

# BMJ Open Prevalence of musculoskeletal disorders among garment workers: a systematic review and meta-analysis

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## ABSTRACT

**Background** Garment workers are at high risk of musculoskeletal disorders (MSDs) due to repetitive physical tasks, long working hours and varying workstations. As there is no existing epidemiological overview of MSDs among garment workers, this systematic review aimed to evaluate the global evidence on prevalence of MSDs in this population.

**Methods** A systematic review of the literature was conducted in accordance with Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines. Medline, Cumulative Index to Nursing and Allied Health Literature, PubMed, Scopus and Web of Science electronic databases were searched to identify studies published in English up to November 2022. Random-effects meta-analysis was used to estimate pooled prevalence.

**Results** The search yielded 258 published studies, of which 14 were deemed relevant and were included in this review. The included studies reported prevalence from India (n=3), Bangladesh (n=2), Ethiopia (n=2), Thailand (n=2), Botswana (n=1), Iran (n=1), Sri Lanka (n=1), Cambodia (n=1) and Denmark (n=1) and involved 15 029 garment workers. Most of the included studies (79%) were assessed to be methodologically sound (low risk of bias). The mean age of participants ranged from 24.2 to 40 years. The prevalence of MSDs ranged from 15.5% to 92%. The pooled prevalence of MSDs from nine studies was 65.6% (95% CI 44.5% to 51.9%). Low back pain and neck pain were reported as the common MSDs in the included studies.

**Conclusions** The findings highlight the considerable risk of MSDs, especially low back and neck pain, linked to repetitive tasks, extended hours and inconsistent workstations. Given the heavy toll of MSDs on this workforce, targeted interventions and ergonomic improvements are crucial to mitigate the risks and improve garment workers' well-being.

## INTRODUCTION

Work-related musculoskeletal disorders (WRMSDs) refer to disabling injuries to the muscles, tendons or nerves caused by work activities.<sup>1</sup> WRMSDs are the leading cause of work absence, indicating that the management of risks related to musculoskeletal (MSK) disorders in the workforce may not be adequate.<sup>2</sup> According to the Global Burden of Disease study, MSK conditions are the

## STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ To our knowledge, this is the first systematic review summarising the prevalence of musculoskeletal disorders (MSDs) among garment workers.
- ⇒ We extracted prevalence data from 14 studies conducted across 9 different countries.
- ⇒ The current study used methodology that is clearly outlined, allowing for replication and transparency in the selection and analysis of data.
- ⇒ The use of varied questionnaires across the included studies to assess MSDs may lead to inconsistencies in measurement, limiting the generalisability of the results.

second-highest contributor (20%–33%) to global disability among those affected by such conditions.<sup>3</sup> Among working-age individuals, MSK disorders are one of the most common causes of years lived with disability).<sup>4</sup> Common risk factors for WRMSDs include awkward postures, prolonged static work, repetitive movements, manual material handling, forceful exertions and vibration.<sup>5 6</sup> Major psychosocial factors, such as job dissatisfaction, work-related stress and time pressure, also play a significant role in the development of WRMSDs.<sup>7</sup> Individuals affected by WRMSDs face a risk of losing income, which can lead to an increased risk of poverty.<sup>8</sup> On average, 4% of the total gross national product across all countries is lost annually due to compensation, medical expenses, lost productivity and insurance costs related to work-related diseases and injuries.<sup>9</sup>

Workers in the garment industry are highly susceptible to WRMSDs,<sup>10</sup> with factors such as perceived physical and psychological demands contributing to their development, as shown in a study on weaving operations.<sup>11</sup> This sector, which is labour-intensive and highly competitive globally, is crucial for economies, particularly in countries like India, where it is the second-largest industry, contributing significantly to gross domestic product, exports and employment,

