

# A Multidisciplinary Focus Review of Musculoskeletal Disorders Among Operating Room Personnel

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**Abstract:** Musculoskeletal disorder is one of the major health issues and is recognized as the second most common occupational disease. The aim of the present study was to investigate the different aspects of musculoskeletal disorders in operating room personnel. The present study was conducted to evaluate the prevalence of MSDs among operating room personnel, in January 2020. In this study, the authors explored 30 articles from five databases including Medline/PubMed, ProQuest, Scopus, Embase, and Google Scholar. The present study found that physical, psychological, and demographic characteristics including age, gender, work experience, and smoking were the most important risk factors for these disorders. Musculoskeletal disorders were also prevalent in different areas of the body, with the highest prevalence being in the lumbar region. In addition, regular exercise and physical activity, the use of stretching and gentle exercise to reduce physical pressure, regard to the principles of ergonomics in the workplace, regular physical examinations, and awareness of the risk factors for these disorders. Therefore, operating room officials need to promote operating room programs focused on reducing musculoskeletal disorders and increase the awareness of the personnel about the risk factors by conducting training courses.

**Keywords:** musculoskeletal disorders, musculoskeletal injuries, operating room

## Introduction

The increasing development of knowledge in human life has increased the speed of work and increased productivity. These advances have also led to complications such as fatigue, stress, and musculoskeletal disorders (MSDs).<sup>1</sup> MSDs are inflammatory and degenerative processes that affect the muscles, tendons, ligaments, joints and peripheral nerves.<sup>2</sup> And they are often caused by repeated and long-term stresses in these tissues.<sup>3</sup> According to the World Health Organization, MSDs are work-related when work activities significantly lead to the development and exacerbation of these disorders.<sup>4</sup> These disorders are the most common and costly occupational injuries, accounting for about 7% of total community diseases, 14% of cases referred to physicians, 19% of hospitalized cases,<sup>5,6</sup> and 32% of total occupational diseases.<sup>7</sup> In addition, MSDs are the most common cause of disability and absenteeism in the Workplace in developing countries.<sup>8</sup> They have also been identified as the second leading cause of disability worldwide.<sup>9</sup> Among the places where people are at risk of injury due to occupational risk factors are health facilities and hospitals where the prevalence of physical injuries including MSDs is high.<sup>10</sup> Health care workers are one of the most important health care providers who are highly exposed to musculoskeletal injuries due to occupational conditions.<sup>7</sup>

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Nurses, which comprise 40% of all hospital staff<sup>9</sup> They are at high risk for these disorders due to occupational status and tasks such as moving patients, lifting equipment and bending for a long time. These have been identified as one of the most important sources of occupational injuries and disabilities in the nursing profession.<sup>11,12</sup> Prevalence of MSDs among nurses in the United States is 53%<sup>13</sup> and in Iran 60–81%.<sup>14</sup> Statistics show that about 7.5% of nurses are absent from work each week due to physical disabilities due to activities or mental exhaustion.<sup>15</sup> Improving nurses' performance leads to increased job satisfaction and mental health, But the lack of mental health indicators and consequently MSDs cause burn-out and ultimately a decline in health care.<sup>16</sup> Operating room nurses are at greater risk of developing MSDs due to specific workplace conditions.<sup>17</sup> Operating room personnel due to static pressures, including prolonged standing, Fixed position, and restriction on movement, or inappropriate physical condition during surgery and perform repetitive tasks for a long time and also dynamic stressors, such as activities that require pushing, pulling, or lifting heavy surgical equipment, are most exposed to MSDs.<sup>18</sup> Therefore, the present study aimed to investigate the factors associated with MSDs in operating room personnel.

## Methods

The present study was conducted to evaluate the prevalence of MSDs among operating room personnel, in January 2020. In this study, the authors explored 30 articles from five databases including Medline/PubMed, ProQuest, Scopus, Embase, and Google Scholar. The selected keywords for databases were classified into two categories as follows: 1- related to operating room personnel (operating room staff, operating room nurses), 2- related to MSDs (musculoskeletal diseases, musculoskeletal pain, and occupational injuries).

