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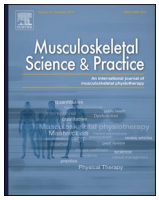

Systematic review

Prevalence of musculoskeletal disorders among hotel housekeepers and cleaners: A systematic review with meta-analysis

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ABSTRACT

Background: Musculoskeletal disorders (MSD) are among the most frequent and costly occupational health problems with a rising prevalence globally.
Objective: This systematic review with meta-analysis was conducted to know and evaluate the prevalence of MSD by anatomic location among hotel housekeepers (HHs) and cleaners.
Methods: Electronic searches were conducted in PubMed, Web of Science, Scopus, Dialnet Plus, PEDro and Cochrane Database for Systematic Reviews using a search strategy to identify cross-sectional studies reporting on the prevalence of MSD in HHs or cleaners. The risk of bias was assessed with Joanna Briggs Institute tool for systematic reviews. A random-effects model was used in the meta-analysis.
Results: Nineteen studies were included in the systematic review, nine of them in the meta-analysis (n = 2299). The study sample sizes ranged from 24 to 1043 participants. The Standardized Nordic Musculoskeletal Questionnaire was the most common tool used to assess MSD among both HHs and cleaners (9/19 of the included studies). The three most affected anatomic locations were the low back 53.9% (95% CI: 43.3–64.6), shoulders 41.4% (95% CI: 27.1–55.8), and wrists/hands 40.1% (95% CI: 24.5–55.7).
Conclusions: HHs and cleaners have a high prevalence of MSD. Low back pain is the most prevalent MSD among both HHs and cleaners affecting up to one of two people.

1. Introduction

Musculoskeletal disorders (MSD) are defined as impairments of bodily structures such as muscles, joints, tendons, ligaments, nerves, cartilage, bones, and the localised blood circulation system (European Agency for Safety and Health at Work [EU-OSHA], 2007). The most common form of these impairments is work-related MSD - caused or aggravated primarily by work and by the effects of the immediate environment in which work is carried out- (European Agency for Safety and Health at Work [EU-OSHA], 2007).

MSD are a public health problem that affect approximately 1.71 billion people worldwide, and they are the leading contributor to disability (Cieza et al., 2021). Due to different factors, the number of people living with MSD and its associated functional limitations is rapidly increasing in recent years (World Health Organization [WHO], 2022). MSD are usually characterised by pain (persistent in most cases) and limitations of mobility and ability, resulting in less productivity, increased disability, and an economic burden on health systems (Hoy et al., 2010; United States Bone and Joint Initiative. TE, 2014).

International agencies, such as the European Agency for Safety and

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Health at Work (EU-OSHA), have identified several work risk factors for MSD, including physical and biomechanical, organisational and psychosocial, and individual risk factors (European Agency for Safety and Health at Work [EU-OSHA], 2007). Similarly, in the specific context of HHs, the risk factors identified are physical, chemical, biological and psychosocial factors (Hsieh et al., 2013). Most studies evaluate physical and organizational hazards and their consequences. Some of this physical and biomechanical risk factors are repetitive work (Fontani et al., 2010; Krause et al., 2005; Abdol Rahman and Muhamad Jaffar, 2017), use of excessive force when lifting/moving weights and awkward postures (Bernhardt et al., 2006; Instituto Canario de Seguridad Laboral, 2016; Instituto Valenciano de Seguridad y Salud en el Trabajo (INVASSAT), 2018; Krause et al., 2005; Abdol Rahman and Muhamad Jaffar, 2017), manual loading of objects (Fontani et al., 2010), standing during long periods, elevation of the upper limbs, and insufficient breaks (Lee et al., 2013; Montross, 2012). While, organisational risk factors include work overload (Faulkner and Patiar, 1997), time pressure (Hsieh et al., 2016; Lee and Krause, 2002) and work intensification (Brun, 2009; Hsieh et al., 2017; Oxenbridge and Moensted, 2016).

According to the World Health Organization (WHO), musculoskeletal pain is the main global burden of morbidity derived from work activity (Marilyn et al., 2006), which is also the most described symptom in HHs (Hsieh et al., 2013) and cleaners (Zock, 2005). These specific labour populations have working conditions and traits that turn them into a vulnerable workforce. The most reported anatomic locations affected by musculoskeletal pain among HHs and cleaners are the lumbar anatomic location (Jiménez Fernández et al., 2010; Krause et al., 2005; Abdol Rahman and Muhamad Jaffar, 2017; Abdol Rahman et al., 2017; Montross, 2012; Oxenbridge and Moensted, 2016), cervical anatomic location (Krause et al., 2005; Abdol Rahman and Muhamad Jaffar, 2017), shoulders, hands, wrists, and knees (Abdol Rahman and Muhamad Jaffar, 2017). Previous large studies reported that HHs have a 47% prevalence of severe bodily pain in general (Krause et al., 2005).

