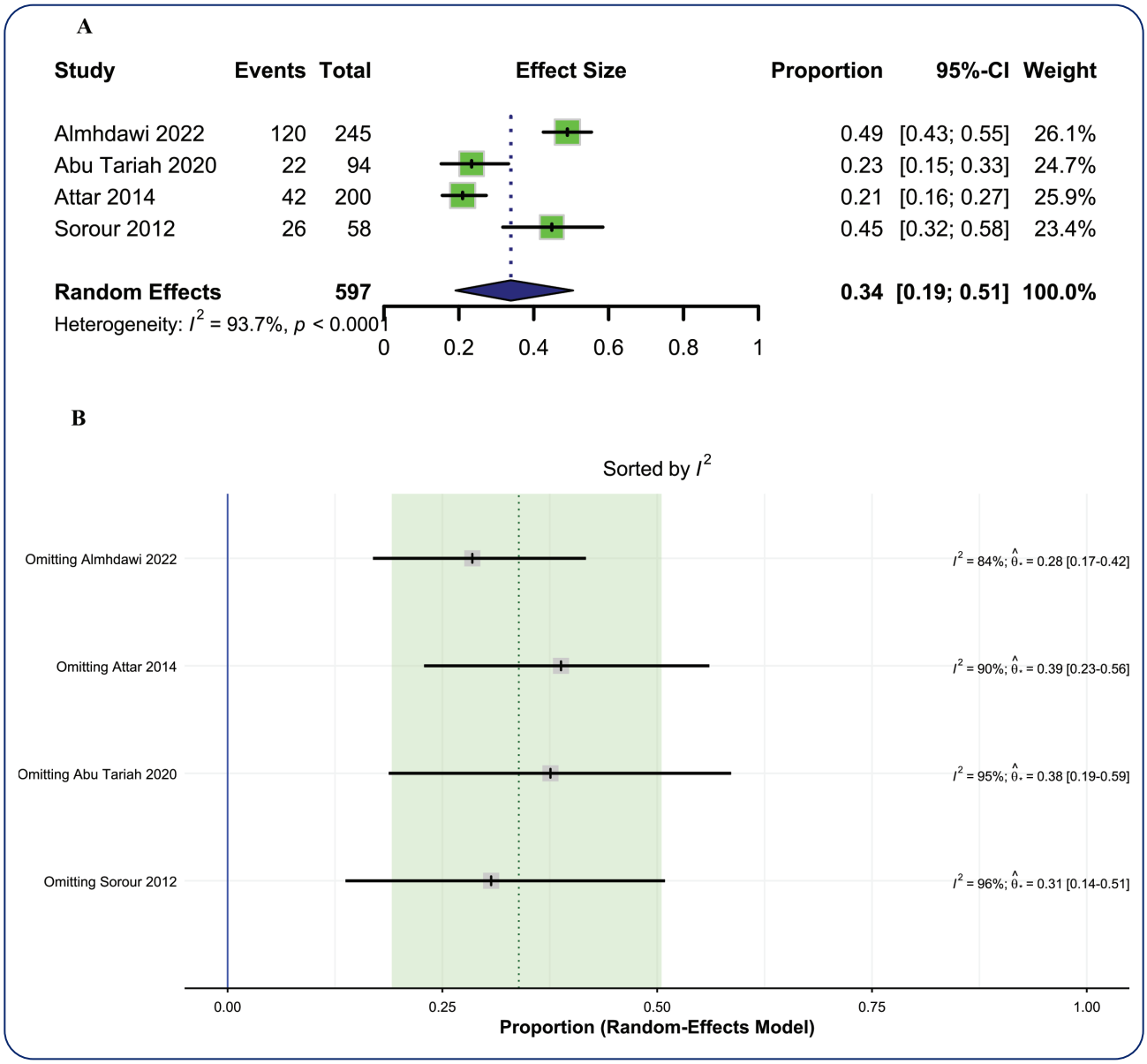

Figure 9. *(a) Prevalence of knee pain among nurses, (b) leave-one-out analysis.*

differences across Arab countries—such as norms around family involvement in patient care or resource limitations in conflict-affected areas—may also contribute to variability. Moreover, methodological factors likely amplify heterogeneity: the primary studies used different sampling frames, questionnaires, recall periods, and cutoffs for pain, making direct comparisons imperfect. In short, the very high I^2 values signal that pooled prevalence estimates must be interpreted in context, acknowledging that local infrastructure and work practices significantly modulate risk.

