

# Ergonomics in medical science

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## Abstract

**Background:** Ergonomics is the study (or science) of the interaction between humans and their working environment. Musculoskeletal disorders (MSDs) are an increasing health problem in workplaces. This study was aimed to assess the distribution and pattern of musculoskeletal disorders affecting health care professionals. **Material and Method:** This was a survey based observational study, conducted among 132 healthcare professionals of various clinical departments of a tertiary health-care hospital, Government Medical College and Hospital Nagpur. The data was collected on **Sample Health Survey** as given by Canadian Centre for occupational Health and safety. The questionnaire included 46 questions pertaining to Work-related Musculoskeletal Disorders (WMSDs) and its impact on profession life. **Results:** We concluded that Work-related Musculoskeletal Disorders (WMSDs) among medical professionals it was found that 95.5% of individuals working more than 48 hours/week were suffering from some sort of musculoskeletal problems. Low back pain followed by neck pain and foot pain were more common in these individuals. We also found that after shift pain/discomfort, even after taking a week off from work pain/discomfort remained same or decreased, due to pain/discomfort they had taken time off from work, the pain and discomfort interfered life outside work was interfered and individuals had stopped enjoying life outside and even its impact on sleep. Ergonomic strategies should be applied to adapt the workplace to the worker - not vice versa. **Conclusion:** More than 95% of medical professional are suffering from some ailments. Ergonomics is way to design tool, equipments, work station and task to fit the job to the workers and not the workers to the job. Ergonomic strategies should be applied to adapt the workplace to the worker - not vice versa.

**Key Words:** Ergonomics, medical science.

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Received Date: 18/01/2018 Revised Date: 22/02/2018 Accepted Date: 12/03/2018

DOI: <https://doi.org/10.26611/1020532>

## Access this article online

Quick Response Code:	Website: <a href="http://www.medpulse.in">www.medpulse.in</a>
	Accessed Date: 16 March 2018

## INTRODUCTION

Ergonomics is the study (or science) of the interaction between humans and their working environment. In spite of significant advances there is currently considerable interest in ergonomics, Musculoskeletal disorders (MSDs) are an increasing health problem in workplaces. These disorders are a major cause of concern for several reasons: the health problem leading to workers' disability and the lost time from work (WHO, 2003).<sup>3</sup> The role of ergonomics plays a major role in combatting the increasing health related problems in workplaces. For

better understanding of ergonomics, the components of ergonomics have been laid down as

- To optimize system performance while maximizing human wellbeing and operational effectiveness, ergonomics embraces a range of human centered issues relevant to equipment or systems design and training, including
- Body size (anthropometry), motion, and strength capabilities (biomechanics)
- Sensory-motor capabilities—vision, hearing, haptics (force and touch), dexterity
- Cognitive processes and memory (including situational awareness)
- Training and current knowledge relating to equipment, systems, and practices
- Training and current knowledge of medical conditions (including emergency conditions)
- Expectations and cultural stereotypes relating to the operation of equipment
- General health, age, motivation, stress levels, mental fatigue, performance under drug treatment or the effects of alcohol<sup>1</sup>

Work-related Musculoskeletal Disorders (WMSDs) are the musculoskeletal disorders to which the work environment and the performance of work contribute significantly.<sup>4</sup> The World Health Organization (WHO) defines WRMDs as “health problems of the locomotor apparatus, i.e. muscles, tendons, the skeleton, cartilage, ligaments and nerves.” It also notes that WRMDs can be “caused or intensified by work, though often activities such as housework or sports may also be involved”<sup>2</sup> Musculoskeletal Disorders are one of the major occupational health problems in India and estimates have shown that it contributes to about 40% of all costs towards the treatment of work-related injuries.<sup>5</sup> In a study done participants were physician, surgeon and orthopedist , gynecologists ,physiotherapist , otolaryngologist and pediatrician , anesthetist , dermatologists , psychiatrist and radiologist , cardiologist and ophthalmologist , and oncologist showed a high prevalence of low back pain in their study.<sup>10</sup> A systematic review of 65 studies revealed that a high prevalence of upper limb musculoskeletal disorders in dental professionals, nurses, and laboratory technicians.<sup>12</sup> This study compares the types of musculoskeletal disorders and its effect in workplace and also outside work place among different medical professions, the results could be used for targeting relevant ergonomics improvements and interventions to specific groups of medical personnel. Medical professionals have knowledge about prevention strategies against musculoskeletal injuries, they do develop work-related musculoskeletal injuries.<sup>11</sup> Therefore, the need felt to study the prevalence of MSDs among medical

