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Risk factor of work-related musculoskeletal disorders among health workers: A systematic review

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***Abstract*---**Work-related musculoskeletal disorders have become a leading reason for absence from work and account for a high proportion of work-related injuries. It has become clear that both workplace and non-workplace factors, may cause or exacerbate work-related musculoskeletal disorders. The purpose of this study was to investigate the risk factor of work-related musculoskeletal disorders among health providers. This was a systematic review study that used articles from online database of PubMed, Research Gate, Science Direct, Google Scholar, and EBSCO published from 2011 until 2021. There are several risk factors that can lead to musculoskeletal disorders among nurses, namely female gender, old age, low level of education, physical workload, long work experience, high workload, poor work habits, high level of physical activity, stress, anxiety, high demand for physical work, uncomfortable work position, sleep problems, burnout, marital status, BMI, work unit, long duration of work, frequency of working time, long standing time, lifting weights weight, lack of physical exercise, low number of nurses per shift, and night shifts.

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Introduction

According to the World Health Organization (WHO), work-related musculoskeletal disorders or commonly called work-related musculoskeletal disorders (WRMDs) are injuries that include various inflammatory disorders or degenerative diseases associated with pain or functional disorders in the body (Milhem et al., 2016; WHO., 1985). Based on a survey in the World, the annual prevalence of WMSDs ranges up to 50% in nurses with a lifetime prevalence of 35-80%, this figure is considered to contribute as the main cause of decreased work efficiency (Buxton et al., 2012; Tinubu et al., 2010). Several occupational factors such as workload, work posture, and duration of work were reported as influencing the prevalence of WMSDs (Bozkurt et al., 2016; Dick et al., 2015). Previous research has shown that WMSDs are directly caused by physically demanding jobs and strenuous working conditions, such as lifting or carrying heavy loads, performing too many repetitive movements, being in tiring positions or in positions where the posture is uncomfortable for long periods of time (da Costa & Vieira, 2010; Long et al., 2012; Ngan et al., 2010). In addition, MSD was also found to be associated with psychologically stressful work, namely with psychosocial and stressful work factors such as time pressure, low job control, little social support or supervisors, imbalance of effort with rewards, and work environment. Conflict(Amin et al., 2018; Azma et al., 2015; Bazazan et al., 2019; Bernal et al., 2015; Hämmig, 2017; Hämmig et al., 2011; Mehrdad et al., 2010). Although there have been many studies related to the risk factors of work-related musculoskeletal disorders, there are still few that specifically identify various modifiable risk factors (stress, obesity, smoking habits, etc.) gender, history of genetic disease, etc). Based on the description of the problem, it is necessary to conduct research to determine the risk factors of musculoskeletal disorders related to work.

Method

Data sources and search strategy

This systematic review was conducted according to the Preferred Reporting Items for Systematic Review and Meta-analyses (PRISMA) guidelines 13. An electronic search of PubMed, Research Gate, Science Direct, Google Scholar, and EBSCO was conducted from their inception to 31th December 2021 with only English language-based literature using the search string: (risk factors OR determinants OR predictor) AND (health worker OR Nurse) AND (work-related musculoskeletal disorders). In addition, we manually screened the cited articles of previous meta-analyses, cohort studies, and review articles to identify any relevant studies.

Study selection

All studies were included if they met the following eligibility criteria: (a) articles on determinants of work-related musculoskeletal disorders; (b) independent variables influencing work-related musculoskeletal disorders; and (c) respondents were

nurse with work-related musculoskeletal disorders. Furthermore, the strategy for research was PECOS: 1) P (population): nurse with work-related musculoskeletal disorders; 2) E (exposure): work-related musculoskeletal disorders such as low back pai, neck pain, upper extremities pain, etc; 3) C (control): nurse with no work-related musculoskeletal disorders; 4) O (outcome): non-adherence of anti-diabetic medicatio work-related musculoskeletal disorders n; 5) S (Studies): cross-sectional studies published in English only. Cohorts, case series, case reports, human-based randomized controlled trials, literature reviews, editorials, and studies not meeting the inclusion criteria were excluded.

Data extraction and quality assessment of studies

Two reviewers independently searched the electronic databases. Studies that were searched were exported to EndNote Reference Library software version 20.0.1 (Clarivate Analytics), and duplicates were screened and removed. Data extraction and quality assessment of included studies was performed simultaneously and independently by two reviewers.