Compared to global benchmarks, these Arab-region prevalence are strikingly high but follow known patterns. Internationally, low back pain is almost always the most prevalent musculoskeletal complaint among nurses, and our results are consistent with that trend—indeed our pooled LBP (69%) exceeds the global nursing average. A recent worldwide meta-analysis of nurses reported an overall work-related MSK disorder prevalence of 81%, with lower back (58.5%), neck (45.9%), and shoulder (40.9%) as the top regions [31]. Our data likewise show LBP as highest and shoulder among the highest. The somewhat higher shoulder and ankle/foot rates in our sample may reflect regional specificities: many Arab hospitals still rely heavily on manual patient transfers due to limited availability of mechanical hoists or lifts, which disproportionately stress the shoulders and lower limbs. Cultural expectations may play a role too (e.g., if family caregivers handle some lifting, nurses may still assume awkward postures). By contrast, nurses in high-income countries often report more moderate

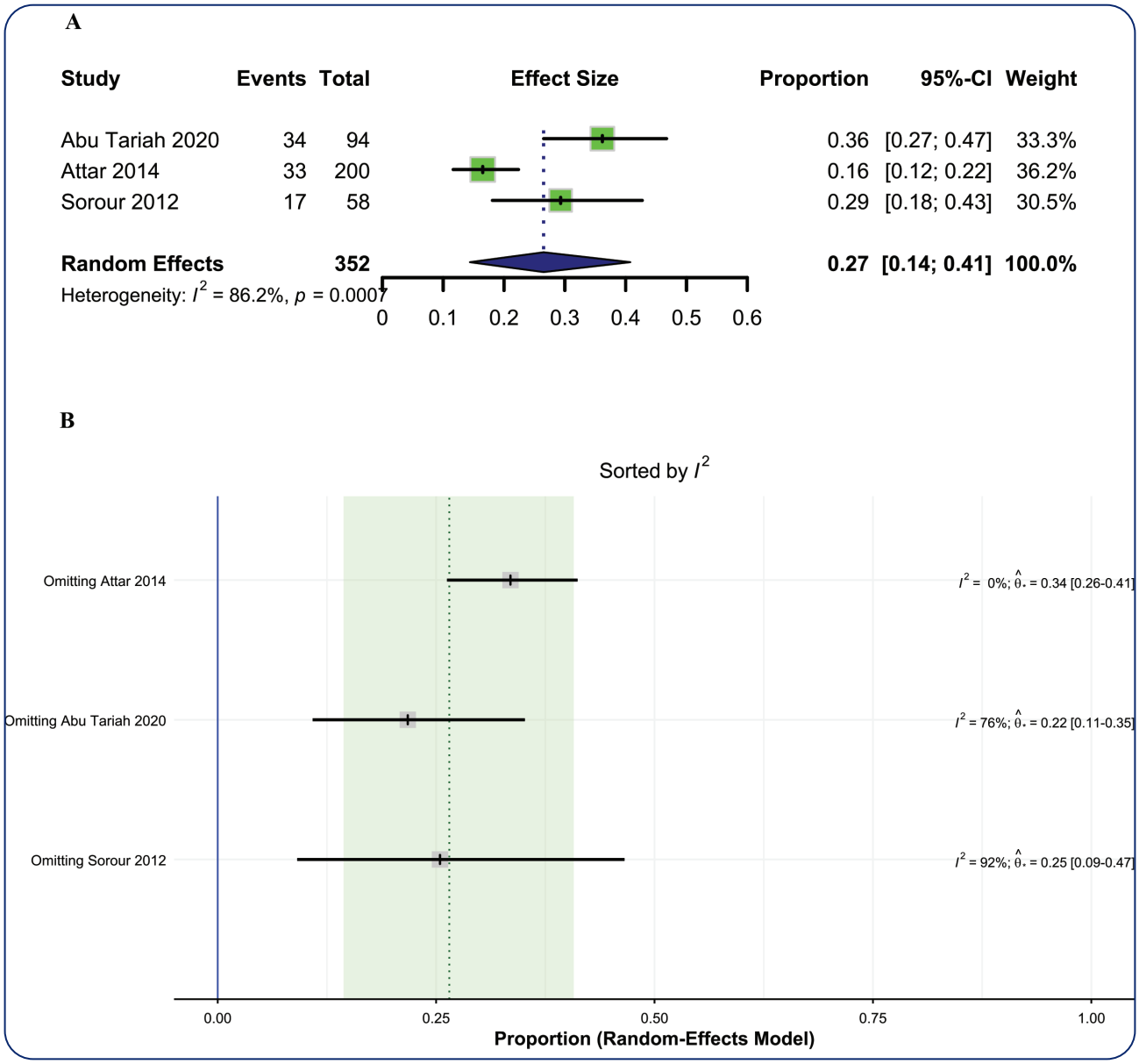

Figure 10. *(a) Prevalence of hips, thighs, and buttocks pain among nurses, (b) leave-one-out analysis.*

shoulder rates, possibly due to stricter safe-lifting policies.