**Table 1** Overview of all studies included in systematic review

Study author	Country	Study design	Data source	Sample size	Male (n)	Age range (mean)	Type of MSDs/ exposure	Risk of bias
Zelee et al <sup>20</sup>	Ethiopia	Cross-sectional	Clinics (integrated textile factories)	7992	40%	40 years, 10 (18–69)	Not reported	Low
Sealetsa and Thatcher <sup>28</sup>	Botswana	A modified Corlett and Bishop body map questionnaire and the NASA TLX	Questionnaire	157	0%	32.25 years (SD=7.00)	Lower back, upper back and midback, shoulders, neck, and legs.	Moderate
Pal et al <sup>14</sup>	India	Cross-sectional study	Face-to-face interview	222	70.22%	36–55 (42.34%)	Not reported	Low
Kebede Deyyas and Tafese <sup>21</sup>	Ethiopia	Cross-sectional study	Face-to-face interview	422	12.30%	26.9 (SD=7.2)	Elbow and wrist musculoskeletal disorders	Low
Shazzad et al <sup>24</sup>	Bangladesh	Cross-sectional study	Questionnaire	350	17.10%	N/A	Shoulder, lower back, neck and knee	Low
Hossain et al <sup>25</sup>	Bangladesh	Cross-sectional study	A structured questionnaire	232	19%	31.3 years (SD=7)	Lower back pain, neck pain, knee pain	Low
Chavalitsakulchai and Shahnava <sup>26</sup>	Thailand	Survey	Interviews based on Standardised Nordic Questionnaires	400	12%	24.2 years (SD=5)	Neck, upper back, lower back, and knees, ankles/feet, shoulders, elbows, hips/thighs	Moderate
Veisi et al <sup>29</sup>	Iran	Cross-sectional study	The Nordic Musculoskeletal Questionnaire	586	41.90%	Age range 16–72 years, 35.7 years (SD=11.8)	Shoulders, wrists and arms, elbows, hand	Low
Lombardo et al <sup>30</sup>	Sri Lanka	Cross-sectional study	Questionnaire	1058	0%	27.8 years±7.3	Back pain, knees, shoulders, hand and wrist, neck, and forearm and elbow.	Low
Van et al <sup>31</sup>	Cambodia	Cross-sectional descriptive study	Face-to-face interviews and direct observation	702	10.70%	27.3 years (SD=7.45)	Neck, shoulder, upper back, lower back	Low
Andersen and Gaardboe <sup>32</sup>	Denmark	Cross-sectional study	Questionnaires	424		37.3 years (SD=8.8)	Neck pain, shoulder pain, elbow pain, forearm and/or wrist pain, hand and/or finger pain	Low

Continued

Table 1 Continued

Study author	Country	Study design	Data source	Sample size	Male (n)	Age range (mean)	Type of MSDs/ exposure	Risk of bias
Mokhasi <sup>22</sup>	India	Prospective observational study	The Nordic questionnaire:	430	0%	29.36 years±6.96	Neck pain, shoulder, elbow, wrist, upper back, lower back, foot/ ankle, knees.	Moderate
Homsombat and Chaiklieng <sup>27</sup>	Thailand	Cross-sectional study	The Standardise Nordic Questionnaire	1674	0%	Ranged between 30 and 60 years old	Low back, neck pain, elbow	Low
Ravichandran et al <sup>23</sup>	India (Tamil Nadu)	Cross sectional study	The Standardise Nordic Questionnaire	380	60.80%	30.53	Neck pain, knee and low back pain	Low
MSDs, musculoskeletal disorders; NASA TLX, The National Aeronautics and Space Administration's (NASA) Task Load Index (TLX).								

