Review Article

Implications of Ergonomic Health Risks on Workers and Ergonomic Risk Assessment: A Review Study Based on Different Industry Contexts

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Abstract

Ergonomics and health are two disciplines that have a similar emphasis on how individuals interact with their surroundings. Ergonomic health risks can have serious implications for workers, including increased risk of musculoskeletal disorders, such as back pain, tendonitis, and carpal tunnel syndrome. The objective of this review study is to review the implications of ergonomic health risks on workers based on different industry contexts and ergonomic risk assessment. Musculoskeletal diseases were found to be the most commonly reported health outcomes among industrial workers, with the highest frequency among those working in manufacturing, construction, the healthcare sector, and transportation. The prevalence of musculoskeletal disorders was found to be reduced by ergonomic interventions such workstation design and equipment modifications, it also contributes to improving the workforce's health and wellness.

Keywords: Ergonomic health risks, Ergonomic risk assessment, Musculoskeletal disorders, Work related musculoskeletal disorders, Workers

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INTRODUCTION

Ergonomics is an interdisciplinary field that studies how individuals interact with their working environment, in order to create tasks, jobs, and products that are safe, efficient, and comfortable. Ergonomics draws on several disciplines, including physiology, psychology, anthropology, engineering, and design, to comprehend the human body's potentials and constraints and how it interacts with the working environment. According to the Occupational Safety and Health Administration (OSHA), ergonomics is "the science of designing the job to fit the worker, instead of forcing the worker to fit the job" [1].

Ergonomics is important in a wide range of fields, including manufacturing, construction, healthcare, and office work. Implementing good ergonomic practices in these fields can lower the risk of musculoskeletal disorders (MSD) and other health issues, enhance productivity, and promote job satisfaction. A group of diseases known as MSD have implications on the body's joints, muscles, and bones, especially, back pain and carpal tunnel syndrome, are common among workers who perform physically demanding tasks or work in awkward or uncomfortable positions. By designing work environments and equipment to support proper posture and reduce excessive force and repetition, employers can

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help to prevent these disorders and improve the overall health and well-being of their workers. In addition, ergonomic design can improve worker productivity and efficiency by reducing fatigue and discomfort, which can help to improve overall job performance and satisfaction.

Ergonomic health risks can arise when workers are required to perform tasks that are not well-suited to their bodies or the equipment they are using. Work-related musculoskeletal disorders (WMSD) are exacerbated by a number of ergonomic health risk factors in the workplace, including (i) Repetitive tasks: Performing the same task over and over can lead to muscle fatigue and strain; (ii) Poor posture: Working in awkward positions or with poor posture can lead to muscle strain and other MSD; (iii) Forceful movements: Lifting heavy objects or performing tasks that require a lot of force can lead to injuries; (iv) Vibration: Using equipment that vibrates can lead to hand-arm vibration syndrome (HAVS) and other MSD; (v) Poorly designed workstations: Workstations that are not set up properly can lead to ergonomic problems [2].

In order to minimize physical strain and operator fatigue in workers, a study on occupational ergonomics has shown how occupational ergonomics can be integrated with activities related to the Safety, Health, and Environment pillars (including minimizing operator movement between machines and enhancing workplace design) and, as a result of this integration, possibility of achieving zero operator accidents is increased, operator safety, and morale are all improved [3].

A thorough review of various studies with an industrial focus was done among the healthcare, transportation, construction, and manufacturing industries in order to identify the implications of ergonomic health risks on workers based on different industry contexts and ergonomic risk assessment.

ERGONOMICS IN HEALTHCARE INDUSTRY

The healthcare is rigorous, entails long working hours, drawn-out procedures, constant posturing, and MSD are highly prevalent among healthcare workers [4]. In the healthcare industry, ergonomics is used to design medical equipment and procedures in a way that minimizes the risk of injury to patients and healthcare workers. For instance, hospital beds, surgical instruments, and medical imaging equipment may all be designed with ergonomics in consideration. The best practices in terms of the methodologies and approaches necessary to obtain the complete range of user needs, as well as guidance for developers on the issues to consider throughout the design and development of medical equipment, are discussed in a study on the challenge for ergonomics in the development of medical devices [5].