This review has several strengths. It provides the first comprehensive synthesis of nursing MSK pain in the Arab region, covering multiple Arab countries and yielding detailed, site-specific prevalence estimates rather than focusing solely on low back pain. The systematic approach—including extensive database searches, strict inclusion criteria, and dual-review processes—enhances validity, and the anatomy-specific breakdown offers granular insight for policy. We also rigorously assessed heterogeneity and risk of bias (e.g., sensitivity analyses and LFK index for publication bias), which bolsters confidence in the robustness of core findings.

Limitations should be noted. All included studies were cross-sectional surveys, which precludes causal inference; we cannot determine whether, for example, ergonomic interventions would reduce pain or whether high pain levels reflect unmeasured confounding. Moreover, the high between-study heterogeneity discussed above further indicates that pooled estimates have wide uncertainty. The geographical distribution of the evidence was also uneven, with half of the included studies conducted in Saudi Arabia and only eight Arab countries represented, limiting the generalizability of the pooled estimates to the wider Arab region. Furthermore, publication bias cannot be entirely ruled out despite our efforts, since studies with very low pain prevalence may be underreported. These issues underscore that our aggregated prevalence

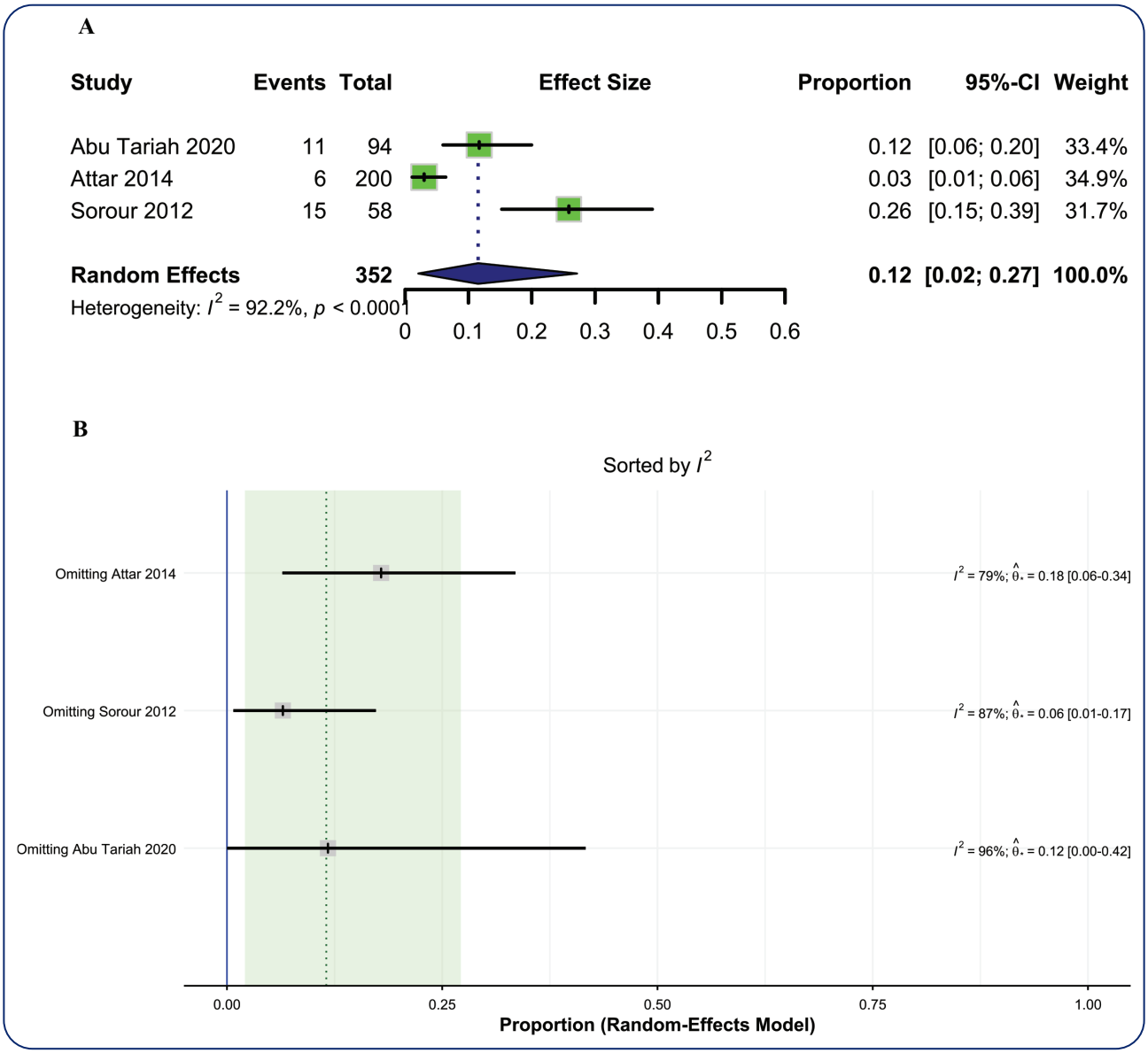

Figure 11. *(a) Prevalence of elbow pain among nurses, (b) leave-one-out analysis.*