HHs and cleaners have common characteristics: they perform similar tasks (e.g., cleaning common areas, hallways, carrying cleaning products), have similar risk factors, both are highly feminised groups and perform unskilled and low-paid jobs. Moreover, as advocated by EU-OSHA, cleaners are better defined by tasks than by sectors or groups (European Agency for Safety and Health at Work [EU-OSHA], 2008). For all the aforementioned reasons we aim to perform a systematic review addressing MSD among both HHs and cleaners.

The most recent narrative reviews available among these population date back to 2005 (Zock, 2005) and 2013 (Hsieh et al., 2013, 2014). These reviews predominantly focused on occupational hazards and health-related issues, yet they did not provide specific prevalence data regarding MSD. Given that there are not systematic reviews available among HHs and cleaners, and previous reviews identified this population have several risks factors to develop MSD, we conducted this systematic review with the aim of evaluate the pooled prevalence of MSD among hotel housekeepers and cleaners. Additionally, we performed a meta-analysis to estimate the overall prevalence of MSD and the prevalence by anatomic locations.

2. Methods

The protocol for the review was made following the PRISMA guidelines (Page et al., 2021) and was prospectively registered in the International Prospective Register of Systematic Reviews (PROSPERO) database (CRD42022321589). Although we wanted to include interventions to reduce the prevalence of musculoskeletal disorders in the protocol, this idea was finally discarded as the number of prevalence articles was higher than expected. Furthermore, due to the lack of previous systematic reviews we searched from the inception even though the search was originally planned since 2012.

2.1. Data search and sources

The search was performed in the databases of PubMed, Web of Science, Scopus, Dialnet Plus, PEDro and Cochrane Database for Systematic Reviews. The search terms were "*hotel housekeeper*", "*hotel cleaner*", "*clean* service*", "*hotel maid*", "*maid*" and "*camareras de piso*", "*health*", "*musculoskeletal disorder**" and "*pain*". The terms "*medical assistance in dying*", "*medical aid in dying*" and "*diabetes*" were purposely excluded due to its recurrent appearance in the search results although not being related to the aim of the study. The reference lists of the selected studies were reviewed to identify potential studies which met the inclusion criteria. The search strategy is exposed in detail in the supplementary material 1.

2.2. Study selection

We included cross-sectional studies that provide information about the prevalence of MSD in HHs or cleaners. Other study designs such as reviews, case-control studies, case reports and case series, commentaries, conference abstracts, qualitative designs, and clinical trials were excluded.

Two authors (C.S.-R. and L.C.-M.) independently screened all the articles by title and abstract. The full text of the selected studies was analysed for eligibility following the inclusion and exclusion criteria. The discrepancies were discussed later to reach an agreement.

2.3. Data extraction and coding study characteristics

A standardized data extraction form was used to extract the characteristics of the selected studies. The information extracted from the studies were: first author, year of publication, country, study design, sample size (% female), age (SD), population, tools for measuring the MSD outcome, other outcomes including physical activity, working conditions, psychosocial factors, job satisfaction, ergonomic risk assessment from each study. Given the wide range of secondary outcomes in the selected studies some of them were compiled under the same category -e.g., psychosocial factors-. All the outcomes were assessed by the participants of the studies.

2.4. Risk of bias assessment

The risk of bias assessment of the selected studies was performed by two assessors independently (C.S.-R. and L.C.-M.). No training to reviewers was done before starting the systematic review. The *Joanna Briggs Institute* (JBI) Critical Appraisal Checklist tool (Moola et al., 2020) was used for assessing the risk of bias in cross-sectional studies following the recommendations of (Migliavaca et al., 2020). The tool consists of structured framework for evaluating the quality, validity, and relevance of research articles using an eight-item checklist with three possible options: yes, no, or unclear. The first two authors independently assessed the risk of bias of the selected studies. As the JBI tool establishes (Moola et al., 2020), authors can decide a scoring system to determine whether a study is of good, moderate, or poor quality. The studies were classified as poor quality with 0–3 items successfully answered, as moderate quality with 4–6, and good quality with 7–8. More specifically, studies were excluded if less than four quality questions were assigned a "YES" label. *(see supplementary material 2)*.