Results

The initial search of the three electronic databases yielded 259 potential studies. After exclusions based on titles and abstracts, the full texts of 205 studies were read for possible inclusion. A total of 25 studies remained for quantitative analysis. Figure 1 summarizes the results of our literature search.

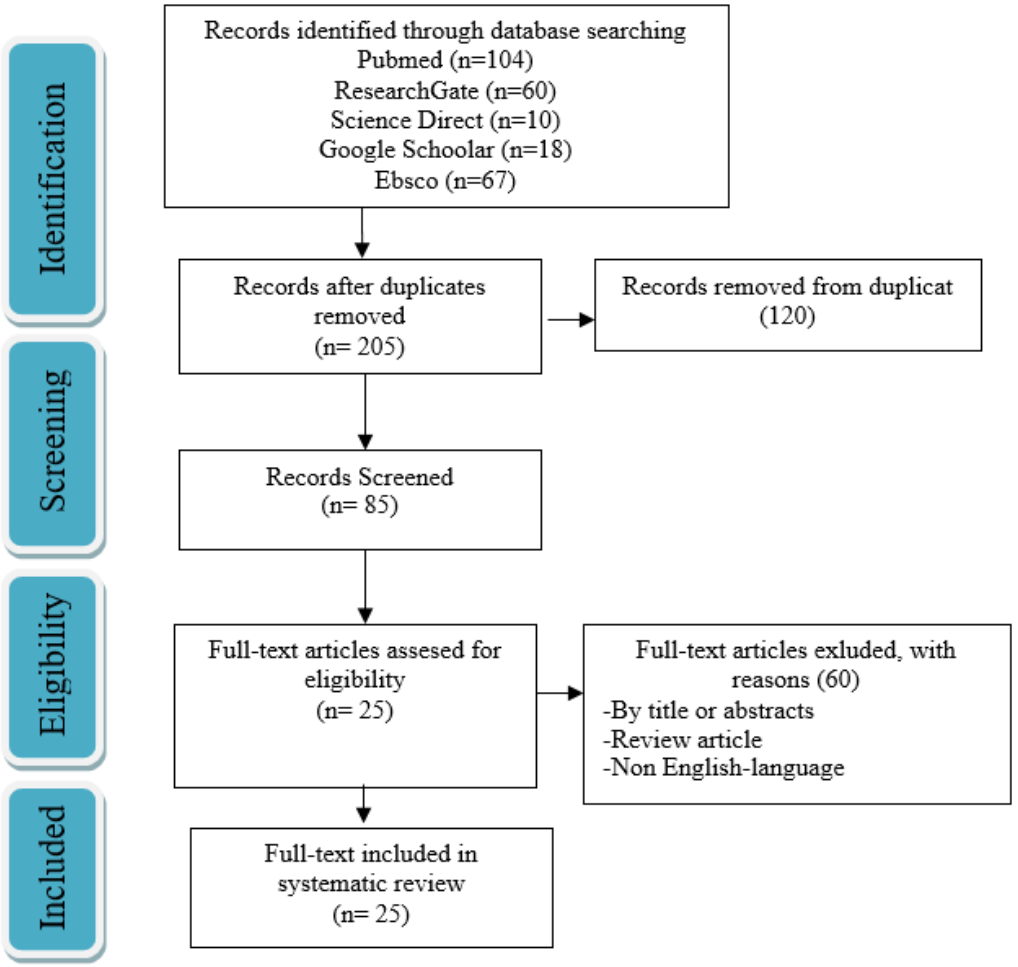

Figure1. PRISMA flow diagram for systematic reviews and meta-analysis which included searches of databases

Study characteristics

Table 1 provides the basic characteristics of the included studies. Our analysis included 25 published studies. All were cross-sectional studies. One study each from South-West Nigeria, Saudi Arabia, Jordania, Australia, Indonesia, Estonia, Malaysia, Italia, Vietnam, Tunisia, Greek, India, Pakistan, Portugal, Slovenia, Turki, and Lebanon. Meanwhile 5 studies come from China, and two studies come from Iran.

Results from review

There are several risk factors that can cause musculoskeletal disorders in nurses. Earlier studies state that female gender is a risk factor for musculoskeletal disorders in nurses (Heidari et al., 2018; Hosseini et al., 2021; Krishnan et al., 2021; Latina et al., 2020; Luan et al., 2018; Passali et al., 2018; Ribeiro et al., 2017; Tugba & Andsoy, 2021; Yang et al., 2019), while study by Akodu &

Ashalejo, (2019) states that gender is not associated with musculoskeletal disorders in nurses.