## Results

### Risk Factors- Physical Factors

#### Static Stress

Each group of healthcare workers is exposed to various occupational injuries, especially musculoskeletal disorders, due to their specific occupational activities. Among healthcare workers, operating room personnel have a high prevalence of musculoskeletal disorders due to specific work conditions.<sup>19,20</sup> Because operating room personnel are an important member of the surgical team in the operating room, Maintaining and improving their health

will improve service quality, job satisfaction, improve patient and community health and reduce costs.

The cause of musculoskeletal disorders is complex and varied.<sup>21,22</sup> One of the most important causes of these disorders is work-related physical activity.<sup>23,24</sup> Static stress is one of the risk factors that cause musculoskeletal disorders in operating room personnel. Static stress includes activities such as prolonged standing and constant physical posture during surgery and holding equipment such as retractors during surgery. Except for a few surgeries where the surgical team is in a sitting position, in other cases, the team members are in a standing position throughout the surgery.<sup>25,26</sup> Standing up for a long time is one of the most important risk factors for musculoskeletal disorders.<sup>27</sup> Andersen et al found that prolonged standing may increase back pain and leg pain.<sup>28</sup> Movement limitations due to maintaining the sterility of the surgical field and being in a constant position also cause operating room personnel to be at high risk for these disorders. Holding retractors for appropriate exposure in during surgery is one of the common activities of a scrub nurse who can cause musculoskeletal disorders.<sup>29,30</sup>

In view of the foregoing, such activities are the working nature of operating room personnel and avoiding them is inevitable. On the other hand, working with this condition over time can lead to the incidence or aggravate musculoskeletal disorders. Therefore, it is recommended to prevent these disorders by controlling measures such as wearing medical shoes and exercising.

#### Manual Handling Activities

Manual activities are another risk factor for work-related physical activity among operating room personnel.<sup>29,31</sup> Manual activities mean the manual movement and transfer of surgical instruments and devices that require special attention.<sup>28,32</sup> Pulling, pushing or lifting surgical instruments, heavy and specialized surgical equipment and patient displacement are the most common manual activities of operating room personnel.<sup>29,33</sup> Doing these activities in the operating room exposes the person to musculoskeletal disorders. Doing these activities in the operating room exposes the person to musculoskeletal disorders, while doing these activities, pay attention to the principles of ergonomics and apply force to the correct position. Transfer equipment also is used to move instruments and patients, and activities should work together if the equipment is not available.

## Psychosocial Factors

Mental health, like physical health, is nothing more than the absence of disease. Mental disorders, like other occupational injuries, have become more prevalent in recent years. A major part of these mental disorders is due to the stress that is caused by working conditions.<sup>34</sup> Occupational stress is a branch of stress created in the workplace and defined according to the physical and physiological effects of the profession on the individual. These effects can affect one's mental or physical activities.<sup>35</sup> Occupational stress among operating room personnel due to various surgeries and seeing stressful scenes of surgery is common which affects their health.<sup>36,37</sup> It can lead to secondary disorders such as fatigue, muscle pain, and bone problems.<sup>38</sup> In addition to musculoskeletal injuries, these stresses lead to absence from work and increasing displacements,<sup>39</sup> decreased quality of service provided,<sup>40</sup> and increased costs and organizational performance impairment that have become apparent worldwide.<sup>41,42</sup>

Occupational stressors in nurses and operating room personnel can include overtime,<sup>43</sup> low occupational benefits,<sup>44</sup> coping with patients' emotional needs,<sup>45</sup> dealing with dead patients,<sup>46</sup> lack of resources,<sup>47</sup> lack of organizational support,<sup>48</sup> disagreements with managers, colleagues, or doctors, unpleasant experiences in the workplace and family problems.<sup>49</sup> According to the above, operating room personnel are exposed to occupational stress and consequent injuries due to the workplace. Therefore, the ability to adapt to these stresses is crucial to achieving professional success.<sup>50,51</sup> Also by controlling the exacerbations of these conditions such as reducing workloads and communicating effectively in the workplace the secondary effects of these stresses can be reduced.