2.5. Data analyses

A random-effects model was used for the meta-analysis using STATA (StataCorp. 2019. Stata Statistical Software: Release 16. College Station, TX: StataCorp LLC). For each anatomic location summary prevalence data and pooled prevalence value with 95% CI displayed (on forest plots) were generated in STATA. In some cases, missing data was calculated (e.g., percentages). Subgroup analyses were performed to

show the prevalence of pain in the three most prevalent anatomic locations (Supplementary material 3). In order to evaluate heterogeneity between estimates, I^2 statistics measures the percentage of variance not due to sampling error across studies and high heterogeneity is indicated by an I^2 score above 75% (Huedo-Medina et al., 2006).

The certainty of evidence was rated using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach (Guyatt et al., 2008) by two assessors independently (X-X and X–Y). This approach requires five domains to be considered: 1) risk of bias, based on JBI due to the inclusion of prevalence studies in this systematic review (Moola et al., 2020); 2) inconsistency, referring to the heterogeneity between studies (based on the I^2 statistic) (Guyatt et al., 2011c; Huedo-Medina et al., 2006); 3) indirectness, whether the available evidence directly and completely answers the questions posed by the review (Guyatt et al., 2011b), 4) imprecision, based on the width of the 95% confidence interval around the pooled estimate (Guyatt et al., 2011a; Iorio et al., 2015) and, 5) publication bias (Guyatt et al., 2011d). The quality of the body of evidence decreases if serious or very serious issues related to these five domains are present.

For the first four domains, the overall confidence in each review finding is rated as "not serious", "serious" or "very serious". For publication bias, the rating is "not detected" or "strongly suspect". The GRADE rating may be downgraded one level for "serious" or "strongly suspect" concerns or two levels for "very serious" concerns. Finally, the overall certainty of evidence is designated as high, moderate, low, or very low (Guyatt et al., 2008; Iorio et al., 2015).

3. Results

3.1. Study selection

The screening process of the systematic review is detailed in Fig. 1. Of a total 615 studies identified in the six selected databases, 17 studies were eligible for full-text analysis after reviewing titles and abstracts. In the full text assessment, 12 studies were included and five were excluded for different reasons which were as follows: one for wrong outcome (Fernández Suárez, 2017), one from wrong population (Bonini-Rocha et al., 2021), one study could not be retrieved (Mammen, 2022) and two for poor quality (Real-Pérez et al., 2011; Silva-Júnior et al., 2012) as they had a score less than four points in the JBI Critical Appraisal Checklist tool. Additionally, we identified seven studies from references of included studies.

At data extraction level we found two separate articles (Wami et al., 2019a; Wami et al., 2019b) that sounds to be referred to the same data study, so we decided to include them as only one study in the meta-analysis. Further we excluded one study (Lee et al., 2013) from the meta-analysis due to non-standardised use of the NMQ questionnaire.

Finally, we included 19 studies (Burgel et al., 2010; Gawde, 2018; Jiménez Fernández et al., 2010; Krause et al., 2005; Laithaisong et al., 2021; Lee et al., 2013; Luz et al., 2017; Marconato et al., 2017; Melese et al., 2020; Abdol Rahman and Muhamad Jaffar, 2017; Premji and Krause, 2010; Raji and Abidin, 2020; Sánchez-Rodríguez et al., 2022; Scherzer et al., 2005; Shapoval et al., 2022; Sotrate Gonçalves and De Oliveira Sato, 2020; Wami et al., 2019a; Wami et al., 2019b; Wang et al., 2019) in the systematic review, nine of them in the meta-analysis (Laithaisong et al., 2021; Melese et al., 2020; Abdol Rahman and Muhamad Jaffar, 2017; Raji and Abidin, 2020; Sánchez-Rodríguez et al., 2022; Sotrate Gonçalves and De Oliveira Sato, 2020; Wami et al., 2019a; Wami et al., 2019b; Wang et al., 2019).

3.2. Study characteristics

Most of the studies included (14/19) were among HHs (Burgel et al., 2010; Gawde, 2018; Jiménez Fernández et al., 2010; Krause et al., 2005; Lee et al., 2013; Marconato et al., 2017; Abdol Rahman and Muhamad Jaffar, 2017; Premji and Krause, 2010; Raji and Abidin, 2020; Sánchez-Rodríguez et al., 2022; Scherzer et al., 2005; Shapoval et al., 2022; Wami et al., 2019a; Wami et al., 2019b) but it should be noted that

