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INDIVIDUAL AND ERGONOMIC RISK FACTORS FOR MUSCULOSKELETAL DISORDERS AMONG HEALTH WORKERS IN INDONESIA: A LITERATURE REVIEW

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Abstract

Musculoskeletal disorders (MSDs) affect approximately 1.71 billion people globally, impacting individuals of all ages. The prevalence of MSDs varies by diagnosis and age, and more than 80% of cases occur among healthcare professionals, who are mainly at risk due to their daily work activities. This study aims to identify the individual and ergonomic factors associated with work-related musculoskeletal disorders among health workers in Indonesia. A scoping review focused on scientific journals published between January 2023 and June 2024. The research identified ten studies that met the inclusion criteria set by the authors. The findings indicate that individual risk factors include age and gender, while ergonomic risk factors encompass years of work, workload, work positions, work attitude, and working posture. To mitigate the risk of MSDs, health workers should be mindful of their body positions and take advantage of rest periods to recover, ensuring they can continue working effectively.

Keywords: Ergonomic, Health Worker, Individual, Risk, Musculoskeletal Disorders

Introduction

Musculoskeletal disorders are the primary cause of disability globally, with low back pain being the leading cause of disability in 160 countries. These conditions severely restrict mobility and dexterity, often resulting in early retirement, decreased well-being, and diminished capacity to engage in societal activities (1). Due to population growth and aging, approximately 1.71 billion people globally are affected by musculoskeletal conditions. These disorders impact individuals of all ages, though prevalence varies by diagnosis and age. High-income countries have the highest number of affected individuals, with 441 million cases, followed by the WHO Western Pacific Region with 427 million cases, and South-East Asian countries with 369 million cases (2).

A recent review of data from the Global Burden of Disease (GBD) 2019 study indicates that 1.71 billion individuals worldwide suffer from musculoskeletal disorders. These conditions encompass osteoarthritis, rheumatoid arthritis, fractures, various injuries, low back pain, and neck pain (3). Although the incidence of musculoskeletal disorders increases with age, occupation, and workload, both young and old individuals are susceptible, often during their peak earning years. These disorders not only elevate the risk of developing other noncommunicable diseases, such as cardiovascular disease, but they also frequently coexist with these conditions (4).

Musculoskeletal disorders are a complaint on the area of skeletal muscle. One can experience complaints of skeletal muscles, both light and heavy. During prolonged static loads on muscles can cause damage to ligaments, joints, tendons, muscles, nerves, cartilago, and intervertebral (5).

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Hundreds of millions of people in various health sectors are affected by musculoskeletal disorders (MSDs), which are widely recognized as some of the most notorious and common causes of severe long-term pain and physical disability (6). A conditions or injuries affecting the musculoskeletal system, which includes the muscles, tendons, ligaments, discs, and nerves, is known as musculoskeletal disorders (MSDs), when these conditions get worse, they could have a negative impact on ones physical and mental well-being as well as have significant financial repercussions (7).

In Indonesia, the prevalence of musculoskeletal disorders (MSDs) is 11.9% based on diagnoses made by health workers, and 24.7% based on diagnoses or reported symptoms (8,9). Health workers are also at risk of sustaining MSDs during their daily work. More than 80% of cases of musculoskeletal disorders have been among health workers such as physiotherapists, nurses, midwives, dentists, and surgeons. Many studies highlighted the use of recurrent, often static, bad postures, especially among surgeons and physiotherapists (10). Compared to other industries, the healthcare sector has a significantly higher incidence of occupational injuries, with 8.1% of cases being work-related disorders or injuries. Approximately half of midwives' sick leave absences are related to ergonomic issues, specifically musculoskeletal disorders (11). Health-related issues, particularly musculoskeletal disorders (MSDs), significantly impact employee well-being and the economy. In health workers, MSDs can also affect patient safety and care, impose functional limits, influence long-term career planning, and hinder performance at both individual and team levels (12). Health workers spend most of their time in unergonomic positions, leading to significant muscle pain, particularly in the neck, shoulders, back, and wrists. According to numerous studies, over 80% of health workers at risk experience considerable pain during surgery. The risk of musculoskeletal disorders from work is consistently higher among health workers compared to other professions (13).