Studies by (Aleid et al., 2021; Doda et al., 2020; Heidari et al., 2018; Hosseini et al., 2021; Krishnan et al., 2021; Lin et al., 2020; Luan et al., 2018; Raithatha & Mishra, 2016; Ribeiro et al., 2017; Skela-Savič et al., 2017; Tsekoura Maria et al., 2017; Yan et al., 2018) stated that nurses who are older are at risk of developing musculoskeletal disorders. A study by (Aleid et al., 2021; Krishnan et al., 2021) states that a low level of education is a risk factor for the occurrence of musculoskeletal disorders in nurses. Heavy physical workload can also cause musculoskeletal disorders in nurses (Aleid et al., 2021).

According to (Almhdawi et al., 2020; Heidari et al., 2018; Latina et al., 2020; Lin et al., 2020; Passali et al., 2018; Raithatha & Mishra, 2016; Tugba & Andsoy, 2021; Yan et al., 2017; Younan et al., 2019) long work experience can cause musculoskeletal disorders in nurses, while study by (Akodu & Ashalejo, 2019) states that work experience is not associated with musculoskeletal disorders in nurses. Study by (Almhdawi et al., 2020) mentioned several risk factors for musculoskeletal disorders in nurses, namely high workload, poor work habits, ergonomics, manual handling of equipment, stress, anxiety, and high levels of physical activity.

Studies by (Ouni et al., 2020) also agree that high levels of physical activity can cause musculoskeletal disorders in nurses. Study by (Freimann et al., 2016) states that stress, burnout and sleep problems are risk factors for musculoskeletal disorders in nurses. Studies by (Amin et al., 2020; Raithatha & Mishra, 2016)mention that high demand for physical work can cause musculoskeletal disorders in nurses. An uncomfortable working position can also cause musculoskeletal disorders in nurses (Doda et al., 2020; Ouni et al., 2020; Rathore et al., 2017).

Unmarried nurses are also more prone to developing musculoskeletal disorders than those who are already (Heidari et al., 2018; Rathore et al., 2017; Yang et al., 2019). Nursing as a permanent job is also a risk factor for musculoskeletal disorders in nurses (Hosseini et al., 2021; Krishnan et al., 2021). Studies by (Aleid et al., 2021; Krishnan et al., 2021; Latina et al., 2020; Passali et al., 2018; Raithatha & Mishra, 2016; Ribeiro et al., 2017) stated that BMI is a risk factor for the occurrence of musculoskeletal disorders in nurses. The place of work unit also affects the occurrence of musculoskeletal disorders in nurses (Lin et al., 2020; Yan et al., 2017, 2018; Younan et al., 2019).

Studies by (Lin et al., 2020; Luan et al., 2018; Tugba & Andsoy, 2021) stated that the duration of work in a day is a risk factor for musculoskeletal disorders in nurses, as well as studies by 12 stated that the frequency of working in a week is a risk factor for musculoskeletal disorders in nurses. Study by (Akodu & Ashalejo, 2019) explained that there was no relationship between duration of work and musculoskeletal disorders in nurses.

Long standing time, often lifting heavy weights, and the presence of injuries to the waist are risk factors for musculoskeletal disorders in nurses (Aleid et al., 2021;

Ouni et al., 2020; Passali et al., 2018). The frequency of physical exercise also affects the presence of musculoskeletal disorders in nurses (Ribeiro et al., 2017; Yao et al., 2019). The study by (Skela-Savič et al., 2017) explained that the number of nurses per shift can affect the incidence of musculoskeletal disorders in nurses. The presence of a night shift is also a risk factor for musculoskeletal disorders in nurses (Tugba & Andsoy, 2021; Yan et al., 2017, 2018; Yao et al., 2019). The study by (Yang et al., 2020) explained that physical factors can affect the presence of musculoskeletal disorders in nurses.

Discussion

This study involved twenty-five primary research articles from several countries in the world. There are several types of risk factors that can cause musculoskeletal disorders in nurses, namely:

1. Gender

Gender is a potentially significant risk factor for knee and ankle symptoms. Female nurses are more likely to develop these symptoms than their male counterparts.