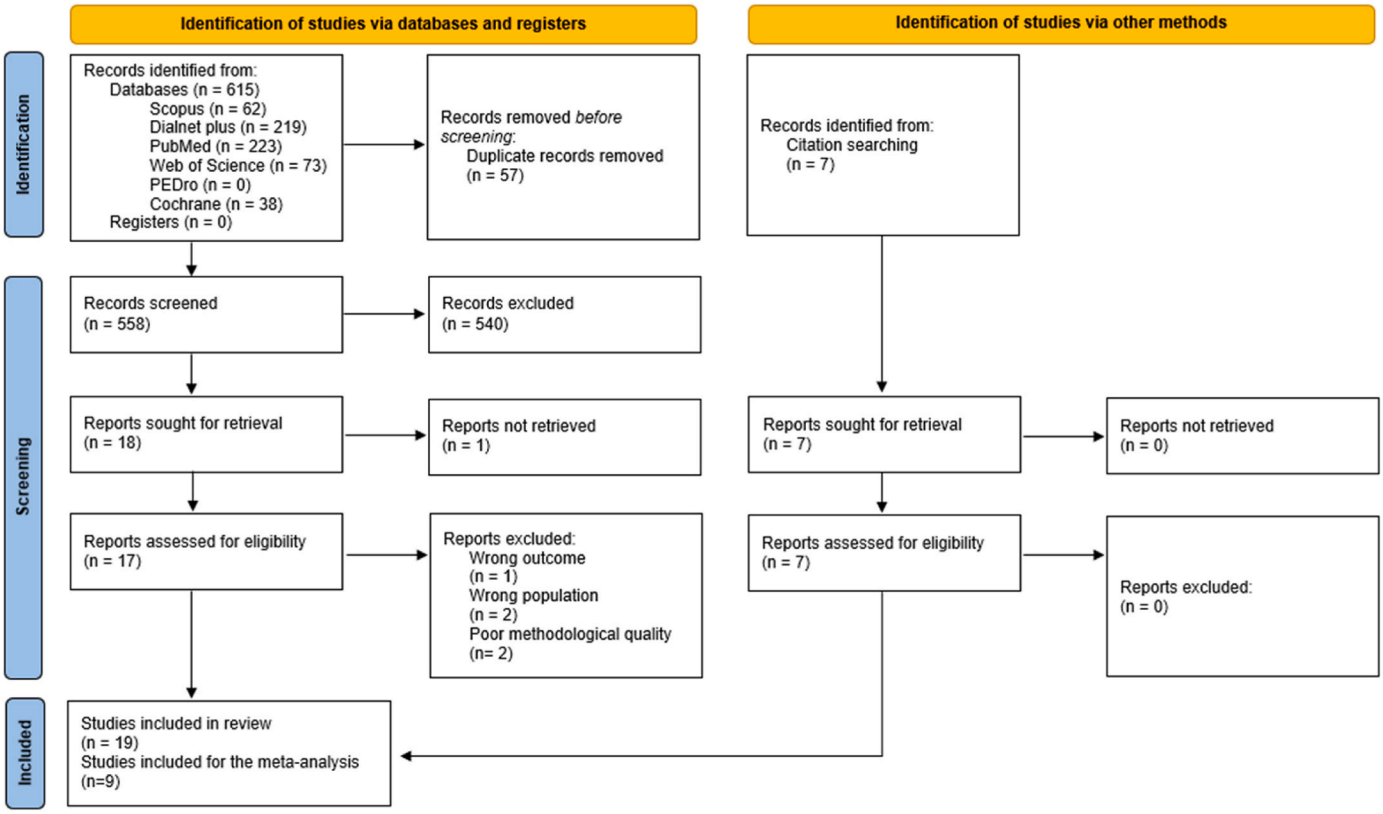

Fig. 1. Flow diagram to illustrate the process by which articles were selected for inclusion in the systematic review (Page et al., 2021).

four of them referred to the same study (Krause et al., 2005). Although the range of countries was wide, most of the studies were performed in Global South regions (Gawde, 2018; Laithaisong et al., 2021; Luz et al., 2017; Melese et al., 2020; Abdol Rahman and Muhamad Jaffar, 2017; Raji and Abidin, 2020; Sotrate Gonçalves and De Oliveira Sato, 2020; Wami et al., 2019a; Wami et al., 2019b; Wang et al., 2019). The characteristics of the included studies are reported in Table 1.

The sample size of the studies ranged from 24 to 1043 participants. The total sample size of the included studies for the meta-analysis was 2299 participants, from which 1544 (67.16%) were HHs and 755 were cleaners.

3.3. Risk of bias

The risk of bias of the studies was assessed with the JBI tool, which is shown in Table 2. The overall risk of bias was medium-low in all included studies. The most common bias was on the confounding factors, followed by the inclusion/exclusion criteria and measurement of the exposure in a reliable way.

