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Knee ergonomics care in health care professionals: A literature review

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***Abstract*---**Background of the Study: - A Musculoskeletal disorder is type of disorders based on pain & discomfort related to soft tissue. Health care professionals have high risk to develop MSDs from patient handling. This study investigates of knee related problem, MSDs, and ergonomics in health care professionals. Aim: - To identify the prevalence of knee ergonomics musculoskeletal complains in health care professionals. Methodology: - An electronic search was conducted; roughly 200 distributions were at first separated after that 29 articles were utilized. Other articles excluded because those were not correlated with study. Result: - Evidence suggested that knee ergonomics were more common in doctors, physiotherapist and nurses. Female health care worker were more prone because of age, job experience, and work environment. The occurrence of MSDs as well as their contributing factors was biomechanically awkward posture, repetitive bending, prolong standing without interval and heavy lifting. Conclusion:- Many of the healthcare workers affected by MSDs and most of the nurses, physiotherapist, and surgeon experience knee symptoms in their working carrier due to high level of physical , social, as well as psychological demand. Most of them change their profession due to high physical demand.

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Keywords---knee ergonomics, musculoskeletal disorders, work related musculoskeletal disorders, health care professional.

Introduction

Musculoskeletal disorders (MSDs) are defined as pain, discomfort and any muscular injuries in the musculoskeletal system in the human body aggravated by work that occur due to repetitive trauma, repetitive overuse, and awkward positioning during occupational activities[1,5,7]. Work-related musculoskeletal disorders (WMSD) are the category of musculoskeletal disorders that will include problems related to tendons, tendon sheaths, and synovial lubrication of tendon sheaths, and related to bones, muscles, and nerves of hands, wrists, elbows, shoulders, neck, and back[29]. Chronic long term pain, discomfort, decreases efficiency of work and reduced quality of life are major signs of MSDs [1,2,8]. It occurs due to standing for a prolonged period of time to do their work activities. Healthcare professionals have higher risk to develop MSDs. According to Kasturba medical college study, MSDs were highly affected by physicians (13.3%) followed by orthopaedists (12.8%), physical therapists (7.4%), and gynaecologists (11.7%). The highest prevalence of MSDs was more commonly in knees (14.36) [1,3] Knee pain is mostly seen MSDs in healthcare professionals like (surgeons, nurses, physical therapists, lab technicians, and occupational therapists) ad mostly due to faculty ergonomics[4]. Professionals have a higher risk to develop MSDs. Mostly they experience shoulder, thoracolumbar, cervical and knee pain. Knee pain is mostly seen in healthcare professionals like (surgeons, nurses, physiotherapists, lab technicians, and occupational therapists).Even though physiotherapists have the knowledge to prevent MSD but due to their work type and physical requirement like continuous tasks and workload they are more prone to MSD. Obesity is also one of reasons to escalate theproblem.[30] Risk factors that aggravate MSD due to maintaining tricky positions, moving after a long duration, work that required repetitive motion and use of maximum strength[4,9].The type of work that requires traction, heavy lifting, dragging, thrusting, frequent changing angle, outstretching and carrying leads to physical pain and discomforts that's why health care professionals are more prone to MSD. Physical therapist required high-frequency strength to treat a patient that places unequal pressure on their joints spine and knee.It's due to treating many patients with different physical demands in a day such as high-frequency manipulation, mobilization, myofascial release, manual traction, soft tissue release, gait training and ambulation. Surgeons and anesthesiologists spend 6 to 7 hr. and the temperature of OT directly affects the knee joint and spine. Female surgeons were more prone to correlate with their practice period[5].In every hospital mostly 60% of work is done by nurses i.e. handling patients and workplace equipment [2]. All these types of work exert force on muscle as well as joints, and different types of forces affect the biomechanics of the body if any biomechanical imbalance developed that means the requirement was higher than the capacity leading to musculoskeletal injury as well as MSDs problem [9,10]. Many other factors that contribute to MSDs include genetic liability, age, physical fitness, cardiovascular fitness, mental pressure at the workplace and plumpness [11]. Diffuse pain, as well as discomfort, increased due to maintenance of excessive flexion postures that are usually adopted during