Most WMSD are considered to affect nurses more than any other type of healthcare professionals. Previous studies on MSD in healthcare professionals have found that nurses are disproportionately at risk (over 90%) [6, 7, 8, 9]. The work of the nursing staff is complicated, and they are under a lot of pressure to do a variety of clinical responsibilities in a short time frame. Lifting, stooping, working in uncomfortable positions, hunching over, and repeated actions are some of the most common physical demands of nursing that have been shown to raise the risk of WMSD [10]. According to several studies, the level of the medical facility, job satisfaction, workload, working hours, stress at work, physical work environment and support, physical demands of individual employees, gender, job tenure and lifestyle factors all have an impact on the increased incidence of MSD, which typically affect the neck, shoulders and lower back [11, 12, 13, 14].

The sonographers, dentists and surgeons are the other group of healthcare professionals other than nurses they also reported high rates of WMSD in upper limb body area [15, 16]. The most efficient ways to lessen upper limb work-related pain were found to be to encourage micro breaks throughout lengthy processes and to employ wider, lighter instrument handles. These ergonomics measures helped the sonographers, dentists and surgeons to reduce their pain on upper limb and help to increase their productivity [17].

ERGONOMICS IN TRANSPORTATION INDUSTRY

In the transportation industry, ergonomics is used to design vehicles and transportation systems in a way that maximizes safety and comfort for passengers and operators. This can include everything from designing ergonomic seats and controls in cars and buses to implementing ergonomic workstation layouts and adjusting the lighting and ventilation in a workspace. The health and quality of life of drivers can be significantly impacted by the transportation system's poor working conditions as well as unfavorable traffic circumstances [18]. Workplace ergonomic risk factors, such as poor posture and repeated movements, as well as psychosocial risk factors, such as a high labor demand and job dissatisfaction, can affect the health of the workers [19].

Bus drivers had the highest prevalence of WMSD in the transportation sector [20]. According to many studies on work-related musculoskeletal disorders in bus drivers, a higher number of MSD in the neck, shoulder, back,

thigh and knee areas was found [21, 22, 23]. Another study on bus drivers in the private transportation sector conducted in Brazil, knee and back ergonomic discomfort is more common among bus drivers [24]. Ergonomic work analysis process was applied in that study and several recommendations like adaptation of workstation, changing the driver's routine and doing stretches during work shifts were suggested to reduce the ergonomic discomfort thereby improving their health condition [24].

ERGONOMICS IN CONSTRUCTION INDUSTRY

Construction workers are at a high risk of injuries and illnesses due to the physically demanding nature of their work [25]. Poor ergonomics can exacerbate these risks, leading to decreased productivity and increased healthcare costs. The most major ergonomic risk factors for construction workers include awkward posture while handling jobs, force, and repetition of specific actions, including vibration. Additional ergonomic risk factors include inconvenient stable postures, muscle and tendon contact pressure, and even excessive temperatures [26].

Construction companies can lower the likelihood of illnesses and injuries occurring to their workers by implementing preventive measures into place, which will also increase their productivity and general well-being. Many construction companies have implemented ergonomic interventions to improve the safety and comfort of their workers. This can include a wide range of measures, such as:

- Providing workers with ergonomically designed personal protective equipment (PPE) such as gloves, hard helmets, and safety glasses to prevent injury
- Implementing safe lifting practices and tools to minimize the risk of back injuries
- Providing ergonomic tools and equipment with comfortable handles and grips to reduce strain on the hands and wrists
- Implementing regular breaks and rotation of tasks to reduce the risk of repetitive strain injuries
- Providing training on ergonomics and safe work practices to help workers understand and prevent ergonomic risks

Implementing ergonomic principles on-site is both unique and challenging in the dynamic and hazardous building and construction industry. As a result, there are many regulating elements that may be taken into account while adopting ergonomics and reducing the risk of ergonomic injuries on the building site. To improve ergonomics application in the workplace and lower risk factors, a number of strategies and actions can be used, such as organization training and education, ergonomic tool and machine design. These measures can be carried out through a variety of monitoring channels, including written ergonomics plans, management controls, ergonomic design issues, training and education, and communication [27].

ERGONOMICS IN MANUFACTURING INDUSTRY

MSD are common in today's manufacturing industry and affect a sizable portion of the workforce. These diseases can cause pain, discomfort, and restricted movement by affecting the body's tendons, ligaments, muscles and nerves. Occupational health issues are currently most prevalent in the European Union with WMSD [28]. Enhancing workplace productivity, health, and safety as well as lowering the prevalence of WMSD requires the implementation of ergonomic principles. Some other examples of health risks in the manufacturing industry include exposure to hazardous chemicals, noise-induced hearing loss, and slips, trips, and falls.