3.4. Outcome measures

Nine studies measured MSD using the Nordic Standardised Questionnaire for Musculoskeletal Symptoms in the working population (NMQ) as the main outcome (Laithaisong et al., 2021; Lee et al., 2013; Abdol Rahman and Muhamad Jaffar, 2017; Raji and Abidin, 2020; Sánchez-Rodríguez et al., 2022; Sotrate Gonçalves and De Oliveira Sato, 2020; Wami et al., 2019a; Wami et al., 2019b; Wang et al., 2019). The NMQ was developed to identify musculoskeletal problems in different parts of the body, with questions about the presence of symptoms (pain, tingling and numbness) in the past 12 months and seven days, functional limitation at home and work and consultation with a health professional due to these symptoms. This questionnaire may be either self-administered or used in interviews. Not all the studies used the NMQ in the same way; some focused on the symptoms reported exclusively in the last 12 months (Lee et al., 2013; Melese et al., 2020; Raji and Abidin, 2020; Wami et al., 2019a; Wami et al., 2019b) or both last 12 months and last 7 days (Laithaisong et al., 2021; Abdol Rahman and Muhamad Jaffar, 2017; Sánchez-Rodríguez et al., 2022; Sotrate Gonçalves and De Oliveira Sato, 2020; Wang et al., 2019). Despite the NMQ being designed initially to collect MSD using dichotomous answers (Kuorinka et al., 1987), some studies added frequencies (Sánchez-Rodríguez et al., 2022).

Other tools used for measuring MSD were Visual Analogic Scale (VAS) (Luz et al., 2017), SF-36 (Krause et al., 2005), and ad hoc questionnaires (Burgel et al., 2010; Gawde, 2018; Scherzer et al., 2005; Shapoval et al., 2022). Therefore, pooled analyses were conducted for MSD measured only by the NMQ.

Regarding secondary outcomes, working conditions were the most frequent analysis, followed by physical activity and psychosocial factors. Other secondary outcomes were knowledge about occupational risk prevention measures (Jiménez Fernández et al., 2010; Sánchez-Rodríguez et al., 2022), perceived health (Gawde, 2018; Sánchez-Rodríguez et al., 2022), ergonomic risk assessment (Abdol Rahman and Muhamad Jaffar, 2017; Raji and Abidin, 2020; Wang et al., 2019), anthropometrics (Burgel et al., 2010; Gawde, 2018; Krause et al., 2005; Sotrate Gonçalves and De Oliveira Sato, 2020), lifestyle (Burgel et al., 2010; Krause et al., 2005; Marconato et al., 2017; Melese et al., 2020; Shapoval et al., 2022), and blood pressure (Sotrate Gonçalves and De Oliveira Sato, 2020).

3.5. Pooled analyses

Finally, we included nine studies for the meta-analysis. The most affected anatomic locations were the low back 53.9% (95% CI: 43.3–64.6), shoulders 41.4% (95% CI: 27.1–55.8), and wrist/hand 40.1% (95% CI: 24.5–55.7). The prevalence of the remaining anatomic locations in descending order were neck 33.7% (95% CI: 16.2–51.1), knee 32.9% (95% CI: 22.8–43), upper back 32.3% (95% CI: 18.2–46.3), ankle/feet 25.6% (95% CI: 12.8–38.3), elbow 25.1% (95% CI: 14–36.3) and, hip/tight 19.9% (95% CI: 9.7–30).

The forest plot of pooled estimates for the most prevalent anatomic location is shown in Fig. 2. The other anatomic locations can be found in Supplementary material 4. Heterogeneity analysis (I^2) is shown in every anatomic location figure.

The certainty of the evidence was analysed for every anatomic location (i.e., low back, shoulder, wrist/hands, neck, elbow, upper back, hip/tight, knee and, ankle/feet). The certainty of the evidence was considered "very low" for all the outcomes (Supplementary Material 5). Specifically, the certainty of evidence was downgraded due to serious concerns in the risk of bias domain (equivalent as medium-low in JBI). For inconsistency, very serious concerns were found (I^2>75%). No serious concerns related to directness and imprecision were found. Likewise, no publication bias was detected.

4. Discussion

This systematic review with meta-analysis was conducted in order to know the actual evidence regarding prevalence of MSD among HHs and cleaners. No MSD prevalence was established in previous literature among HHs (Hsieh et al., 2013, 2014) or cleaners (Zock, 2005). We argued that combining HHs and cleaners as the same population is necessary as they share similar tasks and risk factors (European Agency for Safety and Health at Work [EU-OSHA], 2008).