working hours.In between static and dynamic muscle loading, static loading leads to rapid fatigues compared to a dynamic one. Dynamic loading required more nutrients and oxygen for muscle activity so, it increases circulation there for both leading to restriction in the workplace. This study investigates knee-related problems, MSDs, and ergonomics in health care professionals [12].The prevalence of knee pain was due to long period of standing, pain and discomfort in the lower extremity, and alteration in sitting as well as standing related duties at the workplace [13].there were multifactorial nature of MSDs in different health professionals because of different nature of duties such as verities of surgical procedure, equipment at workplace, Other studies also considering physical, psychological, job characteristics, and mental pressure[14].Laboratory technicians group have a high risk of developing MSDs because of high physical demands, and also working under time pressure. They are exposed to various factors, such as-repetitive posture, excessive force, manual handling, and awkward positioning when working on a microscope [15].the prevalence of work-related musculoskeletal disorders (WRMSDs) in surgeons in different specializations such as gynaecology, orthopaedic, dental, otolaryngologist, and dermatologist varies between 47% to 90%[16].Medical, as well as socio-professional consequences, also contribute to MSDs[17,18,19]. Most of the study uses a Scandalized Nordic questionnaire for the assessment of MSDs, and a visual analogue scale (VAS) for the severity of pain. The nordic questionnaire is mostly used to analyse work-related health in research studies. These questionnaires identify pain and discomfort at different anatomical parts of the body [20]. Lower extremity, as well as foot health, was important for the general health of health professionals, few studies summarize lower extremity MSDs (mainly knee)[23]. More than 20% population working in night shift contributes to inadequate sleep, biological clock disruption and medical error that is positively associated with MSDs[24].

Methodology

Studies include cross-sectional, surveys and reviews related to the prevalence or incidence of work-related musculoskeletal disorders(WRMSDs) especially knee pain in health care professionals, physiotherapists, nurses, lab technicians, tertiary workers, and pathologists in the general population.[6,18]. A review of the literature included research articles published from 2010 to 2021 with search keywords knee pain, health care professionals, knee ergonomics, MSDs, surgeon, pathologist, and physiotherapist. Articles included were from search engines like Google scholar, Pub med, research gate, Medline, Springer; science direct . Only English language articles were selected and analyzed.
Inclusion criteria: - if the study was any incidence of knee pain or knee-related symptoms in health care professionals.
Exclusion criteria: - excluded those articles which were combined with other professionals like architecture and those articles had no prevalence of knee symptoms.

Review

Navin Ganer., et al (2016) “work-related" musculoskeletal disorders among healthcare professional and their preventive measure” according to this study

many factors that contribute to MSDs among healthcare professionals are awkward posture, repetitive stress on joints, lifting, transferring patients, pushing –pulling and many other. Study shows that the neck (20.21%), knees (14.36%) and lower back (25%) were the most affecting anatomical area in work-related MSDs in a different specialization. Most of the causes could be prevented by posture reeducation, yoga, exercises, and ergonomic design at the workplace.[1] Bolanle MS Tinuba, et al (2010) "work-related musculoskeletal disorders among nurses in Ibadan "according to this study nurses were more prone to MSDs cause of handling patients manually, lifting a heavy load, transferring, work posture and organization of work in a hospital. They used 4 sections questionnaire which sought information about the demographic profile, occupational health (Nordic questionnaire), work-related risk factors and strategies to reduce risk. The most affected anatomical areas were the low back (44.1%), and knees (22.4%). [2] Susan Dsouza, et al (2016) "Work-Related Musculoskeletal Disorders in Physiotherapists: prevalence and associated factors" according to this study physiotherapist clinical practitioners were more prone to develop musculoskeletal disorders. Because of the high demand for intense, repetitive physical tasks, work stress that's includes heavy workloads and inadequate resources (i.e. equipment and helping hand). They conclude 14 literature reviews out of 30 and found that 91% of physiotherapists experience MSDs symptoms in any anatomical area over one year period. According to this study, many physiotherapists changed their specialization area due to WMSDs and also found that female therapists were more prone to MSDs.[3]

Yousef Mahmoudifar, et al (2017)"Ergonomic relationship during work on the nursing staff of intensive care unit with operating room" Patients were highly dependent on nurses in ICU. The author only selected ICU and operating room ward nurses, and after that divided into two groups according to the REBA scale (section 1- neck, legs and trunk) and (section 2-arms, forearms, and wrist) and Nordic scale too (included demographic data and pain –discomfort in any part of the body). According to their result, they found the highest prevalence of MSDs in the back (68%), neck (44%) and knee (40%).corrective and preventive methods help to control the MSDs in health care services [4].