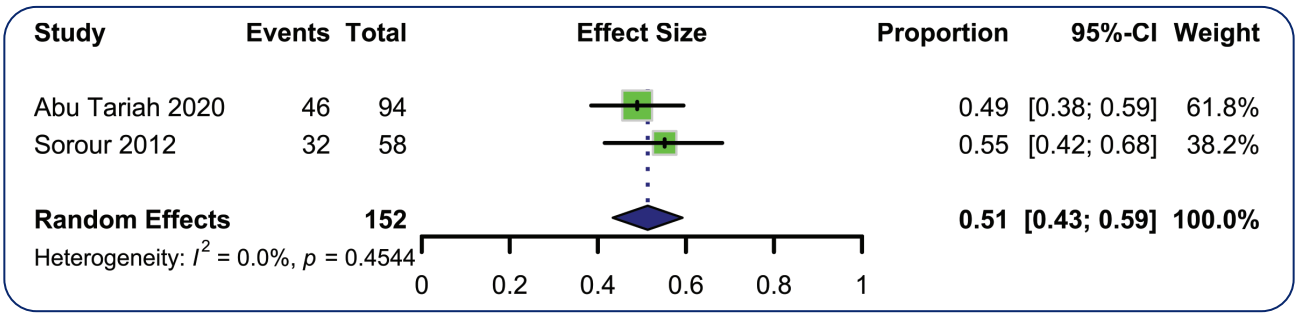

Figure 12. *Prevalence of upper back pain among nurses.*

figures should be interpreted as approximations of the available evidence and highlight the need for cautious interpretation and further research from underrepresented Arab countries.

The implications of our findings are clear for both practice and research. Clinically and institutionally, there is an urgent need for ergonomic and occupational health interventions. Hospitals in the region should adopt mandatory safe-handling protocols—for example, providing and enforcing use of mechanical lifts and transfer devices, which Occupational Safety and Health Administration and other agencies recommend to reduce caregiver injury. Nurse work schedules should limit continuous hours and ensure adequate rest breaks, in line with evidence that long shifts and overtime drive fatigue and pain. Formal ergonomic training (lifting techniques, posture) should be routine for all nursing staff. Additionally, interventions to alleviate psychosocial stress—such as stress-management programs, staffing support, and avenues to report workload issues—may help mitigate MSK symptoms. Each of these measures has the potential to disrupt the cycle of pain and disability in nursing.

Future research should address the important gaps in the current evidence base. Longitudinal studies in the Arab region would help characterize the temporal relationship between occupational exposures and the development of musculoskeletal symptoms. Future cross-sectional studies should follow rigorous reporting standards, such as Strengthening the Reporting of Observational Studies in Epidemiology (STROBE), and provide clear information on sampling methods, response rates, and sample size justification. Greater standardization of MSP definitions and assessment tools, together with stratification by nursing department or specialty where appropriate, may improve comparability across studies and reduce methodological heterogeneity. Well-designed intervention studies are also needed to evaluate the effectiveness of potential preventive strategies, including ergonomic interventions and safe patient-handling programs.

Conclusion

This systematic review and meta-analysis found a substantial burden of MSP among nurses in the Arab countries represented by the available evidence, with particularly high reported prevalence of low back and upper back pain. However, the pooled estimates should be interpreted cautiously given the substantial between-study heterogeneity, uneven geographical representation, and predominantly fair methodological quality of the included studies. The findings suggest that MSP is associated with a range of occupational and individual factors, although the cross-sectional nature of the available evidence precludes causal inference. Further research using longitudinal designs, standardized outcome definitions, and broader geographical representation is needed to better characterize the burden of musculoskeletal pain and inform the development and evaluation of regionally appropriate preventive strategies.

List of Abbreviations

CI	Confidence Interval
HRQoL	Health-Related Quality of Life
LBP	Low Back Pain
LFK	Luis Furuya–Kanamori Index
MSDs	Musculoskeletal Disorders
MSP	Musculoskeletal Pain
NA	Not Applicable
NHLBI	National Heart, Lung, and Blood Institute
NR	Not Reported
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
WMSDs	Work-Related Musculoskeletal Disorders
YLDs	Years Lived with Disability

Conflict of interest

The authors declare that they have no competing interests.

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Consent for publication

Not applicable.

Consent to participate

Not applicable.

Ethical approval

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

Availability of data and materials

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.

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