Despite HHs and cleaners being two of the largest workforces in different sectors, little is known about their health. The findings of the current review revealed that low back pain is the most prevalent MSD among both HHs and cleaners affecting up to one of two people. This finding is in line with previous literature among other manual workers such as physiotherapists (Pellissier et al., 2023). Furthermore, the latest WHO's report, which estimates that 570 million people have been affected by low back pain, making this condition the leading cause of pain worldwide (Cieza et al., 2021). Despite the results, several studies highlight the underreporting of MSD in this group (Jiménez Fernández et al., 2010; Niño López, 2002; Scherzer et al., 2005), so that the prevalence could be higher. Previous reviews concluded that HHs are exposed to a multitude of work-induced hazards, resulting in adverse physical, ergonomic, chemical, biological and psychosocial afflictions, and conditions (Hsieh et al., 2013, 2014).

Inclusion and exclusion criteria were one of the main issues regarding risk of bias compromising also external validity in the included studies. Future studies need to define the inclusion criteria in more detail to improve the research quality. Some recommendations are to specify whether people with sick leave are included or not, and to include these workers in order to minimise the health worker effect (Chowdhury et al., 2017) so, the prevalence would be more accurate.

Most of the included studies used the NMQ as the main tool to assess MSD but with great variability. The main differences were on using the questionnaire with frequencies instead of the original dichotomous answers (Kuorinka et al., 1987), and not using the original anatomic locations and reporting only the prevalence of some anatomic locations. To develop comprehensive approach that allows optimal data collection and standardization including NMQ questionnaire and to report all the anatomic locations would be useful to provide comparable outcomes and reach better understanding and meta-analysis in the future. Additionally, we propose to register more data on pain (e.g., the Spanish version of NMQ, including VAS (Martínez and Alvarado Muñoz, 2017)), and to report additional analysis (e.g., total prevalence of pain and number of people without pain). As this information is not currently being reported, it is not possible to provide a total prevalence of pain among HHs and/or cleaners. Furthermore, although physical examination and assessment are more expensive and time consuming than questionnaires, more accurate results might be obtained by these

Table 1
Study characteristics': Work-related Musculoskeletal Disorders; NMQ: Nordic Standardized Questionnaire for Musculoskeletal Symptoms in the working population; VAS: Visual Analogue Scale; *: Data of the housekeeping department from a larger sample size of hotel workers or employees.

First author, year	Country	Design	Sample size (% female)	Age (SD)	Population	WMSD/pain outcome (tool)	Other outcomes				
							Physical activity	Working conditions	Psychosocial factors	Job satisfaction	Ergonomic risk assessment
Shapoval et al. (2022)	USA	Cross-sectional	140 (92)	–	Hotel housekeepers	WMSD (ad hoc questionnaire)		✔	✔		
Sánchez-Rodríguez C. et al. (2022)	Spain	Cross-sectional	1043 (100)	43.3 (10.1)	Hotel housekeepers	WMSD (NMQ)	✔	✔	✔		
Laithaisong et al. (2021)	Thailand	Cross-sectional	331 (82.2)	39 (–)	Cleaners in a teaching hospital	WMSD (NMQ)		✔	✔		
Melese et al. (2020)	Ethiopia	Cross-sectional	264 (100)	21.9 (5.6)	Cleaners at a university	WMSD (NMQ)	✔	✔	✔	✔	
Raji and Abidin (2020)	Malaysia	Cross-sectional	40 (52.5)	32.8 (11.2)	Hotel housekeepers	WMSD (NMQ)	✔	✔			✔
Sotrate Gonçalves and De Oliveira Sato (2020)	Brazil	Cross-sectional	45 (100)	–	Cleaners of a higher education institution	WMSD (NMQ)	✔		✔	✔	
Wang et al. (2019)	Taiwan	Cross-sectional	115 (100)	57.4 (3.9)	School cleaners	WMSD (NMQ)					✔
Wami et al. (2019a)	Ethiopia	Cross-sectional	422 (91.9)	26.7 (4.9)	Hotel housekeepers	WMSD (NMQ)	✔	✔		✔	
Wami et al. (2019b)	Ethiopia	Cross-sectional	422 (91.9)	26.7 (4.9)	Hotel housekeepers	WMSD (NMQ)	✔	✔		✔	
Gawde (2018)	India	Cross-sectional	204* (–)	–	Hotel housekeepers	Musculoskeletal pain (ad hoc questionnaire)		✔	✔		
Luz et al. (2017)	Brazil	Cross-sectional	157 (87.9)	–	Hospital cleaning workers	Musculoskeletal pain (VAS)		✔			
Abdol Rahman and Muhamad Jaffar (2017)	Malaysia	Cross-sectional	45 (40)	29.9 (8.4)	Hotel housekeepers	WMSD (NMQ)		✔			✔
Marconato et al. (2017)	Brazil	Cross-sectional	157 (87.9)	39.9 (9.8)	Hospital housekeepers	Musculoskeletal pain (VAS)		✔	✔		
Lee et al. (2013)	Korea	Cross-sectional	53* (55.7)	–	Hotel housekeepers	WMSD (NMQ)	✔	✔			
Premji and Krause (2010)	USA	Cross-sectional	941 (99)	–	Hotel room cleaners	Work-related pain (ad hoc questionnaire)		✔			
Burgel et al. (2010)	USA	Cross-sectional	493 (97.8)	41.2 (9.7)	Hotel room cleaners	Musculoskeletal pain (ad hoc questionnaire)		✔	✔		
Jiménez Fernández et al. (2010)	Spain	Cross-sectional	368 (100)	40.1 (8.5)	Hotel housekeepers	WMSD (health records)					
Krause et al. (2005)	USA	Cross-sectional	941 (99)	41.7 (9.6)	Hotel room cleaners	Musculoskeletal pain (SF-36)		✔	✔		✔
Scherzer et al. (2005)	USA	Cross-sectional	941 (99)	41.7 (–)	Hotel room cleaners	Work-related pain (ad hoc questionnaire)		✔	✔		

