



Musculoskeletal Disorders: Definition, Causes, Risk Factors, and Prevention

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Musculoskeletal disorders (MSDs)

are injuries in the musculoskeletal system which is also named as “repetitive motion injury” or “repetitive stress injury” or “overuse injury” [1]. These disorders are the most prevalent and costly injuries which effect on suffered people’ life. As MSDs are multifactorial injuries, implementing a multidimensional musculoskeletal health program may be effective [2]. MSDs can arise from a sudden exertion due to lifting a heavy object [3], arising from repetitive strain, from repeated exposure to force, vibration, or awkward posture [4]. MSDs can affect many different parts of the body including shoulders and extremities (arms, legs, feet, and hands) neck, and upper and lower back [5]. Carpal tunnel syndrome, back pain, tension neck syndrome, tendinitis, hand-arm vibration syndrome and epicondylitis, are types of MSDs [4].

The development of Musculoskeletal Disorders:

When a worker is exposed to MSD risk factors, they begin to fatigue which may outruns his/her body’s recovery system that in turn may be resulted in musculoskeletal imbalance And finally over time, leading to musculoskeletal imbalance persists MSDs develop [6] MSDs

can arise from the interaction of *physical risk factors* with *ergonomic risk factors* such as biomechanical load, heavy loads, repetitive motions or from static positions, repetitive heavy loading [7-8], *Individual* factors like gender and obesity) [8-9], psychological factors such as workplace stressors, high job demands, low social support, overall job strain or job dissatisfaction [10-14]. However, *social*, and *occupational factors* such as workplace design, standing, twisting or tension in the body, posture during work repeated motion, or forces needed to perform actions on the job and vibration exposure [4,15-16]. These risk factors can be broken up into two categories: *work-related risk factors* as ergonomic risk factors and *individual-related* risk factors. Thus, the basic cause of MSDs is exposure to MSD risk factors – both work-related risk factors and individual-related risk factors should be considered in controlling MSDs [17].

Work-related risk factors are as following:

High task repetition. Many work tasks and cycles are repetitive naturally, and are managed by hourly or daily work processes and target production and. High task repetition added with other risks factors like high force and/or awkward position,

can be led to MSDs. A profession is considered highly repetitive if the cycle time be 30 seconds or less^[7-8].

Forceful exertions. Many work tasks require high force loading on the human body. Muscle effort is increased in response to high force requirements, increasing associated fatigue which can lead to MSD^[7-8].

Repetitive or sustained awkward postures. Awkward postures place excessive force on joints and overload the muscles and tendons around the effected joints. Joints are most efficient when they operate closest to the mid-range motion of the joint. Risk of MSDs is increased when joints are working outside of this mid-range repetitively or for sustained periods of time without adequate recovery time^[4,15].

Exposure to these risk factors of workplaces puts workers at a higher risk of MSDs. It's obvious that forceful exertions, high task repetition and repetitive/sustained awkward postures -beyond the ability to recovery- fatigue the worker's body and leading to a musculoskeletal imbalance and eventually MSDs. "Thus there is an international near-consensus that MSDs are causally associated to occupational ergonomic stressors like forceful exertions, repetitive motions, unhealthy postures, vibration, and combinations of these high risk factors^[4,15-16].

Individual-related Risk Factors are as following

Poor work practices. Workers who do not practice for keeping body mechanics and using right lifting techniques are more exposed to risk factors of MSDs. These poor practices leading to unnecessary stress on their bodies that increases fatigue and decreases their body's ability to properly recovering^[6].

Poor overall healthy behaviors. Smoking and drinking excessively, being obese, or other unhealthy habits are risk for not only MSDs, but also for other chronic diseases

that may affect their healthy span.

Poor rest and recovery. MSDs develop when fatigue overcome the workers recovery system and causing a musculoskeletal imbalance. Workers who do not get adequate rest and recovery put themselves at higher risk of MSDs^[17].