Musculoskeletal disorders can arise from both individual and ergonomic factors. Individual factors include age, gender, Body Mass Index (BMI), and overall physical condition. Ergonomic factors encompass work posture, workload, repetitive tasks, body mechanics, duration of work periods, work attitude, and workstation setup (14–16). Health workers with high demands of physical work, they have to move patients, handle heavy objects, stand for long periods of time, repeatedly make movements, and take uncomfortable positions (17). Predisposing variables, such as working or sitting in uncomfortable positions for extended periods of time, overly strained working movements or positions, numerous repetitive movements, and psychosocial pressures, have been linked to the advancement of the condition (18). Body postures, repetitive work movements, material handling, mechanical compression, vibration, extreme temperatures, noise, inadequate lighting, and excessive exposure are some of the risk factors for musculoskeletal disorders. In addition, age, working hours, working postures, and working hours can also affect the occurrence of MSDs at work (19,20).

Health and safety at work is a very important element to be observed and applied during work as workers who experience pain at work will have consequences for themselves, their families, and the environment (21). In order to meet the goals of national health development, health professionals an important role in providing health services to society (22). The workforce in the health sector has various risks of danger if left to result in workplace accidents and illnesses (23). The purpose of this study is to identify related risk factors association with musculoskeletal disorders in health workers. Therefore, it is important to know the risk factors that cause MSDs in health professionals to prevent this.

Method

This scoping review will utilize a five-stage method, incorporating recent advancements in the field (24). Article selection process is presented (Figure 1).