Table 2
Risk of bias assessment. Q1: Were the criteria for the inclusion in the sample clearly defined? Q2: Were the study subjects and the setting described in detail? Q3: Was the exposure measured in a valid and reliable way? Q4: Were objective, standard criteria used for measurement of the condition? Q5: Were confounding factors identified? Q6: Were strategies to deal with confounding factors stated? Q7: Were the outcomes measured in a valid and reliable way? Q8: Was appropriate statistical analysis used? Y: Yes; N: No; U: Unclear.

Author; year	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Total
Shapoval et al. (2022)	Y	Y	Y	Y	N	U	N	U	4/8
Sánchez-Rodríguez et al. (2022)	Y	Y	Y	Y	N	Y	Y	Y	7/8
Laithaisong et al. (2021)	Y	Y	Y	Y	Y	Y	Y	Y	8/8
Melese et al. (2020)	Y	Y	Y	Y	Y	Y	Y	Y	8/8
Raji and Abidin (2020)	Y	Y	Y	Y	N	N	Y	Y	6/8
Sotrate Gonçalves and De Oliveira Sato (2020)	Y	Y	Y	Y	Y	Y	Y	Y	8/8
Wang et al. (2019)	U	N	Y	Y	N	Y	Y	Y	5/8
Wami et al. (2019a)	Y	Y	Y	Y	Y	Y	Y	Y	8/8
Wami et al. (2019b)	Y	Y	Y	Y	Y	Y	Y	Y	8/8
Luz et al. (2017)	N	Y	Y	Y	Y	Y	Y	Y	7/8
Gawde (2018)	Y	U	U	Y	Y	Y	N	Y	5/8
Abdol Rahman et al., 2017	Y	N	Y	Y	N	N	Y	N	4/8
Marconato et al. (2017)	Y	Y	Y	Y	Y	Y	Y	Y	8/8
Lee et al. (2013)	N	N	N	Y	N	Y	Y	Y	4/8
Jiménez Fernández et al. (2010)	Y	Y	N	Y	N	N	N	Y	4/8
Burgel et al. (2010)	N	Y	Y	Y	N	Y	N	Y	5/8
Premji and Krause (2010)	Y	Y	Y	Y	N	N	N	Y	5/8
Krause et al. (2005)	N	N	Y	Y	Y	Y	Y	Y	6/8
Scherzer et al. (2005)	Y	Y	Y	Y	N	N	N	U	4/8

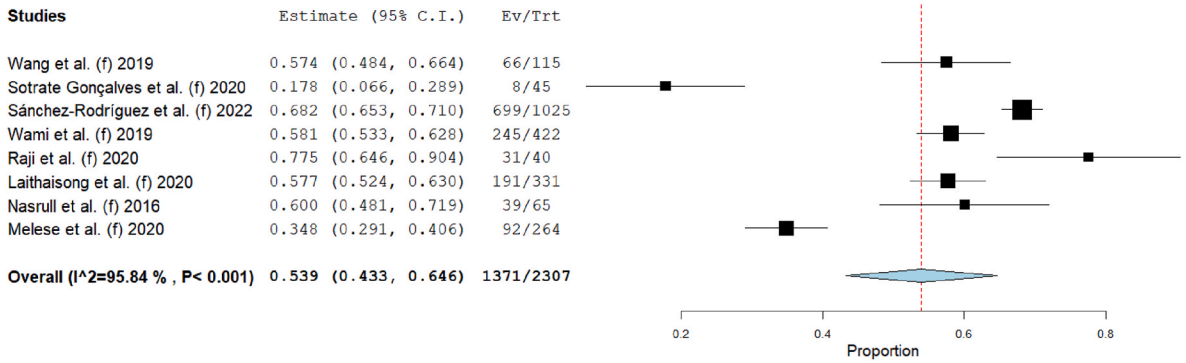

Fig. 2. Forest plot of pooled estimates for low back pain prevalence.