Mohan Jagannath, et al "An Ergonomics Risk Assessment for Hospital Workers" according to this study actual danger factors for MSDs among 85 workers of hospitals in which 10 larger hospitals involved psycho-physiological examination. The result of this study upper extremity (mainly shoulder and back) pain and lower extremity pain (mainly knee and ankle) was more highly affected by government clinic worker than private clinic worker and risk factors were also higher in government clinic worker due to dynamic work in a hospital.[5] Deepak B. Anap, et al (2013)" Work-related musculoskeletal disorders among hospital nurses in rural Maharashtra, India" According to this study they were shown the musculoskeletal factors possibility in nurses of rural Maharashtra from the particular hospital. After 12 months of experiencing pain and discomfort during occupational hours is reported as an (89.1%). overall static reported after a year prevalence of MSD at each body part to be 81%, mainly involved area is lower back 48.2%, shoulder 34.6% and neck, knee 33.1% and 29%. According to this study, there is a high predominance of pain and distress in the lower back, shoulder and knees so they educate about different strategies and techniques. [6]

Sanjib K.Das, et.al (2020) “Ergonomic mapping of work-related musculoskeletal disorders and stress among Indian healthcare workers” Working inward and ICU that highly impact on their static posture. Occupational stress is often connected with changes in catecholamine and corticosteroid levels that directly contribute to pain and fatigue in muscles and tendons. There were 650 participants (nurses) with an average age of 26 yr and 108 male surgeons with an average age between 34 to 43yr. they found that the highest prevalence anatomical area involved in MSDs were the lower back, knee and neck in nurses and ankle, knee and lower back in doctors. [7]

Ramin Mehrdad MD,et al (2012) “Musculoskeletal disorders and ergonomic Hazards among Iranian physicians” This study included 405 physicians who worked as a faculty in hospitals and experienced occupational as well as an ergonomic hazards at their place of work. They divided the participants into two sections, those with no complaints and others with complaint of MSDs in the last few years.They used a Nordic questionnaire to assess the musculoskeletal symptoms and for analyzing the data they used t-test and chi-square test. The overall outcome of this study, the prevalence of knee pain (17.3%) was highly present in physicians followed by back pain (15.1%) and neck pain (9.9%) the pain increased with an increasing years of employment. [8]

Alice Khachian,et al (2018) “relationship of musculoskeletal problems with the quality of working life among critical care nurses” according to this study nurses were high workload, too much stress and repetitive movement in ICU and CCU. This study included 384 nurses from different hospitals in Iran; they used a questionnaire that was divided into 3 groups’ i.e. demographic data, QWL and Nordic questionnaire and find pain - discomfort in any part of the body from last year. They found the highest prevalence was found in the low back (61%), knee (60%) and neck (53%) respectively and also found that the quality of work directly intensifies MSDs problem. According to WHO MSDs was the second cause of short term illness and work left, about 85% of nurses experience MSDs pain and discomfort at least one time in their working carrier. [9]

Ashwini P. Jadhav, et al (2019) “prevalence, severity and characteristics of work-related musculoskeletal disorders amongst obstetrics and gynaecology professionals” according to this study biomechanical imbalance required maximum internal force i.e. greater than the capacity of the body that ultimately leads injury and musculoskeletal pain – discomfort. These problems affect performance, as well as the quality of daily living and they, also found that stress at the workplace and work achievement were also caused of MSDs. There were 69 doctors who participated in this study .They used Nordic questionnaire as well as 15 other questionnaire categories for data collection and found that 85.5% doctors had experience MSDs problem at least one time of their working carrier and 71% reported musculoskeletal injury at work related routine. The prevalence of neck (49%) and knee (34.5%) injury were higher than other anatomical area and most of the participants sought heal from medication and physiotherapy itself [10].

