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A systematic review of the association between job insecurity and work-related musculoskeletal disorders

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Abstract

A number of studies analyze the link between the presence of psychosocial risk factors and work-related musculoskeletal disorders. The increase in job insecurity (JI) has resulted in a growing focus on its likely role as a risk factor within occupational health. Accordingly, the aim of this research was to carry out a systematic review of studies that include JI among the relevant risk factors, specifically drawing data from this variable to observe the significance of its association with musculoskeletal disorders (MSDs). For this purpose, a literature search was carried out: from a sample of 859 studies found and 23 were selected after applying the eligibility criteria. Fifteen studies (65.2% of the selection) presented statistically significant results regarding the link between JI and MSDs: the upper limbs and back were the body areas most affected by this association. In sum, JI should be considered a potential precursor of MSDs. Therefore, further study on this psychosocial risk and its association with these types of pathologies is necessary.

KEYWORDS

musculoskeletal diseases, occupational health, pain, psychological, social

1 | INTRODUCTION

Musculoskeletal disorders (MSDs) are defined as a wide range of inflammatory and degenerative conditions that affect muscles, tendons, ligaments, joints, peripheral nerves, and supporting structures, such as intervertebral discs (Punnett & Wegman, 2004); when caused or exacerbated by work activity, these conditions are called work-related musculoskeletal disorders (WRMSDs). According to the International Labor Organization, nearly 160 million cases of work-related diseases are reported worldwide annually: MSDs are the second most common disease and a leading cause of sickness absence in developed countries (Tavakkol et al., 2020).

WRMSDs have a high economic impact in terms of direct (economic compensation, treatments, etc.) and indirect (lower productivity, disruption of teams, etc.) costs. The *Sixth European Working Conditions Survey* (Wilczynska et al., 2017) revealed that around three out of five workers in the EU reported to have suffered from MSDs in the past 12 months. In 2015, more than half of the workers with MSDs (53%) said they had missed work during the preceding year. These workers are not only more likely to miss work but also, on average, are absent for a longer period of time than workers on sick leave due to other pathologies.

In the year 2020, the European Agency for Safety and Health at Work (EU-OSHA, 2020) issued a synthesis report on MSDs, summarizing the reports provided by ten member states. This report includes general data such as the higher prevalence of these pathologies among women, their increasing prevalence with age, and the decrease of these disorders with higher levels of education.

As for the most common body areas, back pain comes in first place (43%), followed by pain in the upper limbs (41%). MSDs in lower limbs are less frequent (29%). The prevalence of MSDs in different occupational sectors reveals significant differences across sectors: a higher prevalence rate is observed in workers from agriculture, forestry, and fishing (56%), followed by those in the construction sector (54%); MSDs prevalence is also above average in health and social workers (EU-OSHA, 2020).

WRMSDs have a multifactorial etiology. They have been traditionally associated with physical and ergonomic occupational risk factors, but the influence of psychosocial risk factors (PSRFs) on these pathologies has been studied for decades. PSRFs have been defined as those aspects of work design and the organization and management of work, together with their social and environmental context, which may have the potential to cause psychological or physical harm (Cox et al., 2000). Thus, occupational health experts agree that this field must turn its attention towards PSRFs to protect workers' health. In fact, when compared with the working conditions of 50–70 years ago, a significant increase of PRSFs can be clearly observed. The increasing impact of this type of risk has to do with new working conditions such as faster production, service and communication processes, increasing proportion of intellectual work, trend towards a service- and knowledge-based society, growing complexity of work-related demands, new technologies, and constant availability for work and job instability. Everything seems to be faster than before (Portuné, 2012). In short, even if in other periods there were many occupational risks that threatened the safety of workers and which have been reduced, today the challenge seems to be in preventing PSRFs. Although they may be described as "minor risks," perhaps due to the difficulty in quantifying them, it can be stated that their repercussions on health are not minor (Portuné, 2012).

The link between PSRFs and physical health has been analyzed since the early 1980s in light of different theoretical models. The "job strain model" (Karasek & Theorell, 1990) explains work stress as a balance between the psychological demands of the job and the worker's level of control over them: the higher the demands and the lower the control, the more likely the risk of stress and the effect on health (Singh et al., 2022). Then, social support from coworkers and supervisors is recommended as a resource that minimizes the risk (Sargent & Terry, 2000). Meanwhile, the "Effort–reward imbalance model" (Siegrist, 1996) suggests the "gratification crisis" as an aggravating circumstance: the greater the work effort and the lower the corresponding reward, the higher the health risk.

There are several studies that analyze the causes through which PSRFs have been associated with MSDs. The "biopsychosocial stress model" (Melin & Lundberg, 1997) argues that psychological stress is not only induced by demands that surpass the individual's resources, but also by opposite situations, such as monotonous and repetitive jobs: the lack of stimuli produces low job satisfaction and associated stress. This could be the reason why traditional biomechanical models do not explain that sometimes variations in physical effort do not result in MSDs. Lundberg et al. (1989) had previously carried out an experimental study in which they concluded that psychosocial factors such as low satisfaction and monotony in the workplace had a more significant influence on back symptomatology than bad posture and carrying weights. In a subsequent study, Lundberg et al. (1994) analyzed the relationship between perceived mental stress and muscular tension as reflected in the electromyographical activity of the trapezius muscle. Although the response was greater with the combination of physical load, the mental stress factors in isolation were capable of increasing tension in the trapezius muscle and in physiological responses (heart rate, blood pressure, catecholamines, and cortisol).

Among the various causes of MSDs, it has been observed that individuals at risk of developing them are characterized by a lack of unwinding and elevated physiological arousal. The mental load produced by PSRFs can lead to a "physiological vulnerability" of the muscles and a sensation of pain (Melin & Lundberg, 1997).

Hales and Bernard (1996) carried out a bibliographical review in which they analyzed the epidemiology of WRMSDs and their association with both physical and psychosocial workplace risk factors. They proposed three possible mechanisms that could link the presence of PSRFs and MSDs. First, psychological demands could exceed the individual's defense mechanisms and induce a stress response that might increase muscle tension; second, psychological demands could increase awareness of the symptomatology of MSDs and their attribution to the workplace context; third, in some working situations, psychological demands could be related to the increase in physical demands, which might also have an impact on symptoms.

Other studies and reviews show significant associations between PSRFs and MSDs (e.g., Ariëns, Bongers, et al., 2001; Ariëns, van Mechelen, et al., 2001; Ariëns et al., 2002; Bernard et al., 1997; Bongers et al., 1993; Candan et al., 2019; Côté et al., 2008; da Costa & Vieira, 2010; Hauke et al., 2011; Kamwendo et al., 1991; Osborne et al., 2012; Shannon et al., 2001; Theorell et al., 1991; Vie et al., 2012; Zeytinoğlu et al., 2000). The psychosocial risks most frequently associated with this symptomatology are high workload, low control, lack of social support, workplace tension, time pressure, and monotonous work, whereas the perceived stress variable usually acts as an intermediary in the process.

1.1 | Concept of perceived job insecurity (JI)

In 2008, the global economic crisis affected the job market; in this context, many companies had to make cutbacks, reducing the number of workers and reorganizing their internal structure to maintain the same level of efficiency and competitiveness. Among the measures adopted, different types of work contracts began to be used: temporary, via agency, freelance, zero-hours, and so forth. Measures taken for the reorganization of companies share a common trait: they make staff worry about their future. The resulting increase in precarity drew the attention of the scientific community to a PSRF labeled as "JI" (de Sio et al., 2018).

JI has been defined in several ways: the subjectively and undesirably perceived possibility of losing one's current job in the

future (de Witte, 2005), fear or concern about losing one's job (Vander Elst et al., 2014), or the "subjectively experienced anticipation" of the involuntary loss of one's job (Sverke et al., 2002).