professionals as well as need of ergonomics in their work. There are less number of studies done on medical professionals having work related problems, specialty wise their own set of problems have hardly been addressed in a larger population of medical professionals. There are guidelines lacking to overcome such short falls in workplaces. This is a pilot study done on medical professionals to find out problems at their workplaces, their effect in their professional as well as social life and to lay down guidelines by means of ergonomics to improve their yield as well as overcome their problems at workplace.

### METHOD AND MATERIAL

This was a survey based observational study, conducted among the healthcare professionals of various clinical departments of a tertiary health-care hospital, Government Medical College and Hospital Nagpur. The data was collected on Sample Health Survey as given by Canadian Centre for occupational Health and safety. The questionnaire included 46 questions pertaining to Work-related Musculoskeletal Disorders (WMSDs) and its impact on profession life. The Study population consisted of 132 medical professionals working in various clinical departments including general medicine, general surgery, orthopedic, ENT, Obstetrics and gynecology and pediatrics. Medical professionals with work experience ranging between 3 years to 25 years. Working duration was at least 48 hours/week. The study was done between August 2016 to July 2017. Descriptive analysis was done on various data collected from sample health survey.

### RESULTS

On evaluating the Work-related Musculoskeletal Disorders (WMSDs) among medical professionals it was found that 95.5% of individuals working more than 48 hours/week were suffering from some sort of musculoskeletal problems. Low back pain followed by neck pain and foot pain were more common in these individuals.

**Table 1:** Shows frequency of distribution of musculoskeletal disorders due to work related activities.

Musculoskeleton Problems	Frequency	Percentage
Neck Pain	26	21%
Upper Back Pain	16	13%
Lower Back Pain	41	32%
Shoulder Pain	15	12%
Wrist Pain	13	10%
Foot Pain	15	12%

**Table 2:** Shows distribution of different medical professionals and their WRMSDs

Specialty	Frequency	Most common WRMSDs	Second Most common WRMSDs
General Surgeon	16	Low back pain	Neck pain
Orthopedic Surgeon	12	Low back pain	Upper back pain
Otolaryngologist	11	Neck pain	Upper back pain
Anesthetists	21	Low back pain	Neck pain
General physician	19	Low back pain	Neck pain
Gynecologist	15	Lower back pain	Upper back pain
Pediatrician	12	Low back pain	Neck pain
Ophthalmologist	12	Neck pain	Lower back pain
Radiologist	14	Low back pain	Neck pain

It was found that 54% of study had pain/discomfort worsen due to work, while 31% of study pain remained the same and about 15% had less pain during work. After shift pain/discomfort worsened in 60% (n=76) of study individual, while pain/discomfort was less in 28% (n=35) and same in 12% (n=15) of study individuals. Even after taking a week off from work pain/discomfort remained same in 22% (n=28) of the study individuals. Due to

pain/discomfort 55% (n=69) of study individuals had taken time off from work. On evaluating musculoskeletal problems at workplace in last 1 year in study individuals reflected 58% (n=73) were affected at work. The interference was in form of probably rest from work that varied from few hours to days and also delay in their work that was to be in scheduled time.