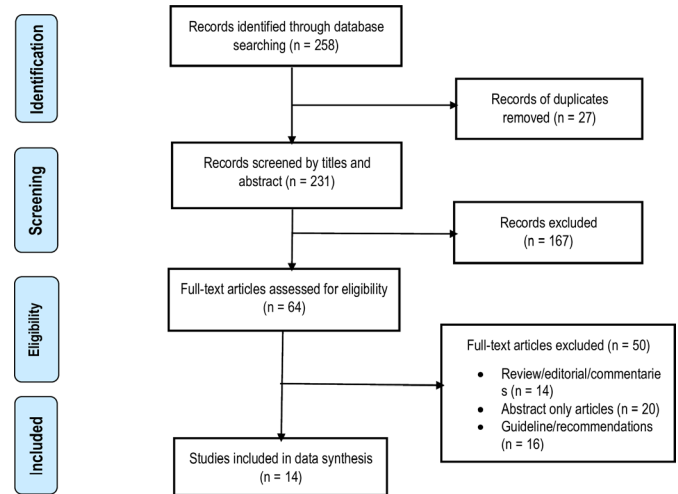


Figure 1 Flow diagram of publications included and excluded in the review.

including for millions of women and rural workers.<sup>12–14</sup> In Bangladesh, the garment sector accounts for 84% of exports,<sup>15</sup> while countries such as India and Cambodia employ millions of people in this industry,<sup>14</sup> with the garment sector representing a significant portion of the labour force.<sup>14</sup> The industry has also seen rapid growth in nations like Brazil, China, India and Vietnam, where the workforce has expanded substantially.<sup>16</sup>

Understanding the potential risk factors for WRMSDs is essential for quality improvement and reducing the incidence of these disorders among garment workers. Numerous studies have explored the prevalence of MSK disorders in this population. Consequently, we conducted a systematic review of studies reporting the prevalence of MSK disorders across various countries and time periods, with the goal of providing updated insights into the prevalence of these conditions among garment workers. We aggregated prevalence estimates from different regions and countries and analysed the prevalence of MSK disorders.

## METHODS

The study was designed as a systematic review and meta-analysis of published literature on the prevalence of MSK disorders among garment workers. It was performed and reported following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses checklist for systematic reviews of intervention.<sup>17</sup> A protocol for this systematic review was prospectively registered on PROSPERO and can be found at [https://www.crd.york.ac.uk/PROSPERO/display\\_CRD42022368808](https://www.crd.york.ac.uk/PROSPERO/display_CRD42022368808).

## Search strategy

The authors conducted a search of several databases, including Ovid MEDLINE, CINAHL, PubMed, Scopus and Web of Science, for studies published from their inception up to 30 November 2022, that reported on the prevalence of MSDs among garment workers. The search

terms included combinations of keywords such as musculoskeletal conditions, MSDs, tailor, seamstress, garment worker, designer, pattern cutter, prevalence and epidemiology (online supplemental appendix 1). These terms were linked using conjunctions like “AND” and “OR.” The search was limited to articles published in English. Additionally, the authors reviewed all relevant references and related systematic reviews from various regions.

### Inclusion and exclusion criteria

Studies were deemed eligible for inclusion if they met the following criteria: the population studied consisted of garment workers (aged 18 years and older), and the focus was on musculoskeletal (MSK) disorders related to garment fit. The review included all studies published in English, irrespective of study design, publication status or publication date. We excluded reviews, editorials, conference papers, case reports or series and animal studies. Three independent reviewers (TG, PA and MCE) initially assessed the titles and abstracts, followed by the full texts of the studies to determine if they met the inclusion criteria. In cases of disagreement, the final decision was made by a fourth reviewer (FF).

### Study selection and assessment of methodological quality

After removing duplicates, one reviewer (TG) screened all titles, abstracts and full-text articles, while a sample of these was checked by a second reviewer (PA and MCE). Any discrepancies were resolved through discussion and consensus with a fourth reviewer (FF). The full texts of the identified studies were then assessed against the inclusion and exclusion criteria.

The risk of bias in the included studies was evaluated using a previously developed risk of bias tool.<sup>18</sup> This assessment tool includes 10 items that address both external and internal validity (online supplemental appendix 2). Each study's overall risk of bias was classified as low, moderate or high. Studies receiving 9 or 10 ‘yes’ answers were considered to have a low risk of bias; those with 7 or 8 ‘yes’ answers were considered to have a moderate risk of bias, and studies with 6 or fewer ‘yes’ answers were considered to have a high risk of bias.