Due to changes in the labor market, the JI construct has varied over time. In the 60s and the 70s it was rather the positive term, "job security," the one that was used, as it was seen as a motivating element which had to do with satisfaction with the employment situation. In the mid-80s, the nature of labor contracts and the increase of temporary employment led to an increase of job uncertainty, and "JI" started to be studied as an occupational stressor (Sverke et al., 2006).

Greenhalgh and Rosenblatt (1984) were the first to develop a theoretical model on this construct, defining it as "perceived powerlessness to maintain desired continuity in a threatened job situation" and establishing its potential causes and consequences. However, there are different conceptualizations of JI. Some authors distinguish between objective JI, associated with observable structural variables (e.g., cutbacks in the company) and subjective JI, based on the person's experience and on how one perceives the employment situation (de Witte & Näswall, 2003; Hartley et al., 1990). An objective employment situation (e.g., the employment contract) can be interpreted by workers in different ways: some may experience feelings of JI that are unfounded from an objective point of view, while others may feel that their job is secure even though they have a real chance of being dismissed. In the field of occupational health research, the subjective theoretical approach is most commonly used, considering JI as a subjectively experienced stressor (Sverke et al., 2006).

Borg and Elizur (1992) describe a cognitive (likelihood of job loss) and an affective (fear of job loss) dimension of JI, while Hellgren et al. (1999) define quantitative JI as concern about the loss of the job itself, and qualitative JI as concern about the loss of options or benefits (social, financial, etc.) that the job offers. Job loss is an immediate experience, while JI is a daily experience that involves ongoing uncertainty about the future (Sverke et al., 2002) and, therefore, it acts as a long-lasting stressor.

The determining factors of JI and its perception are many: country (social welfare policies, unemployment rate, etc.), type of contract (Kim et al., 2012), gender (Menéndez-Espina et al., 2019), age, educational level, or occupational group (Cheng & Chan, 2008). In the event of a job loss, all these factors trigger different resources to cope with the situation, and the magnitude of the fear and concern generated largely depends on them.

Different measurement procedures have been used in the assessment of subjective JI. Although single items are customarily used, multiple-indicator scales with broader content domains are considered better and more robust measures of this theoretical construct, because they show a higher degree of reliability (Sverke et al., 2006). Among these multidimensional approaches, the scale by Ashford et al. (1989) has given rise to different modified versions (Kinnunen et al., 1999; Mauno et al., 2001). Other scales, such as those by Borg and Elizur (1992) and by de Witte (2000) can be mentioned. Moreover, the JI construct has been usually measured with questionnaires created ad hoc (Sverke et al., 2002).

There are three theoretical models that explain the links between the presence of JI and its negative consequences for the health and well-being of workers. Jahoda's model suggests that the possibility of job loss threatens the satisfaction of the individual's needs and consequently leads to frustration (Jahoda, 1981). The psychological contract theory, on the other hand, proposes that JI is perceived by employees as a violation of the contract by the employer: that violation affects workers' well-being and their commitment to the organization (Cuyper & Witte, 2006). Meanwhile, the "vitamin model" (Probst & Brubaker, 2001) suggests that the well-being of workers deteriorates because of the feelings of unpredictability and uncontrollability caused by JI.

Exposure to JI has been associated with a wide range of mental disorders, such as depression, anxiety, or emotional exhaustion (Llosa et al., 2018), as well as with physical disorders, such as fatigue (Swaen et al., 2004; Vanroelen et al., 2009), common infections (Mohren et al., 2003), high levels of catecholamines and cortisol (Kalil et al., 2010; Näswall et al., 2012), or cardiovascular disease (Ferrie et al., 2013; Khubchandani & Price, 2017; László et al., 2013) among others. Also, worse self-perceived health has been linked to JI (Blázquez et al., 2021; Burgard et al., 2012; de Cuyper et al., 2010; Ferrie et al., 2005; Fornell et al., 2018; Ibrahim et al., 2009; Kalil et al., 2010; Kim et al., 2008, 2017; László et al., 2010; Näswall et al., 2012; Pförtner et al., 2019; Rugulies et al., 2008; Urbanaviciute et al., 2019; Virtanen et al., 2011; Waenerlund et al., 2011).

Research suggests that JI is a threat to health comparable to unemployment itself (Kim & von dem Knesebeck, 2015). Moreover, the impact of JI on health increases over time, that is to say, JI is revealed as a chronic stressor which, though seldom having an immediate effect, becomes more harmful as time passes.

In the relationship between JI and health, the most solid evidence points to normal causation: the presence of JI over time has an impact on psychological health and well-being (Llosa et al., 2018). However, there are some studies that have explored reverse and reciprocal causation: worse self-perceived health, depression or exhaustion produce an increase in the perception of JI, sometimes leading to a "cycle of losses" (de Witte et al., 2016; Urbanaviciute et al., 2019).

Despite the diversity of papers that analyze JI's influence on different effects on physical health, there are few specific studies on its correlation with MSDs (Lau & Knardahl, 2008; Zeytinoglu et al., 2009a). Most data collected in respect of this association are found in studies that include the JI variable together with other psychosocial risks by using questionnaires that include single-item measurements of this construct, or conversely, in studies that analyze the impact of JI on health and include MSDs along with many other variables (Nishikitani et al., 2012).

Lang et al. (2012) carried out a review with a meta-analysis of 50 longitudinal studies that analyzed the association between PSRFs and MSDs. They found that out of 23 PSRFs, 17 had significant associations with MSDs, including JI ($p < .01$ with low back pain), although the risk factor with the strongest association with all types of MSDs was "monotonous work."

Nevertheless, most studies and reviews examining the relationship between PSRFs and MSDs fail to collect data on exposure to JI (Acaröz Candan et al., 2019; Bernard et al., 1997; Bongers et al., 1993; da Costa & Vieira, 2010; Kamwendo et al., 1991; Osborne et al., 2012; Theorell et al., 1991; Vie et al., 2012; Zeytinoğlu et al., 2000). This shows that JI is still perceived as a minor psychosocial risk, whereas job demand, job control, or social support are much more widely measured in occupational health studies.

The aim of this systematic review was to gather, analyze, and synthesize into a careful summary all the available primary research on the association between PSRFs and MSDs, focusing specifically on the data produced by the JI variable, given that, so far, this variable has received little attention as a possible cause or aggravating factor of MSDs. Hopefully, the evidence presented may encourage future research to include JI among the psychosocial risks to be considered in studies of MSDs. In addition, those studies should use specific measures based on multidimensional scales.

2 | METHODS

This review was carried out following the Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols guidelines regarding the protocol, search process, selection, and synthesis of results (Cajal et al., 2020; Moher et al., 2009; Schonstein & Verbeek, 2006).

2.1 | Search strategy

The bibliographical search was carried out by two independent reviewers in the following databases: WOS, SCOPUS, PubMed, Science Direct, Cochrane Plus, PsycArticles, PsycInfo, SpringerLink, Research Databases, and DOAJ. Gray literature is not covered in this review. The keywords used were different combinations of "Psychosocial risk factors," "Job insecurity," "Job Content Questionnaire," and "Musculoskeletal disorders." Search strings for each database are provided (Supporting Information Document 1).

2.2 | Eligibility criteria

To define the eligibility criteria (population, phenomenon of interest, context, and study design), the population, intervention, comparators, outcomes, and study design strategy have been used (Tacconelli, 2010) (Table 1), as it is the most common technique within Health Sciences. "Intervention" is described as the exposure to different psychosocial risks including subjective JI. In the scientific literature, the term JI refers to the subjective operationalization unless stated otherwise. Objective JI is linked to contractual flexibility and predominantly driven by economic considerations (de Witte & Näswall, 2003).