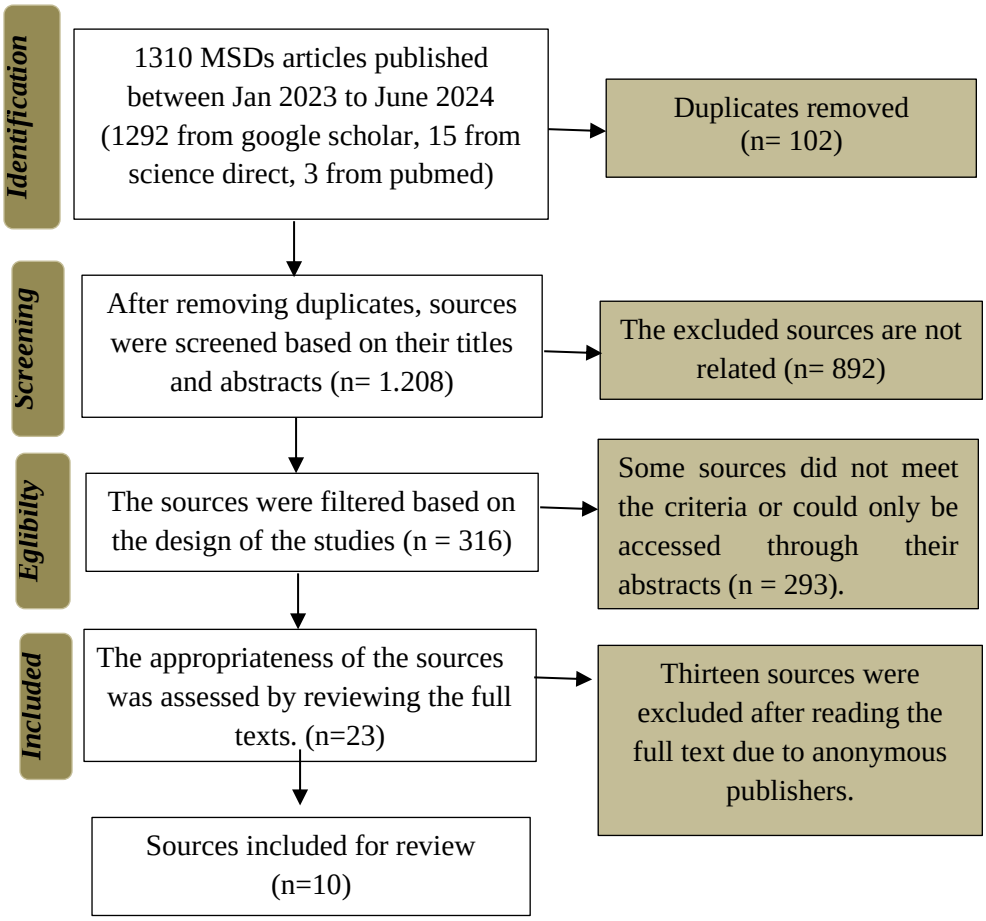

Figure 1. Modified from PRISMA flow diagram for article selection

Step 1: The researchers formulated the research question "What are the individual and ergonomic factors associated with musculoskeletal disorders among health workers in Indonesia?" to guide the study objectives. Step 2: Relevant studies were identified using databases such as Google Scholar (1292 articles), ScienceDirect (15 articles), and PubMed (3 articles). Keywords in English and Indonesian were used to search for studies related to individual factors, ergonomics, musculoskeletal disorders, health workers, and Indonesia. Step 3: Studies were selected based on inclusion criteria, including recent publication dates (January 2023 to June 2024), open access and full-text availability in English or Indonesian, and original research using specified study designs. Exclusion criteria included literature reviews, systematic reviews, studies lacking full-text availability, and those not adhering to the PRISMA model. Step 4: Data extraction will involve capturing variables such as author, publication year, study location, research design, objectives, and findings. Step 5: The results will be collated, summarized, and reported narratively based on the findings of the studies reviewed.

Result

The research identified 10 studies that met the inclusion criteria set by the author and aligned with the topic of musculoskeletal disorders among health workers in Indonesia. The sampling technique and results are summarized in Table 1.

Table 1. Characteristics of the studies

Author	Study Design	Sampel, Results
(25)	Cross sectional	The result of this research were the gender characteristics of 67 female nurses (78%) and 19 male nurses (22%). Characteristics of nurses with the musculoskeletal disorders there are with a female nurse (78%) (p–value= 0,000), a nurse aged 27-35 (55%) (p–value= 0,000).
(26)	Cross sectional	The sample number was 147 respondents. The results of the study stated that there was a relationship between workload and neck pain (p-value= 0,001) and lower back pain (p-value: 0,02) with the musculoskeletal disorders among physiotherapists in hospitals in the East Java region.
(14)	Case control	The sample involved in this study was 144 nurses, consisting of 72 people as case samples and 72 people as control samples. Based on the results of the study, it was found that the older nurses 36-50 years (p-value= 0,045) and long working years tended to experience (p-value= 0,006), as well as nurses who worked in positions work (p-value= 0,003) were related to musculoskeletal disorders (MSDs).
(27)	Cross sectional	The total sample in this study is 53 nurses. The results obtained from this study are that there is a relationship between working attitude and musculoskeletal disorders (p- value= 0,011 < 0,05).
(11)	Cross sectional	The sample in this study was 51 midwives. The results show that workload has a direct effect on performance through Musculoskeletal Disorders (MSDs) (p-value= 0,001) for midwives.
(28)	Cross sectional	The sample consisted of six dentist. The results of the observation of the cause of MSDs complaints in the dentist are due to poor posture when working with the duration carried out within a period of time.
(29)	Cross sectional	Total sample of 32 dentistry. There is a relationship between work attitude (p-value= 0,000) with musculoskeletal disorder in the dental health staff at the dental clinic in Setiabudi district of Bandung.
(30)	Cross sectional	The sample in this study is 20 nurses. According to research, there is a relationship between age (p-value= 0,000) with musculoskeletal complaints in nurses at District Health Center of Balowerti.
(31)	Cross sectional	The sample in this study consisted of 180 midwives at the Karawang district health center. The results show that posture of working (p-value= <0,001; OR=4,149) are related to MSDS. That means a person with a risk posture of working will be 4,149 times more likely to develop MSDs than a person who has a non-risk posture of working.
(32)	Cross sectional	The study population of 134 nurses. Gender, employment duration p-value= <0,001) have a strong correlation with MSDs among nurses in the Dr Soedarso Regional Hospital (DSRH).