methods, especially because certain participant's bias are avoided (e.g., memory bias). Combining both methods -questionnaires and physical examination-may allow clinicians and researchers to achieve a better assessment.

Only two studies analysed chronic pain in HHs or cleaners (Gawde, 2018; Sánchez-Rodríguez et al., 2022). The criteria for stablishing chronic pain was different between the studies; one asked for pain for two weeks in the last six months (Gawde, 2018), the other for self-report of chronic pain (Sánchez-Rodríguez et al., 2022). Future research aiming to determine a uniform diagnosis for chronic pain is needed, as reported in a recent review addressing general population's pain prevalence (Andrews et al., 2018).

Regarding physical risk factors, the most reported work-related factors were repetitive work, use of excessive force when lifting/moving weights and awkward postures, manual loading of objects, standing during long periods, elevation of the upper limbs, and insufficient breaks. Assessing the physical burden of cleaners, and more specifically HHs, is a difficult task because each workplace has different work characteristics depending on different settings (e.g., type of rooms, number of outgoing rooms per day, type of beds, cleaning tools used, etc.). Even though there is no perfect instrument or tool to measure all dimensions of physical risks (Burdorf and van der Beek, 1999; Abdol Rahman and Abd Razak, 2016), their assessment is important since MSD are the most common work-related diseases (Cieza et al., 2021; European Agency for Safety and Health at Work [EU-OSHA], 2019) and, according to the EU-OSHA, preventable (European Agency for Safety and Health at Work [EU-OSHA], 2008).

Regarding lifestyle related risk factors, it should be essential to collect these data from the study population because of their close relationship with MSD. Some of these variables are physical activity, diet, and smoking (European Agency for Safety and Health at Work [EU-OSHA], 2019). In this sense, physical activity is one of key factors to prevent MSD (European Agency for Safety and Health at Work [EU-OSHA], 2019) but we found that only one study (Sánchez-Rodríguez et al., 2022) collected physical activity data through a validated questionnaire. Although some studies collected information on smoking, responses were dichotomous. Due to the lack of data, we have not been able to draw conclusions on these variables. To know these data may help to further understand the implication of lifestyle-related risk factors on MSD among these workers.

Surprisingly, as shown in the meta-analysis, the prevalence of MSD among the included studies is similar between enriched and impoverished regions (Global North/South) despite the assumption of better working conditions, occupational risk prevention and workers training in enriched countries. We could not perform an analysis across types of economies due to a poor representation of enriched countries. This makes it difficult to extrapolate the data worldwide.

Finally, as pointed out in a recent scoping review (Adams et al., 2020), and according to our results, interventions to improve the working conditions and ergonomics, and to promote workers' health, especially culturally tailored ones, are urgently needed.

4.1. Strengths and limitations

The main strength of this study is the choice of the study population, which makes it the first systematic review among both HHs and cleaners, as well as the first systematic review focusing on MSD. Secondly, we only included studies in peer-review journals, guarantying the quality of the results. Moreover, our meta-analysis gives a first approach of the cumulative prevalence of MSD in HHs and cleaners. Additionally, we performed a risk of bias assessment to exclude highly biased studies.

On the other hand, the review has some limitations. Firstly, the poor representation of HHs and cleaners from enriched countries does not allow to extrapolate our findings on such regions. Secondly, our meta-analysis showed heterogeneity in the results, so they should be taken with caution.

5. Conclusions

This systematic review suggests that HHs and cleaners have a high prevalence of musculoskeletal disorders. The three most affected anatomic locations were low back, shoulders, and wrist/hand. These findings highlight the need to focus on MSD's prevention and to carry out interventions to reduce the current prevalence among this population. Future studies should focus on reporting more accurately MSD's prevalence -e.g., definition of chronicity, assessment of risk factors, better use of the NMQ questionnaire-to reduce the heterogeneity of results. This could lead to more appropriate prevention measures and a better overview of the phenomenon.

Declaration of competing interest

None.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.msksp.2023.102890.

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