### Data extraction and analysis

The data were extracted into a standardised Excel spreadsheet, which included study variables such as the first author's name, year of publication, country, study design, data source, sample size, sex, age range (mean), response rate, types of MSDs, overall prevalence, prevalence in males and prevalence in females. All data were double-checked by other researchers to ensure accuracy.

A descriptive and statistical analysis of the extracted results was conducted. The prevalence for each study was calculated using Comprehensive Meta-analysis software (Biostat, New Jersey, USA), V.3 for Windows. Pooled prevalence estimates and 95% CIs were computed using a random-effects meta-analysis model, which is robust and appropriate when there is significant heterogeneity

in prevalence across studies.<sup>19</sup> The prevalence of MSDs among garment workers and the total number of patients in each study population were used as variables. Weighted events were reported with 95% CIs, and heterogeneity was assessed using  $I^2$  values.

### Patient and public involvement

Patients and the general public were not involved in this study.

## RESULTS

### Identification and description of studies

The literature search identified 258 citations (CINHAL and MEDLINE=62, PubMed=102, Scopus=24, Web of Science=70). After removing 27 duplicates, 167 studies were excluded following title and abstract screening. A total of 64 studies were deemed potentially relevant and underwent full-text evaluation. Ultimately, 14 articles met the inclusion criteria and provided prevalence data on MSDs among garment workers. Of these 14 studies, 11 were assessed as having a low risk of bias, while the remaining 3 were classified as having a moderate risk of bias (table 1). The flow chart illustrating the literature selection process is presented in figure 1.

### Characteristics of the included studies

A total of 14 studies reporting data on the prevalence of MSDs among garment workers were included (table 1). These studies enrolled 15 029 participants, with sample sizes ranging from 157 to 7992 individuals. The mean age of participants varied from 24.2 to 40 years. The studies encompassed a broad range of demographic characteristics and were published between 1993 and 2022. The studies were conducted in Ethiopia,<sup>20 21</sup> India,<sup>14 22 23</sup> Bangladesh,<sup>24 25</sup> Thailand,<sup>26 27</sup> Botswana,<sup>28</sup> Iran,<sup>29</sup> Sri Lanka,<sup>30</sup> Cambodia<sup>31</sup> and Denmark.<sup>32</sup> One study employed a prospective observational method,<sup>22</sup> while the others used a cross-sectional design.

### Prevalence

The prevalence of MSDs among garment workers ranged from 15.5% to 92% (table 2). Sri Lanka reported the highest prevalence, while Cambodia had the lowest. Two studies<sup>25 29</sup> found that the proportion of females with MSDs was higher than that of males. For instance, one study reported that the prevalence of MSDs in females was approximately 10% higher than in males.<sup>29</sup> In the random effects meta-analysis ( $n=9$ ), the pooled prevalence of MSDs was 0.656 (95% CI 0.445 to 0.819) (figure 2).

## DISCUSSION

The present study aimed to consolidate evidence on the prevalence of MSKs among garment workers. The findings revealed a high prevalence of MSK disorders, ranging from 15.5% to 92%. The studies included in the analysis provided prevalence data from Ethiopia, India, Bangladesh, Thailand, Botswana, Iran, Sri Lanka, Cambodia and

Denmark. Overall, the studies were assessed to have a low risk of bias.