According to the research findings presented in Table 1, the sample of health workers included nurses, midwives, doctors, dentists, dentistry staff, and physiotherapists. Individual risk factors identified were age and gender, while ergonomic risk factors included years of work, workload, work positions, work attitude, and posture, all correlating with musculoskeletal disorders among health workers in Indonesia.

Discussion

Based on the scoping review results there were 3 articles shows the aged is a significant factors to contribute musculoskeletal disorders (14,25,30). A study conducted (30) on nurses showed that there is a relationship between age and musculoskeletal disorders that age productively affects in the working process. The older get the degeneration that affects the lack of stability and strength of the bones, muscles, so the higher the risk of musculoskeletal disorders, nurses with age. Age is the most common age factor that causes musculoskeletal disorders (33). Musculoskeletal disorders first appear at the earliest working age, between 25 and 65, and the most common complaint appears at the age of 35. Because in middle age, muscle capacity and stamina begin to decline, so the risk of muscle grievances increases (34). Musculoskeletal disorders usually begin to appear at the working age, between 30 and 65. The first complaint usually appears at the age of 35, and continues to increase as you get older. It is caused by a decrease in muscle strength and endurance, which increases the risk of muscle complaints. The body changes with age, and the intervertebral discus is one of the earliest parts of the body to change. At the age of fifteen to twenty, the blood supply directly to the disc stops giving blood to the disk. The maximum muscle strength occurs between the ages of 20-29 years, then continues to decrease as it increases. By the age of 60 years, the rate of muscular strength decreases to 20% (35). By the time the strength of the muscle begins to decline, the risk of musculoskeletal disorders is increased (36). A study showed that there was a correlation between age and musculoskeletal disorders, as workers aged between 56 and 65 had a higher risk of developing musculoskeletal disorders (37).

According to the scoping review results gender is the main female health workers have more risk factors to musculoskeletal disorders (25,32). In previous studies, it was found that women experience musculoskeletal disorders more often than men, with (r: 0,379; $p < 0,05$; p-value = 0,010). Up to the age of 60, men and women are equally likely to experience waist pain, however, the gender of a person can affect the likelihood of the onset of these complaints, because in women these grievances occur more often during the menstrual cycle, and the menopausal process, in which the hormone estrogen decreases, can cause waist pain to get worse, the ratio of muscle strength between men and women is 3:1, physiologically women's muscle capabilities are lower than men's (38). The decrease in mobility is caused by increased physical stress after a certain period of time. Meanwhile, the gender of the health workers both women and men have the same risk of experiencing MSDs complaints. The study was a association between gender and musculoskeletal disorders. Because women's muscles are shorter than men's, female muscle strength is only about two-thirds the strength of male muscles. As a result, the sex has muscle problems physiologically compared to men because the male muscle ability is stronger (14).

Another factors associated with musculoskeletal disorders is years of work in 3 studies (14,28,32) Years of work is the amount of work activity a person performs over a long period of time. When the activity is done continuously, it can interfere with the body, the amount of work activity performed over a certain period of time, usually marked by years, months, weeks, or days, is called working time, the body will be disturbed if this activity continues (39). There's a relationship between nursing time and musculoskeletal disorder (MSDs) with p-value= $0,006 < \alpha$ (0,05), the analysis resulted in an OR=2,749, which means that nurses with long working hours have a 2,749 times greater risk of developing MSDs compared to nursing with new working hours, that nursing who have worked for more than 4 years are at risk of MSDs 2,749 times (14). Pain in muscles, tendons, and bones can be caused by static pressure on the muscles for a long time (33). Working time is the length of time a person works from the first entry to the time research is carried out. Physical stress over a certain period of time can lead to a decrease in muscle performance by causing symptoms of low movement, the musculoskeletal disorders increases with the length of work, because working time is the amount of time spent by a worker since the beginning of the working day, years of work have a

significant correlation with muscle complaints and can also increase the risk of MSDs, especially in jobs that require a lot of effort or workload (40). Previous studies showed a significant correlation between working time and musculoskeletal disorders, at the time of the study, respondents who were under the age of five with physical health complaints could only work 40 to 50 hours a week. More than that, there is a tendency that bad things will happen, unwanted things are more likely to happen with longer working hours (41).