## Demographic Characteristics

Various studies have shown that demographic characteristics are effective in the occurrence of musculoskeletal disorders. Age, gender, smoking, and work experience are the most important factors in this category.<sup>52</sup>

### Age

One of the important and effective cases in the development of musculoskeletal disorders is the age factor.<sup>19</sup> Increasing age has been identified as a risk factor in the development and exacerbation of these disorders.<sup>53</sup>

Muscle strength continues to increase in early adulthood but decreases in middle age and thereafter. Also with increasing age, fat tissue weight and consequently muscle

and bone density decreased and muscle strength was reduced. In addition, the tensile mechanical strength of the bones, muscles, and joints is also significantly reduced.<sup>54</sup> The peak of musculoskeletal disorders, especially low back pain, is in the third decade of life, with the incidence increasing to 65–60 years and then gradually decreasing.<sup>55</sup>

According to the above, it can be concluded that the exacerbation of age-related musculoskeletal disorders is normal due to physiological and anatomical changes. For this reason, it is recommended to reduce workload as you get older and avoid the risk factors related to physical activity as much as possible.

### Gender

In general, among healthcare workers, the prevalence of musculoskeletal disorders is higher in women than in men.<sup>56–58</sup> About age 40, muscle strength decreases and this decrease is greater in women than in men.<sup>54</sup> The prevalence of musculoskeletal disorders in operating room personnel is higher in women than in men.<sup>27</sup> Women in the operating room are 2.69 times more likely than men to develop musculoskeletal disorders<sup>59</sup> and that is especially increased after menopause in women.<sup>60</sup> A study by Classen et al found that there was a statistically significant difference in the prevalence of musculoskeletal disorders in women with men and women were 1.61 times more likely to have these disorders.<sup>61</sup> According to studies and identification of female gender as a risk factor for musculoskeletal disorders, it is recommended that women pay more attention to the principles of care and preventive factors.

### Work Experience

Another risk factor for musculoskeletal disorders is work experience.<sup>19</sup> Increased work experience as a result of increasing age and increasing workload, identified as a risk factor for musculoskeletal disorders in operating room personnel. Various studies have shown that operating room personnel have been exposed to increased risk factors for increased work experience. Therefore, these disorders are more common in people with more work experience. Operating room personnel are more exposed to these disorders due to operating in a high-risk environment.<sup>27,33</sup> A study by Wiitavaara et al found that nurses and operating room personnel with 10 years or more of work experience a higher prevalence of these disorders than those with less work experience.<sup>57</sup> According to the above, there is a direct relationship between musculoskeletal disorders and work

experience. Therefore, it is recommended that the principle of ergonomics be further adhered to with increasing work experience and prevent further spread of these injuries by awareness of other risk factors associated with these disorders.

### Smoking

Smoking can cause muscle weakness by reducing the amount of oxygen needed by the body.<sup>62</sup> Various studies have suggested the association between smoking and musculoskeletal disorders and their impact on the occurrence of these disorders. Smoking with adverse effects on muscles, tendons, cartilage, and ligaments has been identified as a risk factor for musculoskeletal disorders.<sup>20,63</sup>

From the above-mentioned content, it can be concluded that smoking with oxygen deprivation leads to musculoskeletal disorders. Therefore, it is recommended that smoking needs to minimize to reduce the prevalence of these disorders.