Fatemeh Rahimi, et al (2018) “prevalence of work related musculoskeletal disorders Iranian physical therapists”MSDs disorders and injury were more

common in occupational events that include manual work, lifting, frequent movements and traction forces. Inappropriate repetitive movement, Physical and physiological stress at work place also increases the prevalence of MSDs. More than 50% of the physical therapist experience work related MSDs within 10 yr, due to lack of proper knowledge about positioning and ergonomic at work places. They found in their study that lumber (65%), knee (45%) and neck (57%) were highly affected anatomical area of the body , and also shows that94% of Iranian physiotherapist were experience musculoskeletal disorders .According to outcome of study rest and decrease the activity reduces the neck and lumber pain also female physiotherapist were more prone to MSDs disorders[11].

Sokunbi O Ganiyu, et al (2015) "patterns of occurrence of work related musculoskeletal disorders and its correlation with ergonomics hazards among health care professionals" In this study, There were 151 participants that include physiotherapist, nurses, lab technician, dentists and physician with at least 24 month of job experience. The questionnaire were divided into three division in first section include demographic details with job hours second section include work related musculoskeletal questionnaire and third section include ergonomics risk factor that enhance the WMSDs condition. They found that most affected anatomical areas were lower back, shoulder and knees as well as nurses and physiotherapist were more affected by MSDs comparing to physician and dentists [12]

Aishwarya.A.vedpathak , et al (2020) "prevalence of musculoskeletal dysfunction in clinical physiotherapist" according to this study , long time standing in clinic to treat patient and work leads to pain – discomfort in lower limb mostly affecting knee and ankle. In this observational study they found that male and female both physical therapists equally involved. Those therapist who worked more than 7 yr were highly affected area was knee and lower back. Most of the working pattern of physiotherapist was in standing position; with prolong working hours to assess and treating patient so, there was increase in pressure at spine and knees that leads to agony and distress in back and knee. [13]

Elnaz Asghari, et al (2019) "musculoskeletal pain in operating room nurses: associations with quality of work life, working posture, socio-demographic and job characteristics" all health care professionals in ICU attendant were more prone of musculoskeletal pain and discomfort because of excessive manual work as well as mechanical stress in their daily activities. In this study male participant (29) was less than female participants. Outcome of study, the most affected anatomical area were knees approx 61%, lower back 63% and neck pain 42%. Knees related problem was higher in female participant comparing to male participants and REBA score was more than 7% that indicates they were highly risk of musculoskeletal injury.[14]

Shreya Maulik, et al, (2012) "Work related musculoskeletal disorders among medical laboratory technician" In this study there were 49 participants from different department. Including criteria was 12 month of work practice in particular post. To check symptoms of MSDs, stress, posture, occupation related risk factors by using Nordic questionnaire; (VAS), (REBA) as well as (QEC). Outcome of this, most commonly affected anatomical area were low back (30%)

and knee (20.4%) in last 1year and overall MSDs prevalence's was 79.6% seen in laboratory technician that is similar to previous studies. Most of them reported that work as causative factor to improve MSDs.[15]

Iman Diant, et al (2017)"Work related physical, psychosocial and individual factors associated with musculoskeletal symptoms among surgeons: implications for ergonomic interventions" According to this study surgeons class in health care professionals had higher risk to develop MSS having many predisposing factors such as awkward upright and sitting position during entire operating time, use of different surgical instrument , temperature of operating room as well as brief and fine manual skill performed during surgery.There were 316 participants who voluntarily participant in this study and data collections based on questionnaire format.Outcome of study, highly affected anatomical areas were knee (48.7%) and neck (45.8%) followed by lower back. Female surgeons had higher symptoms in knees and shoulder compare to male surgeons. [16]

Anis Jellad, et al (2013) "Musculoskeletal disorders among Tunisian hospital staff: prevalence and risk factors" In this study; 433 participants who participant in this study, conclude all type of hospital staff such as paramedical, health care professional and workers. For data collection they use Nordic questionnaires which include 51 objectives. Outcome of this study, the frequently affected anatomical region were lumber (87.3%), cervical (45.2%), and knee (31.3%) and highly affected group were paramedical staff comparing to other staff. Obesity, sitting and standing without interval leads to knee symptoms [17].