The results of two studies indicate that there is a relationship between musculoskeletal disorders with workload (11,26). Workload is the result of work volume times usual time, which determines how much work a position or organizational unit must do. If an employee's skills exceed what is required of them, boredom will set in. On the other hand, weariness will increase if an employee's abilities are insufficient to meet the demands of the job. As a result, it is critical to consider how the workload is divided fairly and in line with employee capabilities (42). Research by Hilda, 2024 (26) to physiotherapist, the results of statistical analysis of the variable workload size showed p-value= 0,023< 0,05 which means that the workload has a relationship to lower back pain or risk of MSDs in physiotherapists at hospitals in eastern Java region. Workload effect on musculoskeletal disorders, and the study found that most respondents reported working for 21 to 30 minutes on average, and that most respondents had at least 20 patients in their condition and that most respondents had assistants in their work (43). If the work activity is done repeatedly, then it can be called repetitive, the nerve receptor can suffer from pain due to repetitive activity, rapid movements, and heavy loads. Muscle damage occurs when the muscle receives pressure due to constant workloads without allowing the muscles to relax (44). Repeated movements occurring at frequencies of thirty times per minute and more than twice per minute for body parts such as shoulders, necks, back, and legs can pose risks to hand and wrist positions. Statistical tests revealed a p-value of 0.000, which is less than the significance level of 0.05, indicating a direct influence of workload on performance (11). The research findings align with the observation that respondents who perceive their workload positively tend to exhibit better performance. Conversely, those with negative perceptions of workload also tend to show poorer performance. The research results indicate a p-value of 0.012, suggesting a significant relationship between workload and midwife performance (45,46).

A scoping review (14) showed position work is the risk factors of musculoskeletal disorders. The results showed a relationship between a nurse's position work and a Musculoskeletal Disorder (MSDs) complaint in the hospital room of the Langsa General Hospital with a p value = 0,003 < α (0,05), nurses who work in risk positions are 2,966 times more likely to have MSDs than nurses working in low-risk positions. Nurses with an inadequate position at work while providing medical services have a significant relationship between their work and musculoskeletal disorders. Position work is related with work attitude, work attitude or position can cause fatigue and injury to the muscles.

The research by (27) there is a relationship between work attitude and musculoskeletal disorders (p-value = 0,011 <0,05) and r-value 0.346, in line with research by (29) there is a association between working attitude (p-value = 0,000 <0,05) and musculoskeletal disorders in dental health at the dental clinic in Setiabudi district of Bandung. A working attitude that causes a part of the body to move from its natural position is called an unnatural work attitude. For example, when performing hand movements, the risk of musculoskeletal disorders increases with the distance of body parts from the body's center of gravity (47). When working, there are three positions of the body: sitting, standing, and bending, the most commonly used standing or bending positions are when sewing wounds, infusion installation, and blood collection. Infusion, wound treatment, and wound sewing lasts five to ten minutes, while blood collection lasts longer, the principle of work attitude and position work is a natural way of working and does not excessively direct muscles (38). This is in line with (48), which states that unnatural working attitudes such as overly bent backs, elevated hand

movements, and other risks of skeletal muscle complaints increase with partial distance from the body's center of gravity. Because of the demanding nature of the job, this job perspective is generally not natural. In doing working or service, health workers usually stand, sit, bend, squat, walk, and so on. The current working system determines the perspective of this work. If unhealthy working system conditions will lead to work accidents because employees do unsafe work. The risk of injury to the musculoskeletal system increases due to an inappropriate, awkward, and unusual way of working (1,49).