In response to the increased incidence of WMSD, the manufacturing sectors have started a number of projects to restructure their workplaces using ergonomic standards. This may therefore result in increased productivity and lower absenteeism. The risk factors for WMSD in the frame assembly workstation of a prominent Portuguese furniture manufacturing facility were explored and WMSD risk was decreased by redesigning the workstation based on the findings of the ergonomic assessment [29]. The findings demonstrated the importance of ergonomic interventions in reducing the physical mismatch between workers and workstations, supporting postural correction, and preventing WMSD. In a review study, the effect of the ergonomic approach in the automobile manufacturing sector was investigated and the findings showed that adding an ergonomic approach to the industrial production system can lower errors and improve manufacturing process quality [30].

ERGONOMIC RISK ASSESSMENT

An ergonomic risk assessment is a systematic evaluation of a task, environment, or system to identify potential ergonomic hazards and risks, and to develop strategies to mitigate those risks. The goal of an ergonomic risk assessment is to prevent injuries and

illnesses, and to improve the safety, comfort, and productivity of workers.

Rapid upper limb assessment (RULA) and Rapid entire body assessment (REBA) are widely used methods to assess the postural ergonomics of the workers and identify potential risks to the musculoskeletal health of workers. A technique for assessing the ergonomics of tasks requiring the use of the upper limbs is called RULA [31]. REBA, in contrast, is a technique for evaluating the ergonomics of tasks that require the use of the full body [32]. Both methods employ a scoring system to assess the likelihood of developing MSD and offer recommendations for changing the workstation to minimize those risks.

Sue Hignett and Lynn McAtamney of Nottingham Hospital in the United Kingdom developed the REBA method, which was then disseminated in 2000 [33]. The advantages of utilizing REBA are that it is cost effective, simple to use, and provides individual scores after assessing each body area [32]. Only a few of the risk factors for MSD, including inappropriate posture, load/force, coupling, and repetitive and immobile tasks, are assessed by REBA [32]. The assessment of forced postures is the primary application of the REBA method. For evaluating repetitive movements, it is not applicable.

The RULA method was developed by McAtamney and Corlett in 1993 with the objective to determine whether workers are exposed to MSD risk factors in the upper extremities while performing their jobs [34]. The RULA method has the following advantages: it may be used with software to be applied, the assessor does not need experience to use it during the observation phase for repeated actions, primarily in the upper limbs [35]. The RULA score can be automatically calculated from snapshots or digital video using computer vision and machine learning techniques, according to a study on the ergonomic risk assessment method [36]. They were able to analyze a variety of worker postures under difficult conditions that are frequently present in real-world working situations, particularly in outdoor workplaces.

CONCLUSION

The disciplines of ergonomics and health are closely related since they both studies how people and their environment interact. The relationship between ergonomics and health can be illustrated through the following measures in different industrial context:

- To prevent musculoskeletal diseases and other injuries among workers, as well as to advance their general health and wellbeing, manufacturing industry create assembly lines with ergonomically adjusted workstations, tools, and equipment.
- To minimize the risk of illnesses and injuries among healthcare workers and to enhance their health and well-being, medical equipment and procedures should be designed according to ergonomic principles, such as adjustable beds and ergonomic surgical instruments.
- To create comfortable, ergonomic seats and controls for their vehicles, such as cars and buses, in order to reduce accidents and advance the health and comfort of both drivers and passengers.
- To make lifting techniques and the use of ergonomic principles on tools and jobs possible for the construction industry in order to reduce accidents and promote health.

Overall, the relationship between ergonomics and health is one of mutual support and enhancement. The health and well-being of those who utilize products, systems, and surroundings can be improved by designing them with the best ergonomics practicable. Employers must apply ergonomic interventions to reduce these risks, including modifying workstations and equipment, offering ergonomic training, and promoting frequent breaks and stretching. In order to detect and resolve potential risk concerns in the workplace, employers can also undertake ergonomic assessments. By resolving ergonomic issues, employers can increase overall productivity, reduce costs related to absenteeism and lost productivity, and protect the health and well-being of their employees.

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