2. Age

Many similar studies suggest that nurses between the ages of 31 and 40 are particularly vulnerable to developing musculoskeletal disorders. Attar, (2014) found that musculoskeletal disorders were very common among nurses aged over 30 years unlike nurses aged less than 30 years. This may also be due to the differences in the tasks and procedures assigned to nurses in different clinical settings.

3. Education Level

Research by Aleid, Eid Elshnawie and Ammar, (2021) and Krishnan, Raju and Shawkataly, (2021) explains that there is an influence between education level and musculoskeletal disorders among nurses. This may be based on the fact that nurses who have more knowledge can take preventive measures against musculoskeletal disorders.

4. Long Work Experience

Almhdawi et al., (2020), Heidari, Borujeni and Khosravizad, (2018), Latina et al., (2020), Lin et al., (2020), Passali et al., (2018), Raithatha and Mishra, (2016), Tugba and Andsoy, (2021), Yan et al., (2017), and Younan et al., (2019) explain that long work experience has a major influence on the occurrence of musculoskeletal disorders among nurses.

The high number of jobs carried out by nurses also increases the risk of musculoskeletal disorders among nurses.

6. Number of Nurses per Shift

Studies by show that the likelihood of developing WMSDs among nurses who treat 1-2 patients is 1.69 times higher than that of nurses who treat 5-7 patients. This may be because the nurse-to-patient ratio of 1-2 is usually in the intensive care unit where the patient is fully bedridden and the physical burden is higher than in the regular unit which usually has a nurse-to-patient ratio of 5-7 (Younan et al. , 2018).

7. Night Shift

Lack of sleep during the night shift leads to an increased incidence of WMSD. Staying up late causes a variety of damage to the body, including a range of

symptoms such as fatigue, lack of energy and a compromised immune system (Buxton et al., 2012).

8. High Physical Activity Level and Physical Workload

High levels of physical activity were significantly associated with increased levels of musculoskeletal disorders compared to low levels of physical activity. This is supported by previous research, namely research by Naidoo and Coopoo Y (2007).

9. Manual Handling of Equipment

Wang et al., (2011) reported that manual patient handling might explain the increased rate of WMSDs among nurses.

10. Stress and Anxiety

A study by Mann and Cowburn (2005) states that nurses are one of the professions that often report high emotional distress. This may be caused by a work environment with high stress (Humpel and Caputi, 2001). Sukadarin et al., (2014) reported that 35.9% of nurses were at high stress levels. A study based in Hong Kong showed that the overall prevalence of depression, anxiety and stress among nurses was 35.8%, 37.3%, and 41.1% 524 respectively (Cheung and Yip, 2015). Hegney et al., (2014). reported that 11.4%, 15.2% and 13.6% of Australian nurses suffered from stress, anxiety and depression respectively.

11. Worked in any Specific Unit or Department

Nurses working in the Emergency Unit showed the highest prevalence of WMSDs, followed by nurses working in the Supply Room, Surgery Department, and Anesthesia Section. In the Emergency Department, nurses are often involved in lifting and pushing in clinical practice. In addition, these people are exposed to long-term high stress, which can lead to WMSDs. For individuals in the Supply Room, they often engage in long-term standing, keep their heads down constantly, and frequently move around medical facilities. For nurses in the operating room, the workload on local muscles increases in static conditions, which can cause disturbances in blood circulation. Muscle and bone fatigue due to frequent lifting and pushing is an important risk factor for low back pain in nurses. Simultaneously, long-term high pressure and rapid work frequency can cause severe muscle injury (Yan et al., 2017).

12. Duration of work in a day and frequency of work in a week

Working time of 50 hours per week and daily working time of 8.5 hours are considered as risk factors for WMSDs (Yan et al., 2017).

13. Long Standing Period

Standing for long periods of time can cause musculoskeletal disorders.

14. Lifting Heavy Weights

Lifting objects over 35 pounds is a predictor of increased WMSDs among healthcare providers.

15. Lack of Physical Exercise

Physical exercise can improve the body's sensitivity and muscle coordination, and the speed of response and effective action of the human brain. It can also effectively delay age-related declines in muscle strength. Proper physical exercise can effectively reduce the prevalence of low back pain (LBP) in treating workers and act as a protective factor for LBP . The study by Yao et al., (2019) stated that the prevalence of WMSD was lower in nurses who regularly did physical exercise compared to those who did not exercise enough.