Posture of working have a relationship with the musculoskeletal disorders in the health workers, studies by (28) have a results the cause of neck pain complaints in the dentist are due to poor posture when working with the duration carried out within a period of time. The research by (31) results show that posture of working is related to MSDS (p-value = 0,0001 <0,05) obtained OR = 4.149, which means that a person with risky posture of working will have a 4.149 times greater chance of experiencing MSDs. The results of this study are consistent with previous studies of steel and steel workers, there is a correlation (r=0,401) between posture of working risk and musculoskeletal disorders (50). Other studies conducted on tempe workers also showed consistent results, which indicated that there was a significant relationship (p-value=0,033) between posture of working and musculoskeletal disorders (49). Body position significantly impacts the body, with bending positions causing discomfort in the head, eyes, and neck. Four individuals with scores between 5 and 6 indicated a need for future improvement in their work posture, while two individuals with higher scores required immediate improvement. In ergonomics, proper movement and posture are critical to prevent injuries caused by localized mechanical stress on muscles, ligaments, and joints. Such stress can lead to injuries in the neck, spine, shoulders, wrists, and other areas. Even seemingly comfortable postures can become risky when maintained for prolonged periods. Health workers engaged in both sitting and standing jobs may experience problems such as back, neck, and shoulder issues, as well as blood pooling in their legs if proper control is lost (20).

Research measured using RULA worksheets (*Rapid Upper Limb Assessment*) (28,51). A decrease in muscle performance caused by prolonged physical stress causes slow movement. If this pressure accumulates every day for a long time, it will lead to fatigue, both clinical and chronic. The results of this study are in line with previous studies (52) which found that axial neck pain was caused by poor posture and ergonomics, stress, and chronic muscle fatigue. Excessive muscle contractions due to hard work for a long time can cause the muscle to become weak. If blood circulation to the muscles is reduced, the oxygen supply to muscles will decrease, resulting in the accumulation of lactic acid and pain in the upper trapezial muscles. Later, repeated muscle loading in an unhealthy position leads to trauma to soft tissues and nerves (53,54).

According to the *Occupational Safety and Health Administration* (OSHA), there are two ways to reduce the risk of occupational disorders: engineering (for example, the design of work stations and tools) and management engineering, for example, standards and organization of the workplace (33). These preventive steps aim to reduce overexcitement and prevent unnatural work attitudes. Engineering is generally done through the selection of several alternatives as follows: elimination, substitution, partition, ventilation. Then, engineering management is education and training, balanced working time and rest arrangements, intensive surveillance (55).

The WHO launched the Rehabilitation 2030 initiative aimed at preventing musculoskeletal disorders. This initiative seeks to help countries address the anticipated increase in demand for rehabilitation services due to health and demographic trends, while also meeting the current needs of individuals affected by musculoskeletal disorders (2). The WHO is developing a Package of Interventions for Rehabilitation that focuses on addressing a range of musculoskeletal disorders including low back pain, osteoarthritis, rheumatoid arthritis, sarcopenia, fractures of the extremities, and amputation. These interventions are designed to be applicable in low- and middle-resource

contexts and are suitable for individuals at all stages of life, integrated across the continuum of care, and adaptable across various service delivery platforms globally (3).

Health workers has a many of activities to perform health services for the community. Health workers measures for patients, patients need care from health workers such as nurses. Health workers are responsible and authorized to provide services independently and to work with their counterparts to carry out health procedures, health workers like nurses, have very flexible responsibilities such as helping doctors, raising, encouraging patients, the poor position will result in musculoskeletal disorders that will interfere with the productivity of work on the services provided to the patient (43,56). Health and occupational safety team at the healthcare provider team can prepare and implement SOP (*Standard Operating Procedure*) about how health workers treat patients when they work and use it as a reference for instruction, besides organizing training related to patient handling activities or ergonomics on health workers, provide an understanding or socialization of the ergonomic work attitude. The health workers can do routine stretching while not dealing with the patient to minimize the occurrence of lower back pain and neck pain related to musculoskeletal disorders that will result in poor health in the future (33).

Conclusion

Based on the results and discussion from the scoping review, several risk factors for musculoskeletal disorders among health workers were identified, including age, gender, years of work, workload, work positions, work attitude, and working posture. Health workers must maintain proper body positions during work to reduce the risk of musculoskeletal disorders, which can adversely affect their performance. Additionally, optimizing rest periods is essential for their bodies to recover and sustain peak performance.

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