TABLE 1 Characteristics of studies according to PICOS.

P	Active workers for pay aged 18 years or older
I	Exposure to different psychosocial risks including subjective job insecurity
C	No exposure to job insecurity
O	Statistical associations between job insecurity and musculoskeletal disorders
S	Analytical observational studies published from 2010 to 2020

Abbreviations: C, comparators; I, intervention; O, outcomes; P, population; S, study design.

The following inclusion criteria were chosen for the final selection of the articles:

- Analysis of the presence of WRMSDs associated with different PSRFs, among which the JI (or Insecurity at work, or job security) variable must be included.
  - Observational studies that provide descriptive and correlational statistical data.
  - Samples are composed of active workers aged 16 or older.
- Assessment of the JI and MSD variables was carried out with validated instruments.
- JI measurement is based on the subjective perception and not on objective measures (e.g., Contractual insecurity).
- Bibliographical reviews and meta-analyses are not included.
- Articles published in peer-reviewed journals from 2010 to 2020.

Regarding time range, the selection was limited to articles published from 2010 to 2020, because of the increased interest in the JI phenomenon during that decade. In the context of the great economic recession in 2008, psychosocial indicators have been proved to show a decrease of the quality of working conditions (Houdmont et al., 2012). The study by Torá et al. (2015) specifically addresses the prevalence of JI before and after the economic crisis and statistically observes a significant increase. This fact, together with a flexibility and destabilization of the labor market, has led to: first, a greater interest of the scientific community in JI; second, a relevant contextualization of this interest after the 2008 crisis, the clearest impact being observed in the scientific literature produced over the decade 2010–2020.

The search provided a total of 859 results: 17 in WOS, 33 in SCOPUS, 8 in PubMed, 154 in Science Direct, 7 in Cochrane Plus, 48 in PsycArticles, 7 in PsycInfo, 256 in SpringerLink, 251 in Research Databases, and 78 in DOAJ.

The titles and abstracts were screened independently by both reviewers, who used the collaborative resource Mendeley, so that any disagreement could be discussed until a consensus was reached. From the agreed search results, 834 articles were discarded due to being duplicates or not meeting one or more of the eligibility criteria after reading the title or abstract.

Twenty-five articles were selected to read the complete text, two of which were eliminated for not including statistical analyses

that could fit the objective of the study. Finally, 23 articles were chosen for the systematic review. Figure 1 shows the flow chart of the study selection process.

The authors obtained the following data by applying a standardized data extraction form to each study: first author, year, country, sample size, study design, type of JI measurement (specific multidimensional scale or number of items dedicated to the variable), other PSRFs measured, type of MSDs, prevalence of MSDs, and strength of association between exposure to JI and MSDs. Due to the heterogeneity of the studies regarding the measurements of the MSDs variable, it was not possible to combine the results in a meta-analysis. The results of this review were summarized in tables and analyzed to indicate the direction and significance of the associations observed.

2.3 | Quality assessment

The assessment of the methodological quality of the selected studies was carried out independently by the authors according to Joanna Briggs Institute Critical Appraisal Tools (Moola et al., 2020, Chap. 7). This versatile and widely used method has been designed to assess

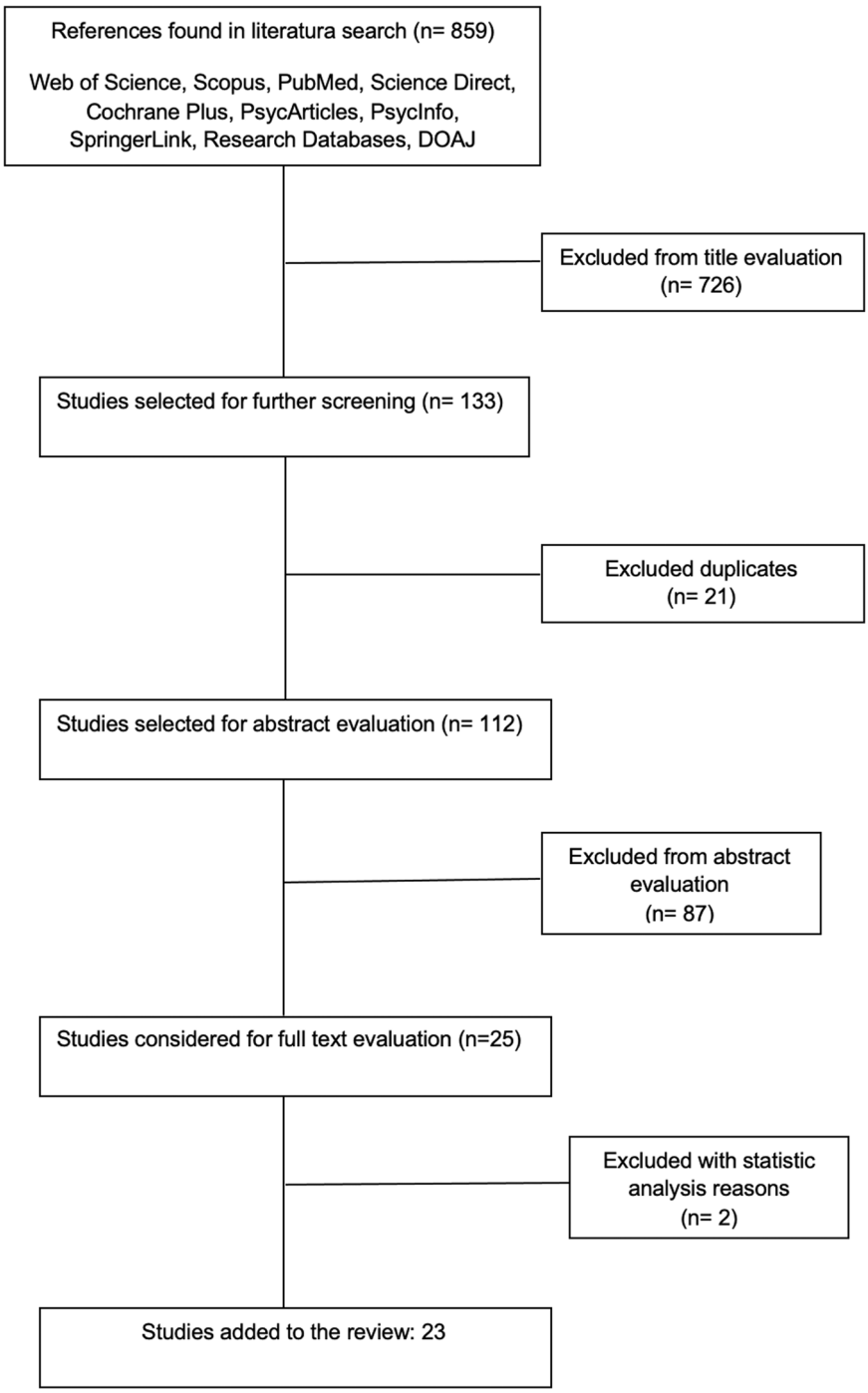

FIGURE 1 Flow diagram of the studies selection process.

the methodological quality of studies to be included in systematic revisions by means of checklists specifically created for each design. In this case, the evaluation criteria used were either those of the analytic cross-sectional studies (eight items) or those of the cohort studies (11 items).

The items were drafted so that they provided information on aspects such as eligibility criteria, validity, and reliability of exposure and outcome measurement, identification of confounding factors, adequacy of the methods used for statistical analysis, and details of the follow-up time (for cohort studies). The score for each item was 1 point in case of compliance and 0 in case of either unclear or null compliance. If the specific characteristics of a study did not allow the scoring of an item, the optimal scoring was reduced pro rata.

The scoring of each study is shown in Table 2. The quality of the studies is shown both as a proportion of the total available points on each checklist and as a percentage of the total score.