Parul Raj Agrawal, et al (2014) "work related musculoskeletal disorders among medical laboratory professionals: a narrative review" This study include all those articles in which participants age were greater than 18 as well as work related MSDs among laboratory professionals. After concluding all the articles, they found that prevalence of knee symptoms are 2nd highest MSDs condition in laboratory professionals. These jobs are considered as sedentary jobs and most of the time high pressure environment improves MSDs condition because of long working hours.[18]

Anu Arora, et al (2015)"Ergonomic risk assessment in pathology laboratory technicians" According to National institute of occupational safety and health Ergonomics defined as work place condition and task demand as well as capabilities working community. This study include laboratory professionals such as pathologist as well as laboratory technician who skilled in test and handling equipment. They include 100 participants; those have at least 12 months of working experience. Outcome of this study, they found that 10%knee pain reported and overall 85% of pain & 41% stiffness found in another anatomical area. To prevent or reduce MSDs problem, laboratory professionals should done certain modification at work place.[19]

Sang D. Choi, et al (2015)"Work related musculoskeletal risks associated with nurses and nursing assistants handling overweight and obese patients" One of the biggest challenges in professionals was obesity, approximately 64%of people comes under overweight as well as 30% comes under obese. They conclude 22 articles related to this study and found that WRMSDs as well as injuries were

more common in nurses, especially if patients were obese. The outcome of study indicates that WRMSDs was highly affecting lower back, knees and shoulder because of manually handling obese patients, lifting, and transferring as well. When lifting obese patient weight transfer to lower back followed by knee and that increases potency of musculoskeletal pain as well as injury.[20]

Hongyun Dong, et al (2019)"prevalence and associated factors of musculoskeletal disorders among Chinese healthcare professionals working in tertiary hospitals" There were 14720 participants with response rate of 93.3%. Female participants was more than male with mean age of 35yr.the outcome of study, the most affected anatomical area were lower back 72%, knee 65.7%, and shoulder 52%. Knee related pain as well as discomfort associated with these factors such as long duration working hour, interval during work, long duration standing, psychological stress, age and BMI. Most of the tertiary workers had no knowledge about prevalence of MSDs. In one year of this study 2nd mostly involved structure was knee 65%.[21]

Pinar Soylar, et al (2018)"Evaluation of the prevalence of musculoskeletal disorders in nurses" Nurses were considered as a main worker who closely contact with patient, instruments as well as hospital territory. the predisposition of MSDs among nurses was approx 33% to 88%.they conclude 34 articles in this study and found that most affected anatomical areas was low back(65%), knees (56%) and neck (49%). Knees related pain & discomfort exerted by long period of standing, high job demand as well as poor work satisfaction. [22]

Minna Stolt, et al (2015)"Lower extremity musculoskeletal disorders in nurses" Nurse's job needs to stand as well as rounds for extended period. Because of overload physical demand nurses need to optimize their feet to maintain their strength whole day. The outcome of study they found that prevalence of knee related MSDs varies from (7.5% to 77%) and also noted that knee problem 43.5% was more usually present in surgical department. They also found that knee pain mostly affecting female nurses compare to male nurses, had higher incidence of ankle pain. [23]

Ahmad Bazazan, et al (2019)"Association of musculoskeletal disorders and workload with work schedule and job satisfaction among emergency nurses" Emergency department required high physical as well mental demanding environment. It is highly challenging zone of hospital that provide nonstop service to the critical patient. This cross-section study divided participants in 2 groups either working at day or working at night with at least 12 month of working experience. Also, Found that highly involved anatomical area was back and knees. Knee pain (73%) severity was highest followed by other anatomical area. [24]

K R Shafiezadeh, et al (2011) "prevalence of musculoskeletal disorders among paramedical working in large hospital in ahwazZ" According to this study, the most prevalent anatomical area were neck 64%, head 62%, and knees 54.7%. Most of the participants were female they also found that 90%of participants experience MSDs in last month. Female were more prone to MSDs due to increased age as well as work experience. They also suggest that regular aerobic

exercises induce positive impact on health as well as improve physical fitness that reduces the risk of MSDs and improve working efficiency.[25]