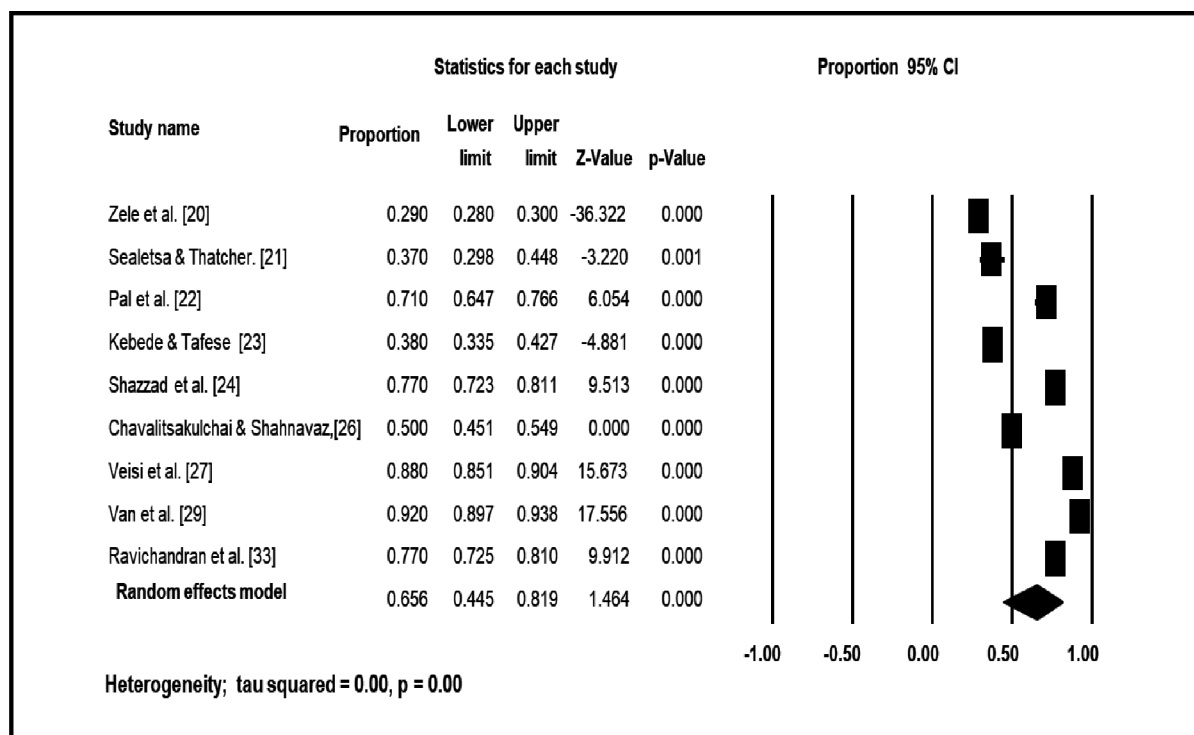
Consistent with our study, a review of health issues among garment factory workers identified MSDs as one of the major health concerns.<sup>33</sup> MSK problems were the most prevalent among all the conditions examined, with a prevalence of 78.89%. Additionally, the mean 12-month prevalence of work-related MSDs in Europe's secondary industries was found to be high, with back pain (60%), neck pain (51%) and shoulder pain (50%) reported.<sup>34</sup> Overall, the results suggest that factory workers, particularly those in garment factories, are highly exposed to MSK problems, which are the most common health issues among them.

Evidence shows that 60% of women working as sewing machine operators suffer from back pain.<sup>35</sup> A study conducted among ready-made garment workers in Bangladesh revealed that the 12-month prevalence of MSDs was highest in the lower back for women (24.7%), followed by the neck (23.7%) and knees (17.7%). For men, the highest prevalence of MSDs was in the neck (21.7%), followed by the knees (13%), lower back (13%) and upper back (10.9%).<sup>25</sup> A study investigating the 1-year prevalence of spinal pain and its consequences—such as pain, function, sick leave and healthcare use—found gender differences in sick leave patterns and healthcare utilisation. It also noted that a small proportion of individuals with pain used a significant amount of healthcare