In this respect, the work of Sekhon et al. (2019) was followed because they carried out the quality assessment of their systematic review in the same way: they included studies ranging from 11% to 100%, and the 23 studies in this review had compliance scores ranging from 42.8% to 87.5%. Detailed information of the critical assessment is available in Supporting Information Table 1.

3 | RESULTS

A summary of the main features of the 23 articles analyzed in this systematic review is presented in Table 2. Most of the articles are cross-sectional analytical observational studies. Only two of them are longitudinal (Bugajska et al., 2013; Sadeghian et al., 2013) while the work by Nella et al. (2015) is a prospective cohort study with two control groups. The studies have been carried out in 16 different countries across five continents. Coggon et al. (2013) carried out an international study that included a sample of 18 countries. The sample sizes ranged from the 60 subjects in the study by Govindu and Babski-Reeves (2014) to the 21,466 in the study by Kim et al. (2013). Thirteen papers included samples with a range of 100–1000, three with a range of 1000–5000, and six with a sample size of more than 5000 subjects.

The occupational groups of the samples in the articles were also diverse. Nine of them studied populations with a variety of jobs, while the rest focused on particular occupational groups, such as nurses (Barzideh et al., 2014; Sadeghian et al., 2013; Surawera et al., 2012), teachers (Erick & Smith, 2014; Yue et al., 2014), and more specific and less common professions, such as carpet weavers (Chaman et al., 2015), rubber workers (Shan et al., 2011), and call center employees (d'Errico et al., 2010).

The average age of the samples analyzed ranged from 32.10 (7.30) to 53.01 (4.90) years old. The study that included the widest range of ages (16–69) in the sample of workers was the one by Hammig and Bauer (2014), while Lourenço et al. (2015) specifically carried out their study with a sample of 21-year-old workers. In five studies the results of the association between psychological risk factors and MSDs were provided across gender (Collins & O'Sullivan, 2010; da Silva et al., 2017; Hammig & Bauer, 2014; Liu et al., 2020; Nicolakakis et al., 2017). Most of the reviewed articles dealt with both genders indistinctly, even if a slight prevalence of female subjects can be observed. Only three studies were carried out on single-gender samples: both Kim et al. (2013) and Shan et al. (2011) dealt with male subjects, whereas Lee et al. (2011) focused on female subjects.

3.1 | JI and other PSRFs

Although the articles chosen do not specifically study JI variable, it was found among the PSRFs in the sample. Most of the studies used internationally validated and recognized measurement instruments, such as the Job Content Questionnaire (Karasek et al., 1998), Copenhagen Psychosocial Questionnaire (Kristensen et al., 2005), and the Korean Occupational Stress Scale (Cho et al., 2008), either totally or partially, and with either reduced or adapted versions.

The number of items dedicated to the JI variable in the articles of this review ranged from studies that contain a single item to others using four items, and just one of them (Zeytinoglu et al., 2015) used a seven-item questionnaire based on Cameron's JI scale (Zeytinoglu et al., 2009b). This study was carried out on a sample of home-care workers, and analyzed the relationship between the contractual characteristics of the job, the employees' perception of insecurity (JI and employability insecurity), and the presence of MSDs; it put forward different hypotheses on the correlation with stress, which acts as a mediator between the above-mentioned variables and MSDs. It is the only one of the papers that more specifically addressed this risk factor as a trigger of MSDs.

Apart from the exposure to JI dealt with in this review, the studies under review also included measurement of other psychosocial risks (see the details in Table 2). Drawing from Karasek's job strain model (Karasek & Theorell, 1990), the most frequent risks discussed in the studies under review were Social support (relating to both coworkers and supervisor) (Barzideh et al., 2014; Bugajska et al., 2013; Chaman et al., 2015; Coggon et al., 2013; da Silva et al., 2017; d'Errico et al., 2010; Erick & Smith, 2014; Govindu & Babski-Reeves, 2014; Hammig & Bauer, 2014; Lourenço et al., 2015; Nicolakakis et al., 2017; Sadeghian et al., 2013; Shan et al., 2011), Job satisfaction (Chaman et al., 2015; Coggon et al., 2013; Collins & O'Sullivan, 2010; da Silva et al., 2017; Erick & Smith, 2014; Govindu & Babski-Reeves, 2014; Sadeghian et al., 2013; Shan et al., 2011; Yue et al., 2014), Psychological demand (Barzideh et al., 2014; Bugajska et al., 2013; da Silva et al., 2017; Erick & Smith, 2014; Govindu & Babski-Reeves, 2014; Liu et al., 2020; Lourenço et al., 2015; Shan et al., 2011), Job control (Chaman et al., 2015; Coggon et al., 2013; da Silva et al., 2017; d'Errico et al., 2010; Kim et al., 2013; Lee et al., 2011; Liu et al., 2020), Decision latitude (Barzideh et al., 2014; Bugajska et al., 2013; Erick & Smith, 2014; Govindu & Babski-Reeves, 2014; Lourenço et al., 2015; Nicolakakis et al., 2017; Shan et al., 2011), Job demand (Collins & O'Sullivan, 2010; d'Errico

TABLE 2 Summary of study characteristics.

Author (year)	Country	Sample size	Occupational group	Job insecurity measurement	Other psychosocial risk factors measured	Type of MSD	Design	Critical appraisal score items positive/total items
Liu et al. (2020)	Taiwan	15,989	Various	Job security (secure/insecure) 1 item	Psychological demands, job control, workplace justice	Neck, shoulder, low back, wrist/hand, anybody part	Cross-sectional	5/7 (71.4%)
da Silva et al. (2017)	Brazil	267	Footwear industry workers	Job insecurity (yes/no)	Psychological demands, job control, support, reward, job satisfaction, work stress, overcommitment, physical violence, sexual harassment, bullying, monotony, discrimination	Neck, shoulder, upper back, low back, elbow, wrist, hand, hip/thigh, knee, ankle/foot, forearm	Cross-sectional	5/7 (71.4%)
Nicolakakis et al. (2017)	Canada	5071	Computer work	Low job security (yes/no)	Support, physical violence, sexual harassment, bullying, decision authority, skill discretion, lack of possibility to take a break, to modify workplace, to do high-quality work, contradictory work demands, emotionally demanding work, tense situations with clients, recognition at work, salary unsatisfaction, lacks prospects for promotion, physical demand	UE	Cross-sectional	5/7 (71.4%)
Yang, Haldeman et al. (2016)	The USA	13,924	Various	Job insecurity (yes/no) 1 item	Work–family imbalance, work environmental	Low back	Cross-sectional	4/7 (57.1%)
Yang, Hitchcock et al. (2016)	The USA	13,915	Various	Job insecurity (yes/no) 1 item	Work–family imbalance, work environmental	Neck	Cross-sectional	4/7 (57.1%)
Zeytinoglu et al. (2015)	Canada	532	Home care workers	Job insecurity (M, SD) 7 items	Employability insecurity	MSD general	Cross-sectional	6/7 (85.7%)
Nella et al. (2015)	Greece	100	Civil servants	Investigation group with Job insecurity	None	MSD general	Cohort study (3 months)	4/8 (50%)
Chaman et al. (2015)	Iran	516	Hand-woven carpet weavers	Job insecurity (yes/no, M/SD)	Job control, support, job satisfaction, time pressure	MSD general	Cross-sectional	3/7 (42.8%)
Lourenço et al. (2015)	Portugal	650	Various, 21 years old workers	Job insecurity (high/low) 3 items	Psychological demands, decision latitude, support	MSD general	Cross-sectional	6/7 (85.7%)
Govindu and Babski-	The USA	60	Various	Job insecurity (3 scores)	Psychological demand, support, work stress, decision latitude, job	Low back	Cross-sectional	4/8 (50%)