Poor nutrition, fitness and hydration. Regular physical activity enhances musculoskeletal health in older adults. Emerging evidence reveals that large amounts of rest time increase the loss of skeletal muscle mass (sarcopenia) and physical function with advancing age could prevent this process. Many evidences verified that physical inactivity accelerate sarcopenic muscle loss by inducing skeletal muscle 'anabolic resistance'^[18]. The environment works as an all encompassing variable that will affect sweat rate. During increased environmental heat strain, one must adjust for critical variables, such as temperature regulation, hydration status, and electrolyte levels, as they can contribute to impaired function. In MSDs, it is necessary to make a synergy between physical activity by minimizing sedentary behavior and adequate nutrition^[19].

Inappropriate psychological state. Psychological and physiological factors could predict change in the number of pain sites. Stress, anxiety and other psychosocial problems are risk factors leading to MSDs. These factors, either directly or indirectly, can lead to MSDs^[20].

Exposure to these individually risk factors puts workers at a higher level of MSD risk. Just like workplace risk factors, individually risk factors could be more prevalent when a worker uses poor work practice, has unhealthy habits, not getting adequate rest and recovery and not taking care of their bodies with healthy nutrition and fitness regimen. Human beings are multi-dimensional, so limiting to a singular cause of MSDs will

limit abilities to create a prevention strategy that addresses the multi-dimensional risk factors. Therefore, both workplace risk factors and individually risk factors should be considered ^[21-22].

Prevention: Prevention of MSDs insists upon identification of risk factors, either what reported by workers or what observed in workplaces, or what be measured through using instrument due to MSDs^[23]. WHILE risk factors have been realized, there are several approaches which could be applied to prevent MSDs development. MSD prevention aimed to identify incidence rates of both disorders and exposure to high risk factors^[24].

Some ways to prevent MSDs are as following

Attention to the general health promotion at the workplace. Epidemiological studies have shown that some individually risk factors for MSDs such as smoking, being overweight or poor physical fitness are the same factors as those relating to poor general health. Therefore general health promotion at the workplace might be leading to MSDs prevention ^[25-26].

1- The collaboration of people with expertise in different areas .Previous evidences revealed that collaboration of people with expertise in different issues like engineering, psychology and human relations is advantageous as this allows MSD-related issues to be approached in a global way. However, the involvement and participation of all employees and their representatives is crucial to success in such a holistic approach and, moreover, in creating a culture where ergonomics and the prevention of MSDs is embedded in the process ^[27-28].

2- The recognition of individually risk factors. The recognition of individually risk factors can be useful in providing training, administrative controls, and awareness.

Individually risk factors can impact the probability occurrence of MSDs. These factors vary depending on different study but may include age, gender, smoking, physical activity, strength, anthropometry, previous MSDs, and degenerative joint diseases ^[29].

3- The namely factors intrinsic to the worker and factors unrelated to work.

Besides risk factors related to workplaces, other risk factors contribute to MSDs development The literature review and epidemiological studies have shown that in regard with MSD three sets of risk factors can be considered . The first is **Physical factors** such as sustained or awkward postures, repetition of the same movements, forceful exertions, hand-arm vibration, all-body vibration, mechanical compression, and cold. The second is **psychosocial factors** like work pace, autonomy, monotony, work/ rest cycle, task demands, social support from colleagues and management and job uncertainty. The third one is **individually factors** which are age, gender, professional activities, domestic activities, sport activities, recreational activities, alcohol/tobacco consumption and, previous MSDs^[30].

4- Pay attention to various other risk factors. Both occupational and non-occupational factors could leading to MSDs. In addition to work demands, other aspects of daily life, like sports and housework, may cause physical stresses to the musculoskeletal tissues. The musculoskeletal and peripheral nerve tissues are affected by systemic diseases such as rheumatoid arthritis, gout, lupus, and diabetes. However, risk varies by age, gender, socioeconomic status, and ethnicity and also other suspected risk factors like obesity, smoking, muscle strength and workplace characteristics ^[29].

5- Pay attention to develop of healthy lifestyle. Regular strengthening exercises and stretching can help keep your bones, joints, and muscles strong. It's also essential

to complete everyday activities in safe manners. Furthermore, maintaining healthy posture to prevent back pain, picking up heavy objects in right position, and try to minimize repetitive motions are recommended^[30-31].

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