Ali pahnabi, et al (2019) “Comparative Study on Musculoskeletal Disorders in Male and Female Personnel of Operating Room of Mazandaran University of Medical Sciences” They found that most prevalent area were back 71%, waist 67% and knee 61%. Over all prevalence only 20% of employees had higher risk to improve MSDs. They also found increase age, reduce physical fitness, obesity as well as work experience improve MSDs condition. They suggest that corrective measures reduces the risk of MSDs that was, correct position of professional during aid training, job rotation, and adequate rest reduce the musculoskeletal pain.[26]

Apexa S Raithatha, et al (2016) “Musculoskeletal disorders and perceived work demands among female nurses at a tertiary care hospital” They found that prevalence of MSDs in last 12 month was 89.2% and last 7 days 60.5%. They also found that most prevalent lower back and knee pain were reported by participants. Marital status also having significant role in MSDs, domestic work and job demand put extra pressure on married participants. These double work burden increases physical and psychological demand that increases the risk of MSDs.[27]

Protiva sarker, et al (2016) “work related musculoskeletal complains among the health care professionals working at CRP” Outcome of study, they found that most prevalent area were lower back (in doctors, physiotherapists and speech therapist) and knee (in nurses and doctors). They also found that most stressful position was bending as well as sitting and least common in lying. More than 23% participants were taken sick leave that was related to MSDs.[28]

Discussion

Work related musculoskeletal disorder (WRMSDs) are defined as Musculoskeletal symptoms initiated or aggravated by work associated events. It is one of the most common issues faced by all health care professionals. Physical inactivity leads to a few musculoskeletal disorders. Physical dysfunction, such as musculoskeletal disorder, associated with sick leave, obesity, low socioeconomic status, increased risk of cancer and increased disease. [31] Most of the studies reported that, it significantly affecting quality of life and reduce the interest in work. This review work focus on incidence of knee related problems in health care professionals. The occurrence of MSDs as well as their contributing factors such as awkward posture, lifting heavy patient, transferring, repetitive stress on joint [1,2,4,11]that improve MSDs symptoms. For assessment of MSDs prevalence most of the studies used Scandalized Nordic questionnaire which is one of the best inspection tool with 83% sensitivity and 53% specificity [12].In this study, we observed that long period of standing position, high job demand as well as poor work satisfaction, night shift, and awkward working posture increase knee symptoms.[13,14,24].knee pain increases as their year of working experience increases, because of age, type of occupation, interval during job, physical and

psychological stress [5,6,15].We noticed that knee symptoms was higher in female health care professional as well as nurses, physiotherapist and surgeon had higher knee symptoms compare to other health care professionals [11,16,21]

Prevalence of musculoskeletal pain

Navin Ganer et al. reported that prevalence of MSDs in healthcare professionals. They mentioned that 61% physical therapist,6.6% dental surgeons, 80% sonographere , 77% physician that participate in endoscopic surgeries daily, 43.7% otolaryngology experienced MSDs manifestations [1]. Deepak B. Anap et al. reported that 89.1% nurses experience MSDs related symptoms in their working hours. Ashwini P. jadhav et al. reported that 85.5% doctors experience MSDs problem at least one time of their working carrier.

Prevalence of knee pain health care professionals

Bolanle MS Tinube et al. they found 22.4% prevalence of knee symptoms in Ibadan nurses and also introduce strategies to reduce the risk. Yousef Mahmoudifar et al. found that 40% knee prevalence in intensive care unit and operating room worker as well as also state that women were higher risk to develop MSDs symptoms. Only 17.3% of knee prevalence was present in physician who worked as a faculty reported by Ramin Mehrdad MD et al. 34.5%.

Limitations

- Management of MSDs was not provided.
- Education for reducing knee symptoms was not administrated.
- Ergonomics training and coping strategies was not administrated.

Conclusion

The target of review to find the predisposition of knee associated symptoms within health care professionals. Many of the healthcare workers affected by MSDs and most of the nurses, physiotherapist, and surgeon experience knee symptoms in their working carrier due to high level of physical , social, as well as psychological demand. Most of them change their profession due to high physical demand. This study finds that knee prevalence was higher in female health care professionals and also notices that if ergonomic intervention strategies used by professionals can reduce the risk of MSDs. They need to modify working environment according to their requirement so, reduce the factors of work related disorders.

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