(Continues)

TABLE 2 (Continued)

Author (year)	Country	Sample size	Occupational group	Job insecurity measurement	Other psychosocial risk factors measured	Type of MSD	Design	Critical appraisal score items positive/total items
Reeves (2014)					satisfaction, organizational level, physical demand			
Barzideh et al. (2014)	Iran	385	Nurses	Job insecurity (M, SD) 3 items	Psychological demand, support, decision latitude, physical demand	MSD general Back, UE, LE	Cross-sectional	3/7 (42.8%)
Hammig and Bauer (2014)	Switzerland	2014	Various	Job insecurity (yes/no)	Support, monotony, lack of promotion, work–family imbalance, time pressure, frequent interruptions, status inconsistency, work time changes at short notice	Back/low back Neck/ shoulder	Cross-sectional	3/7 (42.8%)
Erick and Smith (2014)	Botswana	1732	School teachers	Job insecurity (high/low)	Psychological demand, support, job satisfaction, decision latitude, physical demand	Low back	Cross-sectional	4/7 (57.1%)
Yue et al. (2014)	China	749	Teachers, miners	Insecurity at work (high/low) 4 items	Job demand, influence and development, interpersonal relations and leadership, job satisfaction	Neck/shoulder, low back, UE, LE, any region pain	Cross-sectional	4/7 (57.1%)
Coggon et al. (2013)	18 Coun-tries	12,426	Various	Job insecurity (yes/no)	Job control, support, job satisfaction, time pressure, incentives at work	Low back, wrist/hand	Cross-sectional	4/7 (57.1%)
Bugajska et al. (2013)	Polonia	725 (I) 542 (II)	Various	Job insecurity (yes/no)	Psychological demand, decision latitude, support	9 Regions of original NMQ past 7 days/past 12 months	Longitudinal study (12 months)	7/8 (87.5%)
Kim et al. (2013)	Korea	21,466	Firefighters	Job insecurity (high risk/low risk)	Job demand, job control, interpersonal conflict, organizational system, reward, occupational climate, job stress	MSD general	Cross-sectional	3/7 (42.8%)
Sadeghian et al. (2013)	Iran	428 (I) 383 (II)	Nurses, office workers	Perceived job insecurity (yes/no)	Job satisfaction, support, time pressure, incentives at work, lack of choices	Neck/shoulder	Longitudinal study (12 months)	6/8 (75%)
Shan et al. (2011)	Malaysia	419	Rubber workers	Job insecurity (high/low)	Psychological demand, support, decision latitude, job satisfaction	Neck	Cross-sectional	6/7 (85.7%)
Surawera et al. (2012)	Australia	1111	Nurses	Job security (very safe/safe, rather unsafe/unsafe) 1 item	Job control, support, job satisfaction, job strain	Wrist/hand	Cross-sectional	5/7 (71.4%)

TABLE 2 (Continued)

Author (year)	Country	Sample size	Occupational group	Job insecurity measurement	Other psychosocial risk factors measured	Type of MSD	Design	Critical appraisal score items positive/total items
Lee et al. (2011)	Korea	156	Various	Job insecurity (yes/no) 2 items	Job control, job demand, interpersonal conflicts	MSD general	Cross-sectional	5/7 (71.4%)
Collins & O'Sullivan (2010)	Ireland	332	Various	Insecurity at work (M, SD)	Job demands, job content, work environment, job satisfaction	9 Regions of original NMQ past 7 days/past 12 months	Cross-sectional	3/7 (42.8%)
d'Errico et al. (2010)	Italia	775	Call center employees	Job insecurity (yes/no)	Job control, job demand, job strain, support, lack of possibility to take a break	Neck–shoulder Elbow–wrist/hand	Cross-sectional	5/7 (71.4%)

Note: Information on items used to measure job insecurity is included if the study specifies it.

Abbreviations: LE, lower extremity; M, mean; MSD, musculoskeletal disorders; NMQ, Nordic Musculoskeletal Questionnaire; SD, standard deviation; UE, upper extremity.

et al., 2010; Kim et al., 2013; Lee et al., 2011; Yue et al., 2014), Work stress (da Silva et al., 2017; d'Errico et al., 2010; Govindu & Babski-Reeves, 2014; Kim et al., 2013; Surawera et al., 2012), Time pressure (Chaman et al., 2015; Coggon et al., 2013; Hammig & Bauer, 2014; Sadeghian et al., 2013), and Physical demand (Barzideh et al., 2014; Erick & Smith, 2014; Govindu & Babski-Reeves, 2014; Nicolakakis et al., 2017). Work–family imbalance (Hammig & Bauer, 2014; Yang, Haldeman, et al., 2016; Yang, Hitchcock, et al., 2016) addressed the issue of reconciliation of work and personal life.

With regard to workplace and personal relationships, the psychosocial risks in the studies analyzed were the ones under the following labels: Work environment (Collins & O'Sullivan, 2010; Yang, Haldeman, et al., 2016; Yang, Hitchcock, et al., 2016), Interpersonal conflicts (Kim et al., 2013; Lee et al., 2011), Interpersonal relations and leadership (Yue et al., 2014), Occupational climate (Kim et al., 2013), Workplace justice (Liu et al., 2020), Physical violence, Sexual harassment, Bullying, and Discrimination (da Silva et al., 2017; Nicolakakis et al., 2017).

The perception of recognition at work and the prospects of job promotion have been observed to be related to the following risks: Reward (da Silva et al., 2017; Kim et al., 2013), Lack of promotion (Hammig & Bauer, 2014; Nicolakakis et al., 2017), Incentives at work (Coggon et al., 2013; Sadeghian et al., 2013), Recognition at work, Salary unsatisfaction, Skill discretion (Nicolakakis et al., 2017), Status inconsistency (Hammig & Bauer, 2014), Influence and development (Yue et al., 2014), and Lack of choices (Sadeghian et al., 2013).

The workload management was tested through variables, such as Organizational level (Govindu & Babski-Reeves, 2014; Kim et al., 2013), Frequent interruptions, Work time changes at short notice (Hammig & Bauer, 2014), Contradictory work demands, and Lack of possibility of taking a break (d'Errico et al., 2010; Nicolakakis et al., 2017).

Under Job content (Collins & O'Sullivan, 2010), Monotony (da Silva et al., 2017; Hammig & Bauer, 2014), or Lack of means to do high-quality work (Nicolakakis et al., 2017), different aspects of the work process related to workers motivation are measured, whereas Emotionally demanding work, Tense situations with clients (Nicolakakis et al., 2017), and Overcommitment (da Silva et al., 2017) have to do with emotional competences of work.

3.2 | Musculoskeletal disorders

The variety of the MSDs construct has to do with the broad spectrum of areas included in the studies (Table 3).

Most of the papers used self-reported measures based on the Nordic Musculoskeletal Questionnaire (Kuorinka et al., 1987); some of them paid comprehensive attention to both the topography of the symptoms (nine areas) and the time range they covered (last 7 days and last 12 months) (Bugajska et al., 2013; Collins & O'Sullivan, 2010). In other papers, questionnaires adapted from the Nordic Musculoskeletal Questionnaire were used: in this adaptation, they either selected some of the nine body areas in the Nordic

TABLE 3 Musculoskeletal disorders construct.