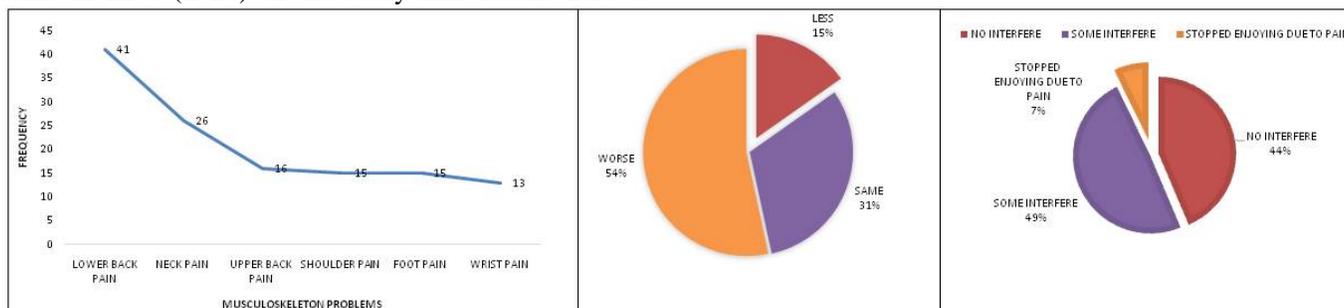


Figure 1

Figure 2

Figure 3

Figure 1: Shows frequency of distribution of musculoskeletal disorders due to work related activities.

Figure 2: Shows distribution of work related pain or discomfort among medical professionals

Figure 3: Shows distribution of study individuals whose pain/discomfort interfered life outside work.

It was found that pain and discomfort due to work related musculoskeletal problems 49% (n=55) of study individual's life outside work was interfered and 7% (n=9) of study individuals had stopped enjoying life outside work due to pain/discomfort from work. On finding sleep of study individuals 11% (n=14) had some sort of interference during sleep while 3% (n=4) had definite interference during sleep due to pain/discomfort.

## DISCUSSION

According to Yasobant et al about half (50.7%) of their study participants reported symptoms at least in one part of their bodies over the past 12 months. Among these, low back pain was the highest (45.7%), followed by neck pain (28.5%) and shoulder pain (23.5%). Elbow pain (5%), hip/thigh pain (7.1%) was the least reported among all participants.<sup>19</sup> the study done by Lahoti, *et al* showed 25% doctors had lower back symptoms, followed by neck, knee, etc., Previous studies also reported a high prevalence of low back symptoms<sup>10</sup> suggesting that low back symptoms are most common site of MSDs among doctors. Their results were similar to our study, though we had higher prevalence. The prevalence of WRMDs among dental professionals in Saudi Arabia was found to be high, with at least 85% of the respondents reporting development of some musculoskeletal pain after joining the dental profession.<sup>6</sup> We found around 95% were suffering from WRMDs. Prevalence of MSDs among doctors in Mangalore was 58%. Medical professionals in Mangalore have better health, because they (58%, n = 109) associate

self with physical activity. Previous studies also reported a high prevalence of low back symptoms suggesting that low back symptoms are most common site of MSDs among doctors.<sup>7,8,9,10</sup> MSIs account for the greatest burden of all injury types in health care with respect to annual incidence. Overall, 83% of all injuries sustained were musculoskeletal.<sup>13</sup> As patient handling activities have been associated with increased Musculo-Skeletal Injuries for direct care providers<sup>14,15,16</sup> and effective ergonomic interventions to improve patient handling techniques have been demonstrated<sup>17,18</sup> continued and heightened attention should endeavour to apply these prevention initiatives to all high-risk patient care occupations. Among all medical professionals, the most common ergonomic hazards reported were prolonged sitting, standing, forward bending of trunk and neck flexion, whereas lifting, pulling or pushing at work and repetitive and/or forceful work were the also some common possible causes. We need to emphasize the role of ergonomics, counseling, proper techniques of patient handling, etc., during the training of medical professionals so that they can work efficiently. Most of the previous studies on WMSDs among healthcare workers were limited to effect in work place, this study also emphasizes the effect of the WRMDs in taking leaves from work as well as its effect in personal life in form of lack of enjoyment in recreational activities outside work place and its effect on sleep. In our study we found that low back pain was most common prevailing factor affecting performance among medical professionals. Many common tasks performed by health care professionals can create awkward postures,