Conclusion

Our study concludes that there are several risk factors that can lead to musculoskeletal disorders among nurses, namely female gender, old age, low education level, physical workload, long work experience, high workload, poor work habits, level of physical activity, high levels of stress, anxiety, high demand for physical work, uncomfortable work position, sleep problems, burnout due to work (burnout), marital status, BMI, workplace unit, long duration of work, frequency of working time, prolonged standing time long hours, lifting heavy weights, lack of physical exercise, low number of nurses per shift, and night shifts. This study highlighted the factors that we need to consider while developing health promotion activities. Further, health literacy, counseling and education program need to be develop in both clinical and community settings.

Conflict of Interest Statement

No competing interests are declared by the authors of this article.

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Ethical Approval

Not needed.

Author contribution

Aris Widiyanto is the main researcher who chooses the topic, searches for and collects research data. Agusta Dian Ellina and Yuly Peristiowati examines research documents.

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Table 1
Basic characters of studies included

No	Author (year)	Country	Study design	Sample	Outcome
1.	Akodu and Ashalejo, (2019)	South-West Nigeria	Cross-sectional	Nurses in general	Gender Hours of work in a day Work experience Age
2.	Aleid, Eid Elshnawie and Ammar, (2021)	Saudi Arabia	A descriptive cross-sectional	Nurses in ICU	Education level Heavy physical workload BMI Long standing time Work experience
3.	Almhdawi et al., (2020)	Jordania	Cross-sectional	Nurses in general	High number of work Ergonomic Equipment handling High level of physical activity
4.	Amin et al., (2020)	Australia	Cross-sectional	Nurses in general	Stress Anxiety Physical work requests
5.	Doda et al., (2020)	Indonesia	Cross-sectional	Nurses in emergency unit	Age Uncomfortable position
6.	Freimann, Pääsuke and Merisalu, (2016)	Estonia	Cross-sectional	Nurses in general	Stress Sleep problems Burnout
7.	Heidari, Borujeni and Khosravizad, (2018)	Iran	Cross-sectional	Nurses in general	Gender Age Working experience Marital status
8.	Hosseini et al., (2021)	Iran	Cross-sectional	Nurses in general	Gender Age Work tenure
9.	Krishnan, Raju and Shawkataly, (2021)	Malaysia	Cross-sectional	Nurses in general	Gender Usia Level pendidikan

10.	Latina et al., (2020)	Italia	Cross-sectional	Nurses in general	Pekerjaan tetap BMI Age Education level Work tenure
11.	Lin et al., (2020)	China	Cross-sectional	Nurses in general	BMI Age Work experience Working units Hours of work in a day
12.	Luan et al., (2018)	Vietnam	Cross-sectional	Nurses in general	Gender Usia Durasi bekerja dalam sehari Frekuensi bekerja dalam seminggu Gender
13.	Ouni et al., (2020)	Tunisia	Descriptive-correlational	Nurses in general	Age Hours of work in a day Frequency of work in a week High level of physical activity Uncomfortable position Standing time Lifting heavy weights
14.	Passali et al., (2018)	Greek	Cross-sectional	Nurses in general	Gender Work experience BMI Lifting heavy weights Waist injury
15.	Raithatha and Mishra, (2016)	India	Cross-sectional	Nurses in general	Age Work experience Physical work requests
16.	Rathore, Attique and Asmaa, (2017)	Pakistan	Cross-sectional	Nurses in general	BMI Uncomfortable position Marital status
17	Ribeiro, Serranheira and Loureiro,(	Portugal	Cross-sectional	Nurses in primary	Gender

	2017)			care	Age BMI Physical training
18.	Skela-Savič, Pesjak and Hvalič-Touzery, (2017)	Slovenia	Cross-sectional	Nurses in general	Age Number of nurses in one work shift Gender
19.	Tugba and Andsoy, (2021)	Turki	Cross-sectional	Nurses in surgery unit	Age Work experience Hours of work in a day Night shift
20.	Yao et al., (2019)		Cross-sectional	Nurses in general	Physical training Night shift
21.	Yang et al., (2019)	China	Cross-sectional	Nurses in ICU	Gender Marital status
22.	Yang et al., (2020)	China	Cross-sectional	Nurses in ICU	Physical factor
23.	Yan et al., (2017)	China	Cross-sectional	Nurses in general	Work experience
24.	Yan et al., (2018)	China	Cross-sectional	Nurses in general	Age Working units
25.	Younan et al., (2019)	Lebanon	Cross-sectional	Nurses in general	Work experience Working units Night shift