Type of MSD	Score			Article
Low back pain	Yes/no		Last 3 months	Yang, Haldeman et al. (2016)
			Last 12 months	Hammig and Bauer (2014)
	Severity of LBP (ODI)			Govindu and Babski-Reeves (2014)
	Disabling LBP: yes/no		Last month	Coggon et al. (2013)
	Yes/no and LBP disability (ODI)		Last 12 months	Erick and Smith (2014)
Neck pain	Yes/no		Last 3 months	Yang, Hitchcock et al. (2016)
			Last 12 months	Shan et al. (2011)
MSD (general)	Score 0–5 (none of the time/all the time)		Last 12 months	Zeytinoglu et al. (2015)
	Score 0–10			Nella et al. (2015)
	Yes/no (multisite pain)		Last 12 months	Lourenço et al. (2015)
	No. painful sites		Last 12 months	Chaman et al. (2015)
	Yes/no		Last 12 months	Barzideh et al. (2014)
				Kim et al. (2013)
				Lee et al. (2011)
9 Sites (NMQ)	Neck		Yes/no	Collins and O'Sullivan (2010)
	Shoulders		Last 7 days	Bugajska et al. (2013)
	Lower back		Last 12 months	
	Upper back			
	Elbows			
	Wrist/hands			
	Hips/thighs			
	Knees			
	Ankles/feet			
5 Sites (NMQ)	Neck		Yes/no	Liu et al. (2020)
	Shoulders		Last 12 months	
	Lower back			
	Wrist/hands			
	Any body part			
5 Sites (NMQ)	Neck/shoulder		Yes/no	Yue et al. (2014)
	Upper limbs		Last 12 months	
	Low back			
	Lower limbs			
	Any region pain			
3 Sites (NMQ)	Back (neck, upper back, lower back)		Yes/no	Barzideh et al. (2014)
	Upper extremity (shoulders, elbows, wrist/hands)		Last 12 months	
	Lower extremity (thighs, knees, leg/feet)			
11 Sites (NMQ)	Neck	Wrist	Yes/no	da Silva et al. (2017)
	Upper back	Hand/fingers	Frequency (no pain, occasional pain, frequent pain, everyday pain)	
	Lower back	Hip/thigh		
	Shoulder	Knee		

TABLE 3 (Continued)

Type of MSD	Score		Article
	Elbow Ankle/foot		
	Forearm		
Upper extremity	Yes/no	Last 12 months	Nicolakakis et al. (2017)
	Proximal zone (neck/shoulder)	Last month	d'Errico et al. (2010)
	Distal zone (elbow/wrist/hand)		
Neck/shoulder	Yes/no	Last 12 months	Hammig and Bauer (2014)
	Incident pain (at 12 months)		Sadeghian et al. (2013)
	Persistent pain (at 12 months)		
Wrist/hand	Disabling pain: yes/no	Last month	Coggon et al. (2013)
	Yes/no		Surawera et al. (2012)

Abbreviations: LBP, low back pain; MSD, musculoskeletal disorders; NMQ, Nordic Musculoskeletal Questionnaire; ODI, Oswestry Disability Index.

Musculoskeletal Questionnaire, or simply described the presence of "MSDs symptoms" with no area specification (Barzideh et al., 2014; da Silva et al., 2017; d'Errico et al., 2010; Erick & Smith, 2014; Hammig & Bauer, 2014; Liu et al., 2020; Lourenço et al., 2015; Nella et al., 2015; Nicolakakis et al., 2017; Shan et al., 2011; Surawera et al., 2012; Yue et al., 2014; Zeytinoglu et al., 2015).

Some studies measured the presence of MSDs with other questionnaires, such as the Korean Niosh Symptom survey (Kim et al., 2013; Lee et al., 2011) or the Cultural and Psychosocial Influences on Disability Questionnaire (Chaman et al., 2015; Coggon et al., 2013; Sadeghian et al., 2013).

Most of the studies were limited to reporting the presence versus absence of symptoms, but some included other measures, such as disability, which is measured through the Oswestry Disability Index (Erick & Smith, 2014; Govindu & Babski-Reeves, 2014), the frequency (da Silva et al., 2017; Kim et al., 2013; Lee et al., 2011), or the intensity (Kim et al., 2013; Lee et al., 2011). The study by Sadeghian et al. (2013) is a longitudinal approach that tested whether the pain was incident or persistent.

The articles also differ in the type of statistical analysis used. The descriptive statistics of the relevant variables are provided either (in most cases) through the prevalence (%) of JI and MSDs, or (in those using scoring scales) through the mean (standard deviation). Only one of the articles (Nella et al., 2015) made use of the median (interquartile range).

The association between the variables was analyzed by means of different inferential statistic types, most of the studies using Logistic regression models with an unadjusted (crude) or an adjusted Odds Ratio, 95% confidence interval, whereas a few of them included further models, such as:

- Poisson regression (prevalence rate ratio, 95% confidence interval) (Coggon et al., 2013; d'Errico et al., 2010; Sadeghian et al., 2013).
- χ^2 test (Bugajska et al., 2013; Erick & Smith, 2014; Hammig & Bauer, 2014; Liu et al., 2020; Shan et al., 2011).
- Correlation coefficient (Chaman et al., 2015; Zeytinoglu et al., 2015).
- Multiple linear regression (adjusted R^2) (Govindu & Babski-Reeves, 2014).
- Mann–Whitney *U* test (Barzideh et al., 2014; Collins & O'Sullivan, 2010; Nella et al., 2015).

Fifteen studies showed statistically significant results in the JI–MSDs association (Table 4), covering 65.2% of the total number of articles in the review. The significant associations were not homogeneous; in the studies where the analysis was carried out by gender, the significant results took place only in men (da Silva et al., 2017; Hammig & Bauer, 2014; Nicolakakis et al., 2017) or in a higher proportion of body areas (Collins & O'Sullivan, 2010; Liu et al., 2020). This difference between genders was also observed in the prevalence of the variables: in all of the studies, the prevalence of JI was higher among men while the prevalence of MSDs was higher among women.

The significant associations of the studies analyzed were also heterogeneous regarding the MSDs construct. Most associations were observed in areas of the upper limbs: wrist/hand (Bugajska et al., 2013; Collins & O'Sullivan, 2010; Liu et al., 2020; Surawera et al., 2012), shoulder (Hammig & Bauer, 2014; Liu et al., 2020), forearm (da Silva et al., 2017), and upper extremities globally (d'Errico et al., 2010; Nicolakakis et al., 2017). Seven studies showed significance in the correlation of JI with symptomatology in different areas of the back: lower back (Collins & O'Sullivan, 2010; Erick & Smith, 2014; Liu et al., 2020; Yang, Haldeman, et al., 2016), upper back (Collins & O'Sullivan, 2010), and neck (Hammig & Bauer, 2014; Shan et al., 2011; Yang, Hitchcock, et al., 2016). Three of them showed a significant association with the MSDs variable as a general symptom without specifying areas (Kim et al., 2013; Nella et al., 2015; Zeytinoglu et al., 2015). Only the study by Bugajska et al. (2013)

TABLE 4 Summary of study results.