### Prevalence of MSDs in Different Areas

Operating room personnel are most affected by musculoskeletal pain (58–90%) due to difficult working conditions.<sup>20</sup> Musculoskeletal disorders can occur in different parts of the body. The most common areas of involvement include the neck, shoulder, elbows, wrists, and hands, upper and lower back, hip and thighs, knees, ankles, and feet. Among the musculoskeletal disorders, low back pain has the highest prevalence.<sup>53</sup>

This disorder is defined as a pain or discomfort in the space between the 12th rib and the lower gluteal folds,<sup>64,65</sup> It ranks eighth among all physical injuries and is the second most commonly diagnosed in the United States.<sup>66,67</sup> In previous studies, the prevalence of back pain in the upper and lower back was evaluated separately, with reported rates of 46–84%<sup>31,34</sup> and 32.7–54.6%<sup>25,33</sup> for the lower and upper back respectively. In addition to back pain, which was most prevalent in operating room personnel, the discomfort was significant in other areas. Various studies have reported pain and discomfort in the ankles and feet, knees and hip in 55.8–74%, 22–60.5%, and 23.8–52% respectively.<sup>31,33,68</sup> The prevalence of these disorders in the upper limbs was also affected by shoulder, elbow and wrist and hands areas 33–74.3%, 19–52%, and 55.8–74% respectively.<sup>33,68</sup> The high prevalence of these disorders in the upper limbs is related to the physical condition of the personnel in the operating room. Because of the movement of the heavy instruments, the traction required during

surgery and holding retractors have an important role in exacerbating musculoskeletal disorders. Various studies have reported neck discomfort in operating room personnel 38.4%–71.4%.<sup>20,68</sup> Various causes can be involved in this disorder, including prolonged bending and focusing on the surgical area, which may be one of the possible causes of injuries in this area. The above shows that the prevalence of musculoskeletal disorders is high in operating room personnel. This high prevalence indicates that there are many risk factors in the operating room environment. Therefore, can only reduce the prevalence of these disorders by observing the control principles.

### Preventive Methods

According to the evidence, musculoskeletal disorders are responsible for a significant portion of the costs in the healthcare system.<sup>69</sup> The Canadian Occupational Safety and Health Center recommends the use of flooring, Suitable shoes, and ergonomic chairs to prevent prolonged standing risks as an appropriate way to prevent musculoskeletal disorders.<sup>32</sup> Other preventive strategies include regular exercise and physical activity, the use of stretching and gentle exercise to reduce physical pressure,<sup>70</sup> regard to the principles of ergonomics in the workplace, regular physical examinations,<sup>71</sup> yoga,<sup>72</sup> using laterally-tilting operating room tables and friction-reducing devices for patient lateral transfers,<sup>73</sup> and awareness of the risk factors for these disorders.<sup>71</sup> In addition to the above, Karahan and Bayraktar introduced teaching patient transfer techniques as one of the most effective and cost-effective ways to prevent musculoskeletal disorders.<sup>74</sup> In another study, Tamminen-Peter et al revealed that the education scheme can both teaches how to work ergonomically and safely, and applies the basic know-how of the physical load and risk assessment and the ergonomic principles in the prevention of musculoskeletal strain and disorders.<sup>75</sup>

### Conclusion

Due to the difficult working conditions in the operating room, musculoskeletal disorders are common among the personnel in this ward. Since the operating room is called the most sensitive part of any hospital and the so-called heart of the hospital, therefore, special attention needs to paid to personnel working in this ward. Because any disorder to the personnel is not only harmful to them, it will also have many detrimental effects on patients and the health system. Therefore, operating room officials need to promote operating room programs focused on reducing musculoskeletal



disorders and by identification of risk factors, preventive measures, and diagnostic and therapeutic methods, prevent the progression of these disorders. It is also possible to improve the awareness of the operating room personnel about the mentioned cases by conducting training courses, which is considered as an important factor in reducing the prevalence of musculoskeletal disorders.

Operating room officials need to promote operating room programs focused on reducing musculoskeletal disorders and increase the awareness of the personnel about the risk factors by conducting training courses.

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## Disclosure

The authors report no conflict of interests in this work.

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