which include twisted, hyper-extended or flexed back positions, reaching, or lateral or side bending. Awkward postures can increase forces on the spine and in joints and can contribute to muscle and tendon fatigue and/or joint soreness. More muscular force is required when awkward postures are used because muscles cannot perform efficiently. Good work practice recommends avoiding awkward postures while working. Try to perform your work while minimizing twisted or bent postures. Engineering controls can be used to reduce some awkward postures. Making use of equipment such as ergonomically designed chairs, transfer devices, adjustable IV stands, etc., can reduce or eliminate some awkward postures when used correctly. All medical professionals should be appropriately trained in order to properly use equipment and ergonomic knowledge. Using ergonomics in a design process can reduce the costs of procuring and maintaining products. Ergonomics can minimize the incidence of injury or longer term malaise from poor working environments. An ergonomics task analysis can help identify key components of surgical skill, ensuring that students have affordable, appropriate, valid, and reliable training.<sup>21</sup> The increased technological complexity and sometimes poorly adapted equipment have led to increased complaints of surgeon fatigue and discomfort during endoscopic surgery. Ergonomic integration and suitable laparoscopic operating room environment are essential to improve efficiency, safety, and comfort for the operating team. Understanding ergonomics can not only make life of surgeon comfortable in the operating room but also reduce physical strains on surgeon. The importance of ergonomics in the setting of endoscopy cannot be over-emphasized. Studies have shown that correct ergonomics can reduce suturing time. Pressurerelated chronic pain among surgeons has been shown to be relieved by the use of ergonomically designed products<sup>22</sup>. As more complex laparoscopic procedures are performed, the need for instrumentation that improves dexterity (degrees of freedom) in an ergonomic manner becomes important<sup>23</sup>. We recommend the study to be conducted in future to include the comorbidities and also the confounding factors like diabetes and hypothyroidism to be taken into account, specialty wise work analysis to identify etiology of specific WRMSDs and ergonomically designed interventions to prevent the same, association between duration and amount of physical activity and WRMSDs, and also psychological correlation with WRMSDs in a larger scale.

## CONCLUSION

We concluded that Work-related Musculoskeletal Disorders (WMSDs) among medical professionals it was

found that 95.5% of individuals working more than 48 hours/week were suffering from some sort of musculoskeletal problems. Low back pain followed by neck pain and foot pain were more common in these individuals. We also found that after shift pain/discomfort worsened in 60% (n=76) of study individual, while pain/discomfort was less in 28% (n=35) and same in 12% (n=15) of study individuals. Even after taking a week off from work pain/discomfort remained same in 22% (n=28) of the study individuals. Due to pain/discomfort 55% (n=69) of study individuals had taken time off from work. On evaluating musculoskeletal problems at workplace in last 1 year in study individuals reflected 58% (n=73) were affected at work. The interference was in form of probably rest from work that varied from few hours to days and also delay in their work that was to be in scheduled time. The pain and discomfort due to work related musculoskeletal problems 49% (n=55) of study individual's life outside work was interfered and 7% (n=9) of study individuals had stopped enjoying life outside work due to pain/discomfort from work. On finding sleep of study individuals 11% (n=14) had some sort of interference during sleep while 3% (n=4) had definite interference during sleep due to pain/discomfort. Ergonomic strategies should be applied to adapt the workplace to the worker - not vice versa. People are very adaptive. They can accommodate poor design and hostile environments. But adaptation takes its toll on users, requiring energy to adapt. Adapting to poor design or environmental elements leads to de-creased performance and fatigue. Fatigue leads to errors, accidents and injury. Appropriately adaptive equipment and environments relieve strain on the worker to adapt to short-comings in the workspace. Ergonomics can have a significant impact on your workplace efficiency. Thus there is Increasing productivity with proper ergonomics.

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Source of Support: None Declared  
Conflict of Interest: None Declared