Reference	Objective/associations	Statistical used	Prevalence/mean JI	Prevalence/mean MSD	Statistical association value
Liu et al. (2020)	Ergonomic, psychosocial factors → MSD (of body parts, by gender)	Prevalence, χ^2 test	M: 47.80% F: 46.56%	M: 57.9% F: 63.0%	**SS** M: all parts ($p < .01$–$<.001$) F: low back, wrist–hand ($p < .001$), shoulder ($p < .05$)
da Silva et al. (2017)	Psychosocial factors → MSD (of body parts, by gender)	Prevalence, adj. OR 95% CI	M: 59.44% F: 54.55%	Prevalence data of body parts by gender	**SS** M: forearm OR: 1.64 (1.17–2.29), $p = .004$
Nicolakakis et al. (2017)	Physical and psychosocial factors → MSD (UE by gender)	Prevalence, adj. OR 95% CI	M: 24.5% F: 23.8%	M: 10.5% F: 13.5%	**SS** M: OR 1.55 (1.06–2.27) $p = .0229$
Yang, Haldeman et al. (2016)	Organizational and psychosocial factors → MSD (LB)	Prevalence, unadj./adj. OR 95% CI (5 models)	32.4%	25.7%	**SS** ($p < .05$) OR: 1.44 (1.24–1.67) OR: 1.28 (1.11–1.47) OR: 1.26 (1.10–1.44) OR: 1.33 (1.15–1.55) OR: 1.23 (1.08–1.40)
Yang, Hitchcock et al. (2016)	Organizational and psychosocial factors → MSD (neck)	Prevalence, unadj./adj. OR 95% CI (4 models)	32.4%	14.3%	**SS** ($p < .001$) OR: 1.5 (1.3–1.7) OR: 1.36 (1.21–1.53) OR: 1.32 (1.18–1.49) OR: 1.33 (1.19–1.5)
Zeytinoglu et al. (2015)	Psychosocial factors, stress → MSD	Mean (SD), correlation coefficient	21.3 (6.37)	13.12 (4.88)	**SS** $r = .193$, $p < .01$
Nella et al. (2015)	JI exposure → anxiety, depression, psychosomatic symptoms, MSD	Median (IR), Mann–Whitney *U* test	EG	EG: 2.67 (2.13) CG 1: 1.08 (1.0) CG 2: 1.0 (0.67)	**SS** U = 420.5, $p < .001$
Chaman et al. (2015)	Psychosocial factors → MSD (no. painful sites)	Mean (SD), prevalence, Pearson correlation	21 (4.1)	1 site: 51.7% 2 sites: 33.3% +2 sites: 21.5%	**NS** $p = .292$

TABLE 4 (Continued)

Reference	Objective/associations	Statistical used	Prevalence/mean JI	Prevalence/mean MSD	Statistical association value
Lourenço et al. (2015)	Psychosocial factors → widespread pain syndrome features, MSD	Prevalence, unadj./adj. OR 95% CI	47.6%	68.5%	**NS**
Govindu and Babski-Reeves (2014)	Occupational, psychosocial factors → MSD (LB severity)	Prevalence, M (SD), R^2	−1 to 2: 75% 3–5: 15% 6–12: 10%	39.55 (16.50) 49.78 (8.92) 43.00 (14.01)	**NS** $p = .9718$
Barzideh et al. (2014)	Psychosocial factors → MSD	Prevalence, mean (SD), Mann–Whitney *U* test	7.74 (3.85) of 17 maximum score	89.9%	**NS** $p = .861$
Hammig and Bauer (2014)	Physical and psychosocial factors → health outcomes, MSD (of body parts, by gender)	Prevalence, χ^2, adj. OR 95% CI	17%	M: back/LB (11%) neck/shoulder (13%) F: back/LB (6%), neck/shoulder (22%)	**SS** χ^2 M: neck/shoulder $p < .05$
Erick and Smith (2014)	Physical and psychosocial factors → MSD (LBP, LBP disability)	Prevalence, χ^2, adj. OR 95% CI	_	LBP: 55.7% LBP disability: minimal (67.1%), severe (4.3%)	**SS** χ^2 LBP disability $p = .010$
Yue et al. (2014) [92]	Psychosocial factors → MSD (of body parts)	Prevalence, adj. OR 95% CI	_	Any region pain Teachers: 72% Miners: 78%	**NS**
Coggon et al., 2013 [86]	Physical, putative, and psychosocial factors → MSD (LB, wrist/hand)	Prevalence, PRRs 95% CI	_	LBP: 22% Wrist/hand pain: 14.4%	**NS**
Bugajska et al. (2013)	Psychosocial factors → repetitive strain injuries, MSD (of body parts)	Prevalence, χ^2, adj. OR 95% CI	_	++ Prevalent: LB (58%), neck (57%), wrist/hand (47%) No significant difference between the two measures	**SS** Wrist/hand OR: 1.18 (1.01–1.38), $p = .03$ Knees OR: 0.77 (0.63–0.95), $p = .01$
Kim et al. (2013)	Psychosocial factors→ MSD	Prevalence, unadj./adj. OR 95% CI (3 models)	26.29%	11.0%	**SS** ($p < .001$) OR: 1.90 (1.71–2.11), OR: 1.13 (1.02–1.25) OR: 1.14 (1.01–1.28)

(Continues)

TABLE 4 (Continued)

Reference	Objective/associations	Statistical used	Prevalence/mean JI	Prevalence/mean MSD	Statistical association value
Sadeghian et al. (2013)	Occupational and psychosocial factors → MSD (incident/persistent neck pain)	Prevalence, PRRs 95% CI	Measure I: 59.81% Measure II: 60.57%	Incident neck pain: 32% Persistent neck pain: 64%	**NS**
Shan et al. (2011)	Physical and psychosocial factors → MSD (neck)	Prevalence, χ^2, unadj./adj. OR 95% CI	47.5%	59.9%	**SS** χ^2 $X^2 = 5.539$, $p = .019$
Surawera et al. (2012)	Sociocultural, physical, and psychosocial factors → MSD (wrist/hand)	Prevalence, unadj./adj. OR 95% CI (3 models)	24.2%	15.3%	**SS** ($p < .05$) OR: 2.01 (1.36–2.97) OR: 1.81 (1.19–2.77) OR: 1.55 (1.04–2.28)
Lee et al. (2011)	Acculturation and psychosocial factors → MSD	Prevalence, mean (SD), adj. OR 95% CI	52.0 (28.67)	34.6%	**NS**
Collins & O'Sullivan (2010)	Psychosocial factors → MSD (of body parts, by gender and age)	Prevalence, mean (SD), Mann–Whitney *U* test	Mean data of Job insecurity by gender and age	Prevalent data of body parts by gender and age	**SS**M: wrist/hand ($p < .05$), upper back ($p < .01$), LB ($p < .05$), F: wrist/hand ($p < .05$)
d'Errico et al. (2010)	Occupational, ergonomic, and psychosocial factors → MSD (proximal and distal UE)	Prevalence, PRRs 95% CI (adjusted and multivariate)	51.3%	45%	**SS** Distal UE: adj. PRR 2.19 (1.40–3.42) Multivariate PRR: 2.24 (1.33–3.74) $p < .05$

Abbreviations: adj./unadj. OR 95% CI, adjusted/unadjusted Odds Ratio 95% confidence interval; CG, control group; EG, experimental group; F, female; IR, interquartile range; JI, job insecurity; LB/LBP, low back/low back pain; M, male; MSD, musculoskeletal disorders; NS, not significant; PRRs, prevalence rate ratios; SD, standard deviation; SS, statistically significant; UE, upper extremity.

SS: The statistically significant values of some of the musculoskeletal variables with job insecurity are detailed.

NS: No musculoskeletal variable is significantly associated with job insecurity in any of the statistical analyses carried out for the study.

obtained significant results in the association with an area of the lower limbs (knees).

4 | DISCUSSION

This study highlights the importance of JI as a PSRF to be taken into account in the prevention of WRMSDs. Even if the articles considered did not analyze this risk factor on its own, the selection reviewed suggests an association between exposure to JI and the presence of MSDs.

The significant associations presented in the articles analyzed show similarities with previous scientific literature, which had pointed to the link between JI and MSDs in upper limbs (Lipscomb et al., 2007; Wang et al., 2009), back (Lee et al., 2008; Linton, 2005), and general musculoskeletal symptoms (Cole, 2001; Kivimaki, 2001; Lipscomb et al., 2008; Mohren et al., 2003; Nishikitani et al., 2012).

Gender expectations and social causes have been found to affect the prevalence of JI among men and women in different ways. The higher prevalence of JI among men observed in the articles of this review has been linked, from a social point of view, to the traditional role of men as "breadwinners" by previous scientific literature (Näswall & de Witte, 2003).