**Table 2** Reported prevalence (%) of MSD among garment workers

Study author	Prevalence total (95% CI)	Prevalence in males (95% CI)	Prevalence in females (95% CI)
Zele <i>et al</i> <sup>20</sup>	29%	N/A	N/A
Sealetsa and Thatcher <sup>28</sup>	37%	N/A	N/A
Pal <i>et al</i> <sup>14</sup>	71%	N/A	N/A
Kebede Deyyas and Tafese <sup>21</sup>	Elbow (40%) Wrist (37.7%)	N/A	N/A
Shazzad <i>et al</i> <sup>24</sup>	77.1% (shoulder=17.9%, lower back=15.2%, neck=13.8%) and knee=10.8%).	N/A	N/A
Hossain <i>et al</i> <sup>25</sup>	N/A	Neck=21.7%, Knees=13%), Lower back=13%	Lower back=24.7%, Neck=23.7% and knees=17.7%
Chavalitsakulchai and Shahnava <sup>26</sup>	50%	N/A	N/A
Veisi <i>et al</i> <sup>29</sup>	87.7%	82.1%	91.60%
Lombardo <i>et al</i> <sup>30</sup>	15.5% (back pain=57.3%, knees=31.7%, shoulders=9.1%, hand and wrist=7.3%, neck=6.7%, and forearm and elbow=3.0%).	N/A	N/A
Van <i>et al</i> <sup>31</sup>	92% (95% CI=90.0% to 94.0%)	N/A	N/A
Andersen and Gaardboe <sup>32</sup>	Neck pain=26.6%, shoulder pain=25.2% and elbow pain=4.5%	N/A	N/A
Mokhasi <sup>22</sup>	Lower back (70%), followed by the upper back (40%)	N/A	N/A
Homsombat and Chaiklieng <sup>27</sup>	Without severity: lower back=41.75%, shoulders=41.21%, neck=41.10% and elbows=40.80% Considering severity: low backs=61.47%, neck=61.23% and thigh=58.06%	N/A	N/A
Ravichandran <i>et al</i> <sup>23</sup>	77.6% (neck=32.1%, knee=28.7% and low back pain=26.6%)	N/A	N/A
N/A, not available.			





**Figure 2** Forest plot of prevalence of MSDs among garment workers. MSDs, musculoskeletal disorders.

resources.<sup>36</sup> One contributing factor may be that women often perform dual roles, such as childcare, which can lead to increased stress and psychological problems.<sup>33</sup>

Biomechanics plays a crucial role in the prevention and management of WRMSDs in the garment industry.<sup>37</sup> It is the scientific field that applies mechanical principles to biological systems.<sup>38</sup> MSDs are strongly associated with factors such as peak hand force, the percentage of time spent in forceful hand exertion and the rate of forceful hand repetitions.<sup>39</sup> Studies consistently indicate that repetitive movements are a key risk factor for shoulder pain.<sup>40</sup> Additionally, working in static postures for extended periods with minimal or no breaks has been identified as a significant cause of neck pain among garment workers.<sup>22 32</sup> Further evidence also shows that the incidence of WRMSDs increases with the age of workers.<sup>41</sup> Therefore, a deeper understanding of tissue tolerance under varying loading conditions, along with proper workstation design, may help reduce garment workers' vulnerability to MSDs.

This review has both strengths and potential limitations. A systematic and rigorous approach was used to identify relevant studies on the prevalence of MSDs among garment workers. However, the use of different questionnaires across the included studies to investigate MSDs may limit the generalisability of the results. Diagnosing MSDs in various settings and countries can be challenging due to the adoption of specific surgical procedures, and the prevalence data may be based on self-reported measures.<sup>42</sup> Additionally, since only English-language publications were reviewed, relevant literature in other languages may have been overlooked. Except for

two studies,<sup>25 29</sup> the results were not reported by gender. Despite these limitations, this is the first systematic review on this topic to provide a meta-analysis.

## CONCLUSIONS

MSDs are highly prevalent among garment workers, particularly affecting the low back and neck. This prevalence significantly impacts health service utilisation. Therefore, it is essential to gain insights and develop targeted programmes to prevent MSDs among garment workers. By effectively summarising the prevalence of MSDs, the findings from this study could play a key role in shaping decisions related to workstations and in addressing the physical challenges and risks faced by garment workers.

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