However, the contributions here reviewed have shown a higher prevalence of MSDs in the female population, so the experts have explained this prevalence either through physical and biological factors, or through social factors other than JI. Occupational segregation suggests that women often do jobs that involve physical risk factors such as high repetition or static postures in more administrative jobs. In addition, from an ergonomic point of view, the anthropometric differences across genders and the size of the workstations, usually designed for male bodies, trigger a postural adaptation in women that results in greater muscular tension (Treaster & Burr, 2004). Biological factors explain the relationship of MSDs with hormonal fluctuations, which affect women in a variety of life situations (use of contraceptives, pregnancy and maternity, and menopause), this would lead to a higher prevalence of MSDs in the female population (Kilbom et al., 1998). Finally, from a social point of view, it is suggested that women experience greater exposure to risk factors outside work, due to domestic tasks and childcare and to their more problematic work–family imbalance (Collins & O'Sullivan, 2010).

The articles analyzed have also shown differences related to the countries where the studies were carried out. As for the JI reported by the populations analyzed, the study by Hammig and Bauer (2014) is the one showing the lowest prevalence (17% of the sample): it was carried out in Switzerland among different occupational groups. The highest prevalence is shown in the following papers: da Silva et al. (2017), Brazil, with figures of 54%–59% depending on gender (female and male, respectively), and Sadeghian et al. (2013), Iran, with a prevalence of 59%–60% depending on the moment of measurement (start of the study, follow-up after 12 months).

These data could be related to socioeconomic and cultural differences between countries. In this respect, Niedhammer et al. (2012) analyzed the prevalence of 18 different PSRFs (including JI) in 31 European countries and found that Nordic countries such as Norway and Denmark, with better social welfare policies, showed the lowest prevalence in four or more risk factors, while southern and eastern countries, such as the Czech Republic, Greece, or Turkey, showed the highest prevalence. On the other hand, a low socioeconomic position usually leads to more physically and psychosocially harmful work environments (Kausto et al., 2011). However, several studies in this review did not present data on this value, and others presented it as an average (standard deviation), which makes comparisons difficult.

The lowest prevalence of MSDs (11%) is shown in the study by Kim et al. (2013), which was carried out on a sample of firefighters. As for the highest prevalence, it is observed in the study by Barzideh et al. (2014), with 89.9% of the sample, but it is not significant with respect to the association with JI. Samples from specific occupational groups (nurses) were also analyzed in the papers by Sadeghian et al. (2013) and Surawera et al. (2012), with a prevalence of 25% and 15.3%, respectively, though limited to MSDs of specific body areas (neck and wrist/hand). Those very different prevalence rates might have to do with the wide range of occupational and socioeconomic groups on which the studies were based.

Among the papers in this review, the study of Liu et al. (2020) was the one paying the most attention to this factor: it combined rigorous methodology with a large sample (N = 15989), and the MSDs were analyzed according to sex and also to a wide range of demographic and social characteristics and employment conditions. Lower socioeconomic status (reflected in poor educational level and low employment grade) is linked to a higher risk of lower back and wrist/hand symptoms, and to a lower risk of shoulder/neck pain: This conclusion was coincidental with those in the study of Yang, Haldeman et al. (2016), in which a lower socioeconomic status was related to the prevalence of lower back disorder. This may have to do with the working conditions of the groups with a low educational and socioeconomic level, since physical workload is mainly associated with lower groups (Leinonen et al., 2011).

The papers in this review showed the following results: jobs with a higher physical workload, among which nursing is included (Barzideh et al., 2014; Coggon et al., 2013), imply more low back symptoms (Kim et al., 2013; Yue et al., 2014). Administrative and other skilled jobs (such as teachers) were rather linked with a prevalence of neck (Sadeghian et al., 2013; Yue et al., 2014) and upper limb symptoms (Coggon et al., 2013; d'Errico et al., 2010; Nicolakakis et al., 2017). Maybe due to the relationship of sex and type of work activity, women seemed to show a higher prevalence of MSDs in the neck, and men in the lower back area (Hammig & Bauer, 2014; Yang, Hitchcock, et al., 2016).

Although the mechanism linking JI and musculoskeletal symptoms is not known, the hypothesis has been put forward that, for fear of being fired, employees with unstable jobs were more likely to continue working after having developed symptoms of MSDs: in their refusal to reduce exposure through a job change, those workers could suffer increasingly severe symptoms (Lipscomb et al., 2008). It

has also been suggested that work-related stress may arise from both a change in the nature of work and from insecurity in the labor market, and that this form of stress can easily result in MSDs (Zeytinoglu et al., 2015).

4.1 | Implications for future research

The evidence put forward in this review shows the importance of developing new lines of research that pay attention to JI as an important risk factor to be considered in the prevention of MSDs. To this end, it is necessary to carry out studies with specific scales that are capable of measuring the different dimensions of this construct, so that their eventual results show greater reliability. In this way, scientific evidence will encourage measures that lead to actively addressing that psychosocial risk within Occupational Health.

The actions to be taken in this field should include individual measures that lead to the development of personal skills of workers, such as emotional intelligence and resilience, since they have been linked to a decrease in the negative impact of JI on health (Shoss et al., 2018).

As for companies, it would be necessary for them to implement measures such as sponsored training, as this would improve the employability of workers by enhancing their work skills. A clear and timely communication of reorganization and changes in the company, together with participative decision making (Probst, 2005), would be also in order. Moreover, it is important to promote interpersonal relationships at work, by increasing the social support as a health protector agent (Karasek & Theorell, 1990). All these measures should be accompanied by macrolevel actions, such as social protection policies and the improvement of working conditions for employees.

Some occupational sectors, such as nursing, show a high prevalence of MSDs (Davis & Kotowski, 2015) and a great exposure to JI (Prado-Gascó et al., 2021), because the current contractual flexibility causes frequent situations of job instability. Therefore, this particular field could provide a good framework for research and prevention policies.

The main limitation of this review is the lack of meta-analysis combining the effects of the association between MSDs and JI: the heterogeneity of the articles included prevents it. In addition to this, the cross-sectional design of most of the studies makes it difficult to reach sound conclusions.

Another limitation of this review may be in the corpus itself from which the papers were selected, since as indicated above (see Section 2.1), gray literature has not been included. Nevertheless, the number and coverage of the databases used make it unlikely that articles truly relevant to the study have been overlooked.

The heterogeneity of the studies concerning the types of MSDs makes it difficult to draw conclusions. The subjectivity inherent in the measurement of the MSDs construct in the studies included should also be taken into account. Due to their low cost and simplicity, this variable is usually measured through questionnaires that collect the symptoms experienced by the population and not so much by means of physical signs or more objective medical diagnoses (Wang et al., 2009).

5 | CONCLUSIONS

Although the effects of JI on physical and mental health have been widely studied, few papers have considered its potential association with MSDs. This review seeks to be an approach to the data observed within multivariable studies and an argument that supports the need for more specific studies.

With pathologies as prevalent as MSDs, occupational medicine should take into account all of the possible risk factors, ergonomic and psychosocial, and include among the preventive measures workplace policies that reduce the subjective perception of JI in workers.

By focusing on an emerging occupational hazard (JI) and its association with a prevalent occupational disease (MSDs), this review could be a point of departure for future research: studies adopting a more specific stance which may provide a scientific basis both for the implementation of occupational health measures and for intervention policies to reduce JI.

AUTHOR CONTRIBUTIONS

Laura Mateos-Gonzalez: Conception and design of the work, bibliographical search, analysis and interpretation of data, and drafting the work. **Julio Rodríguez Suárez**: Conception and design of the work, bibliographical search, analysis and interpretation of data, and revising the paper critically. **José Antonio Llosa**: Conception and design of the work, analysis and interpretation of data, and critical